KA POWER LIMITED

23rd Floor, Ufone Tower,
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Dated: 4 Jul 2022

The Registrar
National Electric Power Regulatory Authority (NEPRA)
NEPRA Tower Attaturk Avenue (East)
Sector 0-5/1,
Islamabad.

Subject: **Application for Grant of Generation License to KA Power Limited in respect of 238 MW Kalam Asrit Hydropower Project, Swat, Khyber Pakhtunkhwa**

Dear Sir,

Korea South-East Power Co. ("KOEN"), a premium generation company owned by Government of Korea, has been awarded LOI by Pakhtunkhwa Energy Development Organization (PEDO) for developing a 238 MW hydroelectric power project (the "Project"). In this regard, KA Power Limited (the "Company"), a special purpose company, has recently been established under the laws of Pakistan for the execution of development process of the Project. The Project would be developed on a Build, Own, Operate and Transfer ("BOOT") basis under Pakistan Power Generation Policy 2015 and KPK Hydropower Policy 2016.

I, Oh Inhwan, Chief Executive Officer, being the duly authorized representative of the Company by virtue of board resolution dated 29 April 2022, hereby apply to National Electric Regulatory Authority ("NEPRA" or "Authority") for grant of Generation License to the Company pursuant to the section 14B of the Regulation of Generation, Transmission and Distribution of Electric Power Act 1997.

I hereby certify that the documents-in-support attached with this Application are prepared and submitted in conformity with the provisions of National Electric Power Regulatory Authority Licensing (Application, Modification, Extension and Cancellation) Procedure Regulations, 2021 and undertake to abide by the terms and provision of the above-said regulations. I further undertake and confirm that the information provided in the attached documents-in-support is true and correct to the best of knowledge and no material omission has been made.

A bank draft in the sum of Rupees 1,814,686 (Pakistani Rupees One Million Eight Hundred Fourteen Thousand Six hundred and Eighy Six only), being the license applicable fee calculated in accordance with Schedule II of the National Electric Power Regulatory Authority Licensing (Application, Modification, Extension and Cancellation) Procedure Regulations, 2021 is also attached herewith.

We would like to submit that the Grid Interconnection Study (GIS) for the Project was conducted by Power Planners International and has been submitted to National Transmission and Dispatch Company (NTDC). NTDC has informed that an integrated study for evacuation of power from the hydropower projects in Swat cascade projects through 220kV transmission lines is under final stages by NTDC/PEDO, therefore NTDC shall approve the Project's GIS study as part of the said integrated study and shall make their comments upon its completion accordingly.

We would take this opportunity to submit that all legal requirements regarding Environmental Impact Assessment (EIA) approval/NOC from Khyber Pakhtunkhwa (KPK) Environmental Protection Agency (EPA) has been fulfilled including public hearing, redressed of all comments of EPA, NOCs from line departments like Mines, Minerals, fisheries and wildlife etc.. All is set by EPA for issuance of NOC except project requires 4 Acres of protected forest land which need to be de-notified by KPK

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Cabinet for which approval is expected shortly. We would submit EPA NOC as soon we receive it. Documentary evidence of above is attached.

Keeping in view the forgoing, the Authority is requested to kindly process Company's application for grant of generation license for the subject Project so that further required steps can be taken for the full implementation of the Project.

Yours Sincerely,

Chief Executive Officer

KA POWER LIMITED ISLAMABAD

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Name of Applicant	:	**KA Power Limited**
Project Name	:	**Kalam Asrit Hydropower Project**
Capacity	:	**238 MW**

New Generation Facility (Hydropower) – License Application		
Regulation Reference[1]	**Information / Document-in-Support**	**Attachment Reference**
3 (1)	Prescribe Application for grant of license	√
3 (3)	Application for license	In triplicate
3 (4) (b)	Prospectus	Annex-A
3 (4) (c) (i)(A)	Certified Copy of Certificate of Incorporation	Annex-B
3 (4) (c) (i)(B)	Certified Copy of Memorandum and Articles of Association	Annex-C
3 (4) (c) (i)(C)	Certified Copy of Annual Report of the company	The Company has incorporated on 8 April 2022. Annual Report shall be submitted after its first Annual General Meeting.
3 (4) (c) (ii)	Last Annual Report under Section 130 of the Companies Act	The Company has incorporated on 8 April 2022. Specified Form shall be submitted after its first Annual General Meeting.
3 (4) (c) (iii)	Details of Authorized, Issued, and paid-up capital	Annex-D
3 (4) (c) (iv)	the shareholding pattern	100% owned by Korea South-East Power Company (KOEN).
3 (4) (d) (i)	Cash Balance and Bank Certificate	Annex-E
3 (4) (d) (ii)	Details of charge or encumbrances attached to any asset	No encumbrances are attached to any asset of KA Power Limited.
3 (4) (d) (iii)	Latest Audited Financial Statements	The Company has incorporated on 8 April 2022. The first audit shall be made after completion of its financial year i.e. 30 June 2022. Latest Financial Statements of KOEN are attached as Annex-F.
3 (4) (d) (iv)	Expression of Interest to provide credit and financing along with sources	Expression of Interest from International Finance Corporation (IFC) and Asian Development Bank (ADB) are attached as Annex-G
3 (4) (d) (v)	Documents describing the net worth and the equity and debt ratios	The Company has recently been incorporated on 8 April 2022 with 100% equity of KOEN. Financial Statements shall be made after completion of its financial year i.e. 30 June 2022. The Project shall be financed with a debt to equity ratio of 80:20 as per the assumption taken in Feasibility Study. The estimated total Project Cost is $489.33 million at feasibility stage and shall be firmed up at EPC stage.
3 (4) (d) (vi)	A reasonably detailed profile of the applicant and the applicant's senior management. technical and professional staff	Annex-H
3 (4) (d) (vii)	Employment records of engineering and technical staff of the applicant proposed to be employed;	
3 (4) (d) (viii)	Profile of sub-contractors, if any, along with expressions of interest of such sub-contractors	No contractor or sub-contractor has been selected by the Company at this stage.

[1] National Electric Power Regulatory Authority Licensing (Application, Modification, Extension and Cancellation) Procedures Regulation, 2021

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3 (4) (d) (xi)	Verifiable references in respect of the experience of the applicant and its proposed sub-contractors;	Annex-A
3 (4) (e)	Technical and financial proposals in reasonable detail for the operation, maintenance, planning and development of the facility or system in respect of which the license is being sought	Annex-I
3 (4) (f)	Detailed Feasibility Study duly approve by panel of experts	Annex-J
3 (4) (g)	An affidavit stating whether the applicant has been granted any other license under the Act;	Annex-K
3 (4) (h)	a duly authorized statement stating whether the applicant has been refused grant of license under the Act and, if so, the particulars of the refused application, including date of making the application and decision on the application;	Annex-K
3 (6)	Board of Directors Resolution authorizing to submit Generation License	Annex-L
3 (7)	Affidavit with regard correctness, authenticity, and Accuracy of the application, documents and information submitted	Annex-K
Schedule III of Regulation[2]		
1.	Environmental and Social Soundness Assessment (ESSA)/Study	The study is attached as Volume-5 to the Feasibility Study as attached Annex-J to this application
2 & 3	Interconnection Study including load flow, short circuit, stability study	Annex-M
4 (i)	Location	Annex-N
4 (ii)	Plant Type	Run of the river
4 (iii)	Generation Voltage: Power Factor: Frequency: Ramping Rate Control Metering & Instruments	220kV 0.8 lagging and 0.9 leading 50 Hz SCADA
4 (iv)	Head (gross, net head)	222.1 meters, 204 meters Head loss 18.1 meters
4 (v)	Technology	Vertical Francis (4 Units) 3 x 68.4MW 1 x 33.0MW
4 (vi)	Tunnel (length, diameter)	L: 11,589.6 Kilometers, D: 7.4 Meters
4 (vii)	Resettlement Issues	Land resettlement issues are addressed in ESIA as attached Volume-5 of Feasibility Study (Annex-J)
4 (viii)	Necessary approvals from the concerned authorities of the Federal Government and Provincial Governments.	Annex-O 1. Letter of Intent issued by PEDO 2. Correspondence related to ESIA approval with EPA (KPK) 3. PEDO approval of Project Feasibility Study 4. Correspondence related to Grid Integration Study
4 (ix)	Infrastructure Development	Details are provided in Project Feasibility Study as attached Annex-J.

[2] National Electric Power Regulatory Authority Licensing (Application, Modification, Extension and Cancellation) Procedures Regulation, 2021

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		The development/construction of any infrastructure shall be started after the start of construction works.
4 (x)	Project Schedule and Expected Life	**Project Schedule**: The Project is expected to achieve Financial Close in June 2024 and the project shall be constructed in 60 months' time as provided in Feasibility Study, Project Schedule is provided at Annex-P **Expected Life**: The construction life of the Project is expected to be 100 years. However, after the expiry of concession period of 30 years from COD the Project shall be transferred to GOKPK.
4 (xi)	Peaking/base load operation	Base load operation
4 (xii)	Training and development	Annex-Q
4 (xiii)	Efficiency Parameters	Turbine: 94% Generator: 98.2% Transformer: 99.5% Plant Factor: 45.04%

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ANNEX-A

PROSPECTUS & SPONSORS PROFILE

238 MW KALAM ASRIT HYDROPOWER PROJECT

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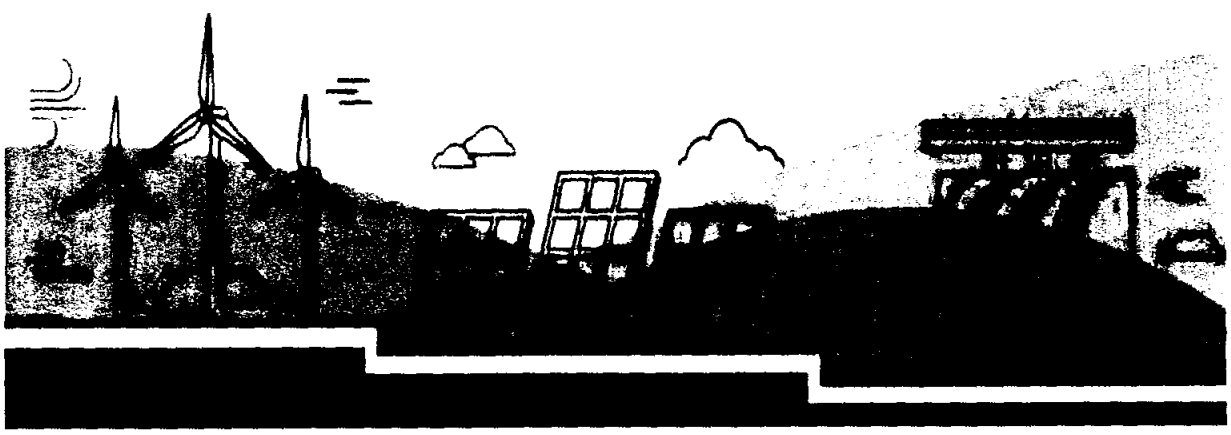
PROJECT PROSPECTUS

238MW KALAM ASRIT HYDROPOWER PROJECT

KA POWER LIMITED



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1. PROJECT COMPANY

1.1. INCORPORATION DETAILS

KA Power Limited is a Special Purpose Company incorporated on 8 April 2022 with Securities and Exchange Commission of Pakistan to design, construct, own, operate and maintain 238MW Kalam Asrit Hydropower Plant under Government of KPK Hydropower Policy 2016 and Power Generation Policy 2015. KA Power Limited is a wholly owned subsidiary of Korea South East Power Co. Ltd. The word KA is the acronym of Kalam Asrit.

1.2. INTRODUCTION TO SHAREHOLDERS

1.2.1. KOREA SOUTH EAST POWER COMPANY

KOEN is a leading generation company of South Korea and owns 11.4% of total Korea's generation capacity amounting to 10,376 MW. Total asset base of KOEN is USD 10.342 billion with approx. USD 4 billion per annum revenue. KOEN is the wholly owned subsidiary of Korea Electric Power Company (KEPCO). KOEN has successfully implemented 102MW Gulpur Hydropower Project in Pakistan which is in its 3rd year of operation.

Korea South-East Power Co. Ltd. ("KOEN") is a foreign state owned organization and leading generation Company of South Korea that owns 13.1% of total Korea's generation capacity amounting to 10,329 MW. KOEN is a core subsidiary of KEPCO which owns entire transmission and distribution network of Korea which is a government owned company.

1.2.2. GENERATION PORTFOLIO OF KOEN

Generation Portfolio as of 2020

Plants in operation

(As of Dec. 2020)

Load Type	Plant Name	Fuel	Installed Capacity	Remarks
Base Load	Yeongheung	Bituminous	5,080MW	8,988.6(86.4%)
	Samcheonpo		3,240MW	
	Yeosu		668.6MW	
Peak Load	Bundang	LNG	922.1MW	922.1(8.9%)
Renewable	Biomass (Yeongdong #1,#2) Wind Power, Solar Photovoltaic, etc.	-	489.6MW	489.6(4.7%)
Total			10,400.3MW	10,400.3(100%)

※Renewable : KOEN's Own Business(ESS excluded)

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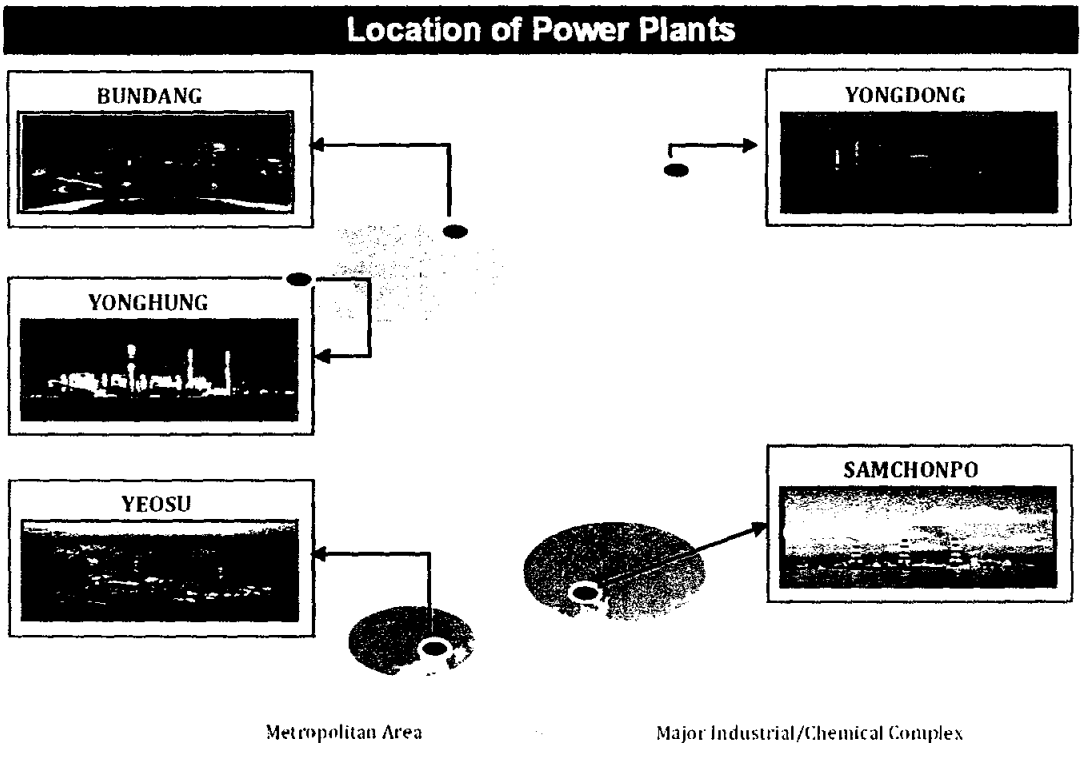

1.2.3. OVERSEAS BUSINESS

KOEN has been consistently promoting professional and systematic business, including overseas plant construction and operation, maintenance and R&M capabilities, commissioning consulting and training. With the experiences in 24 power plants construction and operation worldwide, KOEN is expanding its business portfolio worldwide such as USA, Rumania, Bulgaria, Malaysia, Indonesia, Nepal, Hungary, Turkey, Kazakhstan, Sri Lanka, China, Thailand and **Pakistan**.

In renewable sector, KOEN has already completed construction of 102 MW Gulpur Hydropower Project in Pakistan and is in operational Phase since March 10, 2020 while KOEN is currently constructing a hydropower plant of 216 MW in Nepal with target commercial operations in 2023.

KOEN has invested and has operational facilities in USA Novus Wind Farm (120 MW) and Bulgaria Photovoltaic Project (42 MW).

Novus Wind Power Complex, located in Oklahoma, USA, has total generation capacity of 120MW, the biggest overseas wind power project done by any domestic company. Constructions were completed in Sep, 2012 for Novus I, and Dec, 2012 for Novus II.

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Solar Photovoltaic Project in Bulgaria is the first renewable energy project invested by Korean company in Eastern Europe and it is also the 15th largest mega photovoltaic project in the world. It is BOO (Build-Own-Operate) type project which operates 42MW photovoltaic power plant for 20 years from the completion of construction, March 8, 2010. The complex is located in Veliko Zlitarica and Samovodene area, 200km to the east from Sofia (capital city of Bulgaria).

KOEN, as a pilot project in Pakistan, acquired a virtually dormant 102 MW Gulpur Hydropower Project and started development back in 2013 on fast-track basis. Gulpur Hydro is one the most challenging hydro IPP in Pakistan being its location in Mahasher Fish National Park and very high flood design criteria, however, with the persistent effort, experience and commitment of KOEN, the Project achieved Financial Closing in October 2015 and Commercial Operations on March 2020. The Gulpur Hydropower Project has become a Flagship Project worldwide and has won various prestigious international awards (including IJGlobal Deal of the Year 2015, The Asset Asian Award, the Gold Award of Hydropower Project of the Year from Asian Power Award 2016 & Bronze Award for Environmental Updgrade of the Year from Asian Power Award 2016) due to its excellent structuring and project implementation approach.

KOEN has involvement in establishing thermal power plants and commissioning consulting services in in Indonesia, India, Bahrain, Turkey and Philippines. KOEN has also invested in the mines of Bituminous Coal in Indonesia and Australia.

1.2.4. KOEN'S VISION 2030 AND INVESTMENT PLAN FOR PAKISTAN

KOEN is increasing the share of renewable power generation capacity to 25% by 2030 to transform into a renewable energy specialist, in addition to leading national new energy industry by developing renewable energy-based microgrids, smart grids using new IT technologies, and virtual power plant systems.

By exporting power plant construction and operation technologies to foreign countries, KOEN seeks to generate a new source of revenue growth, in addition to promoting joint advance of domestic partner companies to overseas markets (equipment production, construction service, etc.). Distributed Solar PV power plant project in Chile and hydropower plant project in Nepal and Pakistan are underway, as well as a PV power plant project in Bulgaria. KOEN is also expanding business areas to countries with high growth potentials for the diversification of revenue structure.

To achieve the targets of Vision 2030, KOEN has categorized Pakistan as one of its priority investment market and has allocated 1,000 MW for investment in Pakistan

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renewable power sector. In this respect KOEN has signed an MOU with the Government of Khyber Pakhtunkhwa (GOKPK) on 15 May 2017 under which KOEN shall develop and implement two hydropower projects with cumulative capacity of around 450 MW on fast track basis. These hydropower projects comprise of 215 MW Asrit-Kedam Hydropower Project and 238 MW Kalam-Asrit Hydropower Project. In addition,

1.2.5. HYDROPOWER EXPERIENCE

KOEN has many years of experience in the construction and operation of pumped storage hydropower plant. On top of constructing the first pump storage hydropower plant in Korea i.e. Muju Pumped Storage Power Plant (600 MW) and its 15 years of operating experience, KOEN has also constructed and operated Yecheon Pumped Storage Power Plant with capacity of 800 MW (the largest in Korea amongst single units).

KOEN established world's first 4 MW Hydropower Plant that utilizes discharged cooling water in Samcheonpo. KOEN also installed and operates a 12.6 MW hydropower plant in Yeonghuen (coal based) Thermal Power Plant. With this experience and technology, KOEN is promoting construction and operation project for hydropower plants in Pakistan (102 MW) and Nepal (216 MW). The 102 MW Gulpur Hysrdopower Project of Pakistan has completed the construction and is in operation phase since March 10, 2020 while NEPRA hydropower project will achieve Commercial Operations in 2023.

Muju Pump Storage Power Plant (600 MW)

Yeocheon Pump Storage Power Plant (800 MW)

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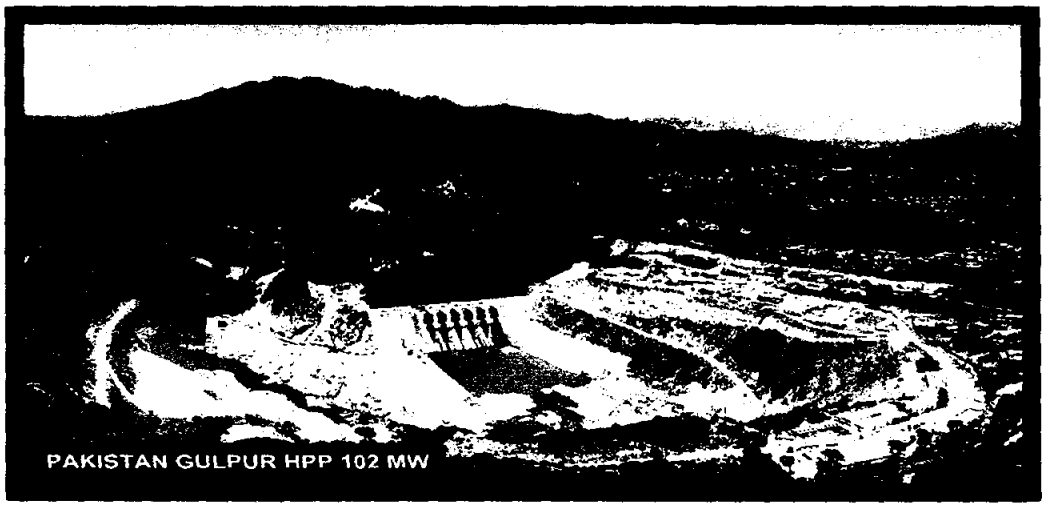

Nepal Upper Trishuli-1 Hydropower Project (216 MW)

1.2.6. KOEN FINANCIAL STRENGTH

The total asset amount of KOEN in 2020 reaches to USD 10 billion.

Highlights of financial statements				(unit : US$ Mill)
Category	**2016**	**2018**	**2019**	**2020**
Total Asset	8,633	8,767	8,916	10,009
Total Liabilities	4,330	4,382	4,521	5,587
Total Equity	4,302.23	4,384.93	4,395.43	4,416.65
Sales Revenue	4,459	4,719	4,844	4,737
Operating Income	711	347	164	202
Net Income	419	153	25	28

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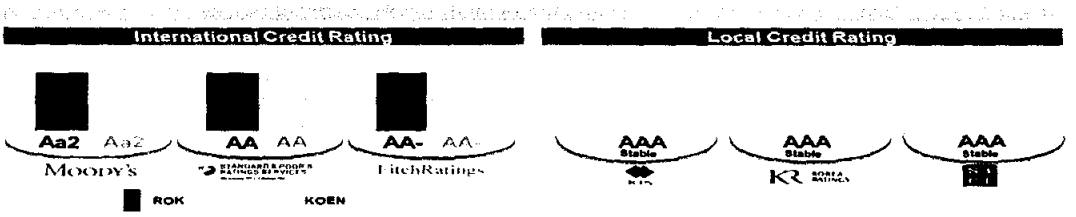
1.2.7. CREDIT RATINGS

KOEN has solid credit ratings from international and Korean rating agencies. These are reflected as follows:



1.2.8. KOREA ELECTRIC POWER COMPANY

KEPCO is the largest electric utility company in South Korea and responsible for the generation, transmission and distribution of electricity and the development of electric power projects including those in nuclear, wind and coal. KEPCO have more than 70,000MW generation capacity worldwide with asset base of $150 billion.

1.2.9. OTHER SHAREHOLDERS

KA Power Limited intends to add other shareholders having proper expertise and financial strengths at advance stage of the development. Currently, KA Power Limited is solely owned by KOEN.

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2. PROJECT INTRODUCTION

Project was first identified by German Agency for Technical Cooperation (GTZ) during a hydropower potential study conducted between 1990-1995 under a Program of Pakistan German Cooperation.

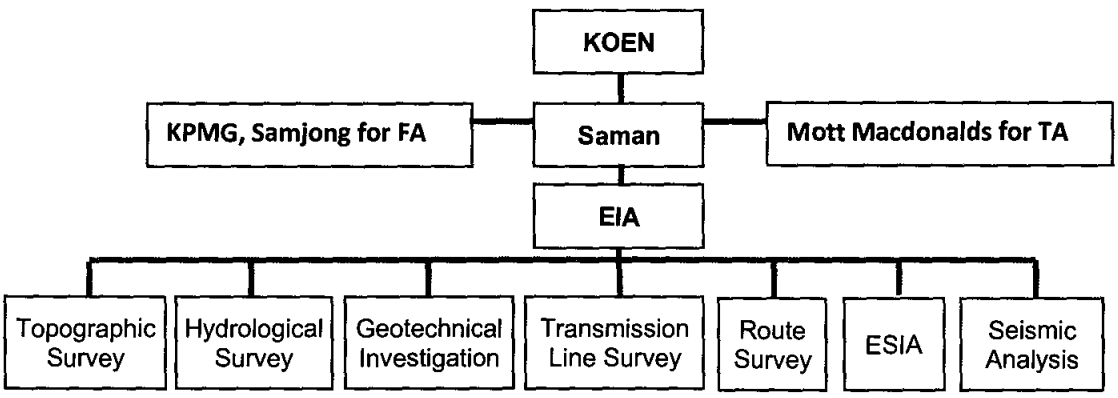
GTZ study identified four medium sized hydropower projects including along the 50Km reach of upper Swat River. Kalam Asrit hydropower with a potential of 197 MW was one of amongst identified sites.

The LOI issued to local sponsor was cancelled by PPIB due to non-performance and it was returned back to government of Khyber Pakhtunkhwa ('GoKPK") for further development. GoKPK signed a memorandum of understanding ("MOU") with Korea South-East Power Company ("KOEN") for development of Project on 15 May 2017.

Following the completion of the due process under the KPK Hydropower Policy 2016, a Letter of Intent ("LOI") for 197MW Kalam Asrit Hydropower Project as raw site was issued to KOEN by GoKPK through Pakhtunkhwa Energy Development Board ("PEDO") on 24 April 2018. PEDO is one window facilitation agency for private sector investment in the province.

KOEN conducted a competitive bidding process for selecting renowned international engineering firm , for carrying out the bankable feasibility study of Project and selected SAMAN Corporation of South Korea ("SAMAN") & Mott MacDonald of United Kingdom.

The following organizations was implemented for the feasibility study.



SAMAN conducted and completed the feasibility in 2020 and following extensive review of Panel of Experts (POE) including representative from PPIB, NTDC, Irrigation Department and EPA, the feasibility was approved on 6 April 2022.

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A Special Purpose Company (SPC), namely KA Power Limited, has been incorporated as a public limited company under laws of government of Pakistan ("GoP") to develop the Project on 8 April 2022.

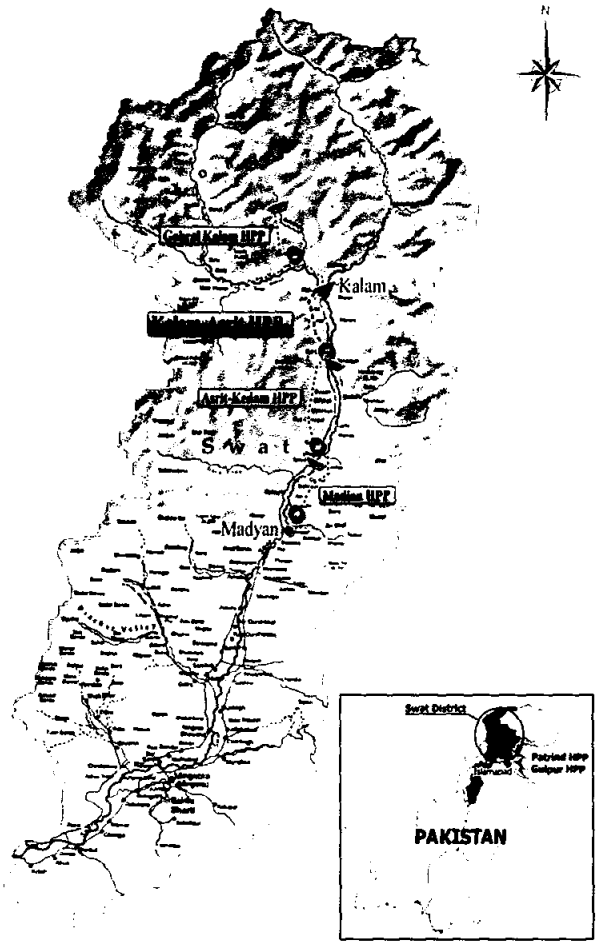
As per findings of the Feasibility Study, the potential installed capacity of the Project has increased from 197MW to 238 MW.

3. PROJECT LOCATION

The Project is located on the Swat River across from the Kalam to the Asrit Villages in District Swat, Khyber Pakhtunkhwa Province, Pakistan.

The project area is accessible from Islamabad by motorway M1 and then Swat Expressway M16 to Chakdarra then from Chakdarra to Site by N95 highway. Both N45 and N95 are metaled roads. The distance of the Project is approximately 350 Km from Islamabad.

The proposed dam and intake structure is located three approx. 2 Km downstream of the confluence of Gabral River and Ushu River. The proposed location for the powerhouse is 500 m upstream upstream of the Asrit village. The proposed headrace tunnel is proposed on the right side of Swat river, straight down to the village Asrit.



The project area falls in sub-humid and sub-tropical zone of district swat with moderate summer and extreme cold winter. The hottest month is June with mean maximum and minimum temperature of 26°C and 11°C respectively, and the coldest month is January with mean maximum and minimum temperature of 7°C and -6°C, while the annual precipitation averages 9 mm.

Air temperature is decreased by 0.6°C ~ 1.0°C per every 100 m increase in the elevation. Snowfall occurs from EL. 5,000. Considering the elevation of the catchment

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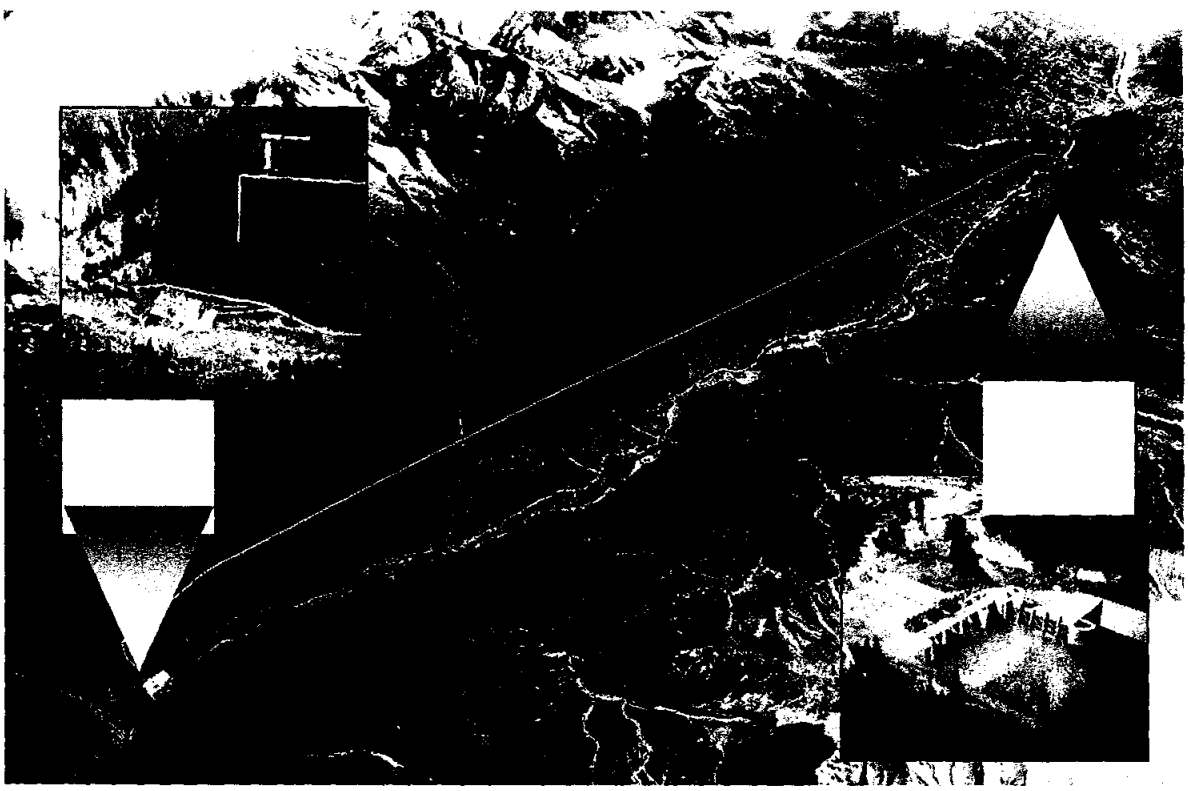
area and temperature, it is supposed that snow accumulation plays a major role in the hydrological cycle.

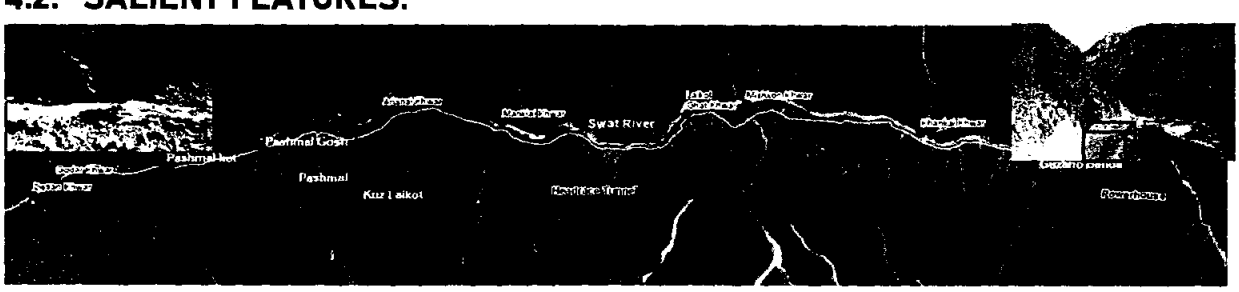
Major precipitation events are concentrated from January to May and maximum precipitation is in March and April. It is supposed that the precipitation from March to April is falling as snow and rainfall.

4. SALIENT FEATURES OF THE PROJECT

4.1. PROJECT AERIAL VIEW:



4.2. SALIENT FEATURES:



Item		Unit	F/S, 2022	Remark
Hydrology	Catchment Area	km²	2,030	Weir Site

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Item		Unit	F/S, 2022	Remark
	Annual Average Run-off	m^3/s	88.4	Weir Site
Power Generation & Energy Estimation	Plant Discharge	m^3/s	130.0	
	Gross Head	m	222.1	
	Head Loss	m	18.1	
	Installed Capacity	MW	238 (4 Units) 68.4 MW x 3 Units 33.0 MW x 1 Unit	(after turbine, generator & transformer efficiencies)
	Annual Average Power Generation	GWh /year	945.8	
	Plant factor	%	45.37	
Diversion Tunnel	Diversion Discharge	m^3/s	400.4	2 Year return period
	Size	m	D-shaped, 7.5x 7.5x3.75	B x H x R
	Length	m	484.0	Excluding portal of Inlet & outlet
Upstream Cofferdam	Type		Concrete Dam with secant pile	
	Dam Crest Level	EL. m	1,944 (1,940)	During Construction (During Operation)
Downstream Cofferdam	Type		Rockfill Dam	
	Dam Crest Level	EL. m	1,935	
Weir & Spillway	Type		CGD	Concrete Gravity Dam
	Design Discharge	m^3/s	1,258.3 (1,000yr)	
	Safety Check Discharge	m^3/s	1948.0	10,000yr including GLOF
	Weir Crest Level	EL. m	1,947.0	
	Spillway Crest Level	EL. m	1,939.0	
	Length	m	90.3	
	Height	m	23.0	
	Spillway Gate	m	10.0 x 6.0 x 3	B x H x Nos.
	Sluiceway Gate	m	5.0 x 4.5 x 2	B x H x Nos.
Desander Basin	Type		Design Particle 0.2 mm	
	Width	m	Var.	Natural Desander Volume : 199,104 m^3
	Height	m	12	
	Length	m	230	
Intake	Type		Bellmouth circular	Box shape
	Invert Elevation	EL. m	1930.0	
	Inlet Diameter	m	7.4	Trash-rack W 8.0 × H 10.9 for FS
	Length	m	29.2	
Headrace Tunnel	Type		Circular	Excavation : Modified Horse Shoe
	Diameter	m	7.4	
	Length	m	11,589.6	
Vertical	Type		Circular	

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Item		Unit	F/S, 2022	Remark
Pressure Shaft	Diameter	m	7.4 (Con'c)	
	Height	m	125.9	
Surge Shaft	Type		Restricted Orifice	
	Size	m	D18.0	
	Height	m	81 (incl. Orifice)	
	Orifice size	m	D5.0	
	Max. up-surging water level	EL. m	1,969.6	
	Min. down-surging water level	EL. m	1,903.8	
Penstock (Manifold)	Type		Circular Steel lined	Excavation : Modified Horse Shoe
	Diameter	m	5.6 ~ 2.1	
	Length	m	339.5 (straight distance) D5.6, L 296.9, D3.0, L 29.06, D2.1, L 10.45	
Powerhouse	Type		Surface	
	Size	m	41.7 x 100.65 x 50.9	W x L x H
	Turbine Type		Francis	
	Turbine Capacity	MW	238 MW 68.4 MW x 3 Units 33.0 MW x 1 Unit	(after turbine, generator & transformer efficiencies)
	Turbine-Center Level	EL. m	1,713.7	

5. PROJECT IMPLEMENTATION PLAN

5.1. METHODOLOGY

a) KOEN has requisite experience and capability for fast-track project development which is evident from the implementation of Gulpur Hydropower Project. Additionally, KOEN has a very experienced and strong local team who played key role in the development of Gulpur Hydro and New Bong Escape Hydropower Project (1st Hydro IPP of Pakistan).

b) KOEN already has strong foothold in Pakistan and understand the sensitivities to work in Pakistani market and local environment.

c) KOEN work philosophy revolves around the maximum participation of local human resource and materials into the project. In Gulpur Hydropower Project more than 95% labour and staff is Pakistan national. KOEN believes to procure all those materials locally which are available in local markets;

d) KOEN considers local community as partners in progress. Therefore, implement a comprehensive and need based Corporate Social Responsibility programs and allocate upfront budgets and date specific target for such program;

e) Track record of Korean companies shows that they believe in fast-track project

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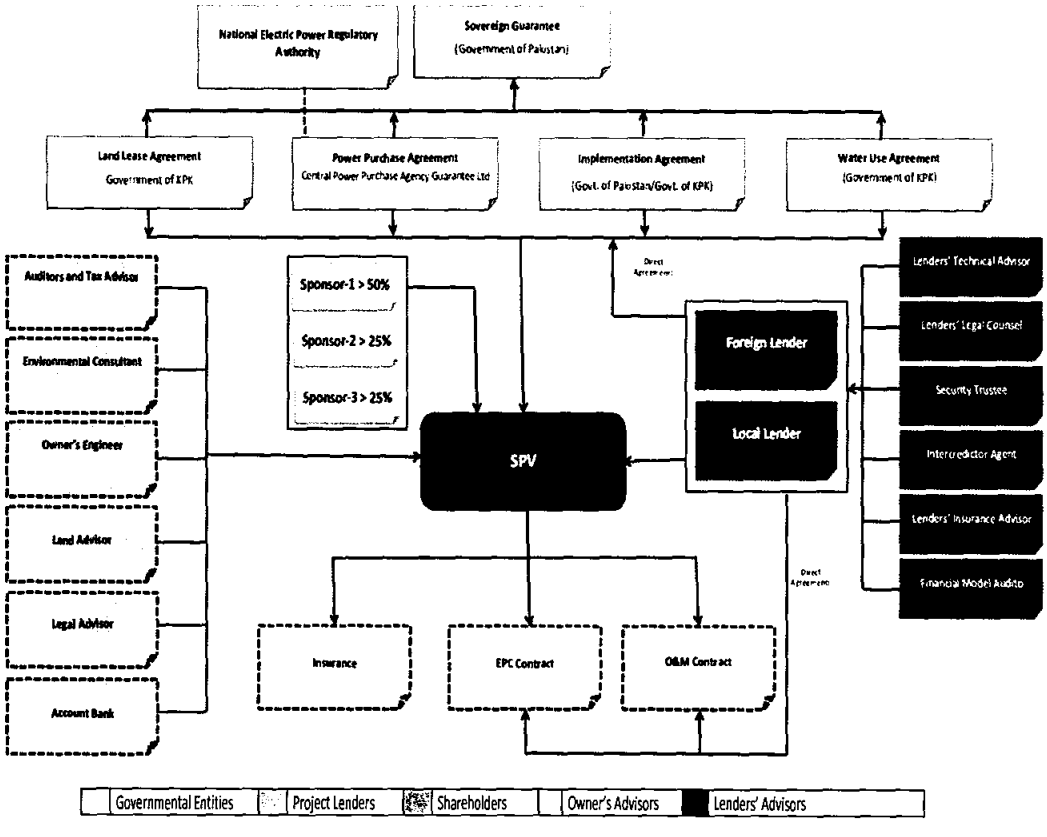
development and progress. The philosophy is to complete the project within time and allocated budgets.

f) The construction quality of Korean companies is at par with European Companies and preference is given to European turbines and generators to ensure durability and long life of the projects.

g) KOEN has very positive reputation worldwide and has the capability to raise debt financing at favorable conditions.

h) KOEN fully understand the provisions of KP Hydropower Policy 2016 and will not require any additional benefits or concessions to bring this investment to KPK.

5.2. PROJECT CONTRACTUAL STRUCTURE:



The methodology for development of the Project would include the various activities and the 10 major areas of control and responsibility are:

a) Financing arrangements;
b) EPC Contractor;
c) Owners Engineer arrangements
d) Concession Agreements
e) Power Purchase Agreement;

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f) Tariff arrangements & NEPRA approval;
g) Land Acquisition & Resettlement entitlement framework
h) O&M Contract & arrangements
i) Placement of Project Insurances;
j) Environment, health and safety approvals and compliance;

5.2.1. FINANCING

KOEN has planned to get lending amount through international financial institutions like Asian Development Bank, International Finance Corporation, Korean Export Import Bank and CDC UK based on its precedent investment in Gulpur Hydropower Project. In this regard, International Finance Corporation will be invited for loan of 20% of the Project Cost. KOEN will try to arrange 20% of the loan through Korean Export Import Bank. Some of the international banks have already shown their interests to collaborate with KOEN in its future transaction due to its earlier performance and standards. Additionally, the Sponsors may also consider bringing in local banks, subject to its impact on the tariff. The prime activities involved in the financing are:

- ✓ Arrangement of financing of the Project
- ✓ Appointment of Lenders Technical Advisor, Legal Counsel, Insurance Advisors, E&S Advisor and Financial Model Auditors
- ✓ Managing the due diligence (technical, financial, E&S and legal) by the Lenders
- ✓ Preparation of Information Memorandum and development of Financial Model
- ✓ Negotiations and finalization of Term sheets
- ✓ Negotiations and finalization of all Finance and Security Documents
- ✓ Satisfaction of conditions precedents to achieve the Financial Closing

5.2.2. EPC CONTRACT

As customary in limited recourse project financing, the construction of the Project shall be carried out based on "fixed price, time certain and turnkey" EPC Contract. The EPC Contractor shall be selected and appointed through "competitive bidding process" to ensure transparency and competitiveness. To make the bidding process transparent and meaningful, a standard RFP/Tender Documents/Project Requirements will be issued to all the bidders and bidders shall be required to include at the minimum following information in their bids (i) Technical Proposal, (ii) Financial Proposal, (iii) any variation from Tender design and detailed Project requirement; (iv) vendors list for the E&M equipment. Following the receipt of bids from contractors, a detailed evaluation (technical as well as financial) shall be carried out by an independent party which shall serve as the basis for selection of EPC Contractor. The key milestones involved are:

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- ✓ Issuance of Tender Documents to contractors
- ✓ Independent evaluation following receipt of bids
- ✓ Award Letter to selected EPC Contractor
- ✓ Ensuring all technical specifications are in line with prudent practices and NEPRA Grid Code
- ✓ Negotiations of EPC Price and EPC Contract
- ✓ Approval of the EPC Contract and its terms and conditions from the Government, Power Purchaser and the Lenders
- ✓ Signing of EPC Contract

5.2.3. OWNER'S ENGINEER

The Owner's Engineer role is pivotal in successful implementation of a hydropower project. Owner's Engineer role is primarily to carry out design review, construction monitoring, QA/QC and milestone completion certifications after physical check. Owner's Engineer ensures that Project is being constructed according to design, project requirements, EPC Contract and international and prudent practices. The Owner's Engineer role is critical for the fact that each hydropower project has unique site conditions and distinctive features and involves a high content of civil works which demands stringent construction monitoring.

To effectively play its role Owner's Engineer requires strong team of experts and professionals on site (for construction monitoring) and offsite (for design review). The Sponsors shall appoint a consultant consisting of a mix of foreign expats and local expertise for the construction monitoring and design reviews of the Project. The activities to be done for this are:

- ✓ Selection and appointment of most suitable Owner Engineer through competitive bidding
- ✓ Estimation of budgets and resources
- ✓ Drafting and negotiations of Owners Engineer Contract
- ✓ Getting the approval of OE Cost from the Power Purchaser & NEPRA
- ✓ Approval of the OE structure and contract from the Lenders
- ✓ Signing of OE Contract

5.2.4. CONCESSION DOCUMENTS

Concession Documents will comprise of Implementation Agreement with GOP and Water Use Agreement with Government of KPK. GOP Implementation Agreement provides the framework under which the Company will implement the Project and sets out fundamental obligations of the Company and GOP with respect to implementation of the Project. In the event that the GOP terminates the Implementation Agreement it is obliged to pay compensation to the Company, thus securing the investments made in the Project. The Water Use Agreement between

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the Company and the Government of KPK primarily is a consent given to the Company to utilize the water for the generation of electricity.

The GOP shall, at Financial Closing, execute and deliver to the Company, the Guarantee. The GOP Guarantee is an irrevocable and unconditional guarantee and the key document in the overall structure. Under this document the GOP guarantees the payment obligations (including monetary damages assessed) of all the Power Purchaser under the Power Purchase Agreement, and the Government of KPK under the Water Use Agreement. The key activities involved in this milestone are:

- ✓ Drafting of Concession Agreements
- ✓ Negotiations of Agreements with the Government
- ✓ Approval of the concession documents from Lenders
- ✓ Signing of Concession Agreements

5.2.5. POWER PURCHASE AGREEMENT

The Power Purchase Agreement shall be signed with CPPAG before Financial Closing for a term of 30 years after Commercial Operations Date. Under this Agreement, the Company shall be obligated to make available to the Power Purchaser the Tested Capacity (as applicable from time to time) from the Plant.

The Power Purchaser is obligated to purchase and the Company is obligated to deliver NEO (the net electrical energy delivered by the Company to the Interconnection Point for sale to the Power Purchaser) produced (i) after Commercial Operations Date at agreed tariff (ii) during testing and commissioning prior to COD, and (iii) during sectional completion at the rate to be mutually agreed. The key activities involved are:

- ✓ Drafting and negotiations of Power Purchase Agreement
- ✓ Ensuring that PPA is consistent with technical and commercial requirements of the Project
- ✓ Approval of all costs and PPA by NEPRA
- ✓ Signing of PPA

5.2.6. TARIFF ARRANGEMENTS

The Tariff structure under the KPK Hydropower Policy 2016 of Government of KPK has two basic components: Energy Purchase Price ("EPP"-Variable Component) and Capacity Purchase Price ("CPP"-Fixed Component). The EPP component of the tariff is based on the actual dispatch of the plant. It comprises of Water Use Charges and variable O&M costs. The CPP is the payment made for components that are independent of the amount of actual generation and ensures the smooth functioning of the plant and returns of the investors. The CPP comprises of (i) Fixed O&M cost, (ii) Insurance cost, (iii) Return on Equity (ROE), (iv) Return on Equity During Construction (ROEDC), (v) Debt Servicing (Principal and interest). Along with EPP and CPP, certain indexations and one-time adjustments are also

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allowed under the Power policy 2002 to maintain 17% IRR stream of the investors. The key activities involve are:

- ✓ Development, drafting and finalization of "Tariff Proposal"
- ✓ Negotiations of Tariff with the Power Purchaser and National Electric Power Regulatory Authority (NEPRA)
- ✓ Ensuring that Project Tariff covers all the legitimate costs incurred for the benefit of the Project

5.2.7. LAND LEASE

Site/Land acquisition is one of the most critical processes in the development of the Project. The area required for the construction of the Project (as per design criteria) shall be demarcated through installation of monuments. The listing of ownership shall be done to identify the land owned by Government and the land owned by private parties.

The Government land shall be leased to the Company for a period of thirty (30) years after COD i.e. the term of the Project. However, the private land shall be acquired by the Government from the private parties under the provisions of Land Acquisition Act 1894 and thereafter shall be leased to the Company for the term. The key activities to be carried out are:

- ✓ Demarcation of the Land as per required NOL
- ✓ Listing of ownership record of the land with the coordination of local administration of Government
- ✓ Filing of land lease applications and Notification 4
- ✓ Public consultation with the community to take them on board for the Project
- ✓ Negotiations of the rates of the land lease and compensation with the Government
- ✓ Negotiations and finalization of land lease agreements
- ✓ Ensuring that all land lease costs are part of approved tariff
- ✓ Approval of the lenders for overall land lease arrangements

5.2.8. INSURANCE ARRANGEMENTS

An overall Project Insurance Program, covering certain risks of construction and operations phase of the Project, shall be arranged by the Company; however, construction phase insurances shall be largely placed offshore. To assist in this, the Company shall appoint and seek guidance of international reputable insurance broker/advisor. The typical insurances placed during construction and operational phase of the Project are given below:

Construction Phase	*Operational Phase*
Construction "All Risks" Insurance	*"All Risks" of Physical Damage Insurance*

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Construction Delay in Start-Up Insurance	*Business Interruption Insurance*
Marine Transit Insurance	*Terrorism Asset & Revenue Protection*
Marine Transit Delay in Start-Up Insurance	*Third Party Liability Insurance*
Terrorism Asset & Revenue Protection	
Third Party Liability Insurance	

- ✓ Appointment of Company Insurance Advisor & Broker
- ✓ Arrangement of the insurance of the Project on best suitable rates under advice of the Insurance Advisor
- ✓ Arrangement of all reinsurances of the Project
- ✓ Approval of the insurance terms from the Power Purchaser and the Lenders

5.2.9. O & M ARRANGEMENTS

KOEN has a versatile Operation and Maintenance and Management track record and would operate the plant itself during the concession period. The KOEN shall mobilize its O&M Team at site six to eight months prior to commercial operations to ensure smooth taking-over of the Plant from the EPC Contractor. During this mobilization phase, the KOEN shall run the individual units (partial completion) under the supervision of the EPC Contractor. However, following COD, the KOEN shall be responsible for all the on-going maintenance and repair works of the Plant and will bear all the cost of routine work. The activities involved in this process are:

- ✓ Circulation of RFP for O&M of the Project
- ✓ NOC of O&M Contract and Contractor from Government
- ✓ Negotiations of the O&M Contract
- ✓ Ensuring the O&M Costs are consistent with the approved tariff and project budgets
- ✓ Approval of O&M Contract and O&M Budget from the Lenders

5.2.10. ENVIRONMENT HEALTH & SAFETY

Under Section 11 of the 2000 Act, a Project falling under any category (qualifying IEE or EIA) requires the proponent to file IEE or EIA with the Pak-EPA. The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. Other important policy documents and legal requirements of the project are: National Environmental Quality Standards (NEQS), National Resettlement Policy and Ordinance, The Land Acquisition Act, 1894, The Forest Act, 1927 and the Forest (Amendment) Act 2010, The Motor

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Vehicles Ordinance, 1965, and Rules, 1969, The Factories Act, 1934, The Pakistan Penal Code, 1860, The Explosives Act, 1884. Besides providing overview of Policy, Legal and Administrative Framework, the section 2 also adumbrates guidelines of ADB and requirements of IFC related to the project. To ensure environmental compliance, various studies to be conducted by the Company are:

i. Environmental and Social Impact Assessment (ESIA Study)
ii. Land and Resettlement Action Plan (LARP)
iii. Ecological Flow Assessment including Drift Model
iv. Health & Safety Plan
v. Contingency Plan
vi. Environment and Social Issue Management Plan

In addition to this, the Company shall be required to:

- ✓ Get approval of above documents from various stake holders including Government and Lenders
- ✓ Ensuring compliance with health and safety requirements for the Project and the Company
- ✓ Managing community relationships and implementation of the CSR program

6. PROJECT COSTS

6.1. CAPITAL COSTS

The cost estimates, presented below, are established based on the feasibility level design of the Project. The estimates have been made based on the skill, experience, and international best practices in context of similar hydropower projects in Pakistan to surmise all the cost components of the proposed hydropower scheme.

COST HEAD	AMOUNT (US$)
EPC Costs	365,958,331
Non-EPC Cost	86,173,259
Base Project Cost	452,131,590
Interest During Construction	37,201,428
Total Project Cost	489,333,018

6.2. EPC COSTS

The EPC Cost of the Project will be finalized after reception of firm bids from local and international EPC Contractors through international competitive bidding at later stage. The EPC Contract will be awarded on the base of quality and cost rankings as per guidelines provided by NEPRA for this purpose. Currently following cost is approved by POE under the Feasibility Study:

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COST HEAD	AMOUNT (US$)
Civil works	228,911,461
Electrical and Mechanical	105,398,764
Preliminary works & EPC Camp establishment	31,648,106
Total Construction Cost	**365,958,331**

6.3. NON-EPC COSTS

Non-EPC Costs are the non-construction capital costs and comprise all the overheads, already incurred and expected to be incurred during project development and construction phases, for developing the Project efficiently and complete it positively in timely and prudent manner. The development costs include all non-construction costs and have been computed warily by the consultants keeping in view the international and local best practices. While calculating these costs NEPRA's tariff guidelines are observed and explanations are provided where required.

The breakup of non-EPC cost is as follows,

Cost Head	AMOUNT (US$)
Owner Administration/ Overheads	9,000,000
Engineering and Supervision	20,001,023
Insurance during Construction	9,148,958
Financing/ Lender Fees	10,399,780
Custom Duties and Taxes	5,185,619
Owner's Advisors	3,573,209
Land Acquisition and Resettlement	5,052,367
Environment & Ecology	1,999,440
O&M Mobilization	2,500,000
Feasibility, Technical Studies/Tendering	3,000,000
Lenders Advisors & Agents	4,470,686
Sales Tax on Service	8,526,528
Government Fees and Approval	1,207,674
E&M LC Commission	2,107,975
Total - Non-EPC	**86,173,259**

These cost estimates are based on preliminary assessments and may need revision based on conditions prevailing on EPC stage tariff of the Project.

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

Company Registration Office

CERTIFICATE OF INCORPORATION

[Under section 16 of the Companies Act, 2017 (XIX of 2017)]

Corporate Unique Identification No. 0199665

I hereby certify that **KA POWER LIMITED** is this day incorporated under the Companies Act, 2017 (XIX of 2017) and that the company is **limited by shares.**

Given at **Islamabad** this **Eighth** day of **April,** Two **Thousand** and **Twenty Two**

Company Registration Office Islamabad
SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
SECP

SEAL OF REGISTRAR OF COMPANIES
SECP

19/04/2022

Saila Jamshaid
Joint Registrar

https://eservices.secp.gov.pk/eServices/ControllerServlet?request_id=VERIFY_ONLINE_INCORP_CERT&id=0199665

THE COMPANIES ACT, 2017 (XIX of 2017)

(COMPANY LIMITED BY SHARES)

MEMORANDUM

OF

ASSOCIATION

OF

KA POWER LIMITED

THE COMPANIES ACT, 2017 (XIX of 2017)

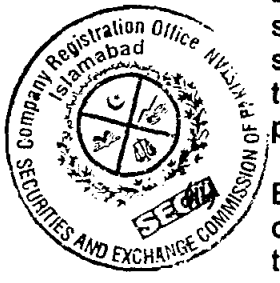
(COMPANY LIMITED BY SHARES)

MEMORANDUM OF ASSOCIATION

OF

KA POWER LIMITED

1. The name of the company is **KA POWER LIMITED**.
2. The registered office of the Company will be situated in **Islamabad Capital Territory.**
3. (i) The principal line of business of the company shall be to carry on all or any of the businesses of generating, purchasing, importing, transforming, converting, distributing, supplying, exporting and dealing in electricity and all other forms of energy and products or services associated therewith and of promoting the conservation and efficient use of electricity and to perform all other acts which are necessary or incidental to the business of electricity generation, transmission, distribution and supply, subject to permission of concerned authorities; and to locate, establish, construct, equip, operate, use, manage and maintain thermal power plants, coal fired power plants, hydal power plants, wind mills, power grid station, grid stations, cables, overhead lines, sub-stations, switching stations, tunnels, cable bridges, link boxes, heat pumps, plant and equipment for combined heat and power schemes, offices, computer centres, shops and necessary devices, showrooms, depots, factories, workshops, plants and to provide transforming, switching, conversion and transmission facilities, subject to permission of relevant authorities.



Except for the businesses mentioned in sub-clause (iii) hereunder, the company may engage in all the lawful businesses and shall be authorized to take all necessary steps and actions in connection therewith and ancillary thereto.

(iii) Notwithstanding anything contained in the foregoing sub-clauses of this clause nothing contained herein shall be construed as empowering the Company to undertake or indulge, directly or indirectly in the business of a Banking Company, Non-banking Finance Company (Mutual Fund, Leasing, Investment Company, Investment Advisor, Real Estate Investment Trust management company, Housing Finance Company, Venture Capital Company, Discounting Services, Microfinance or Microcredit business), Insurance Business, *Modaraba* management company, Stock Brokerage

business, forex, managing agency, business of providing the services of security guards or any other business restricted under any law for the time being in force or as may be specified by the Commission.

(iv) It is hereby undertaken that the company shall not:

(a) engage in any of the business mentioned in sub-clause (iii) above or any unlawful operation;

(b) launch multi-level marketing (MLM), Pyramid and Ponzi Schemes, or other related activities/businesses or any lottery business;

(c) engage in any of the permissible business unless the requisite approval, permission, consent or license is obtained from competent authority as may be required under any law for the time being in force.

4. The liability of the members is limited.

5. The authorized capital of the company is Rs. 528,000,000 (Rupees Five Hundred Twenty Eight Million Only) divided into 5,280,000 (Five Million Two Hundred Eighty Thousand Only) Ordinary Shares of Rs.100/- (Rupees Hundred Only) each with powers to increase and reduce the Capital of the Company and to divide the shares in the Capital for the time being into several classes in accordance with the provisions of Companies Act, 2017.

We, the several persons whose names and addresses are subscribed below, are desirous of being formed into a company, in pursuance of this **Memorandum of Association**, and we respectively agree to take the number of shares in the capital of the company as set opposite our respective names:

Name and surname (present & former) in full (in Block Letters)	NIC No. (in case of foreigner, Passport No.) Father's	Father's/ Husband's Name in full	Nationality(ies) with any former Nationality	Occupation	Usual residential address in full or the registered/ principal office address for a subscriber other than natural person	Number of shares taken by each subscriber (in figures and words)	Signatures
KOREA SOUTH-EAST POWER CO., LTD. THROUGH CHOI, HOON TAE	Reg. No. 120-86-19151 M96807349	NA CHOI, KYU SIK	KOREA (SOUTH) KOREA (SOUTH)	BUSINESS	IN KOREA 32, SADEUL-RO, 123 BEON-GIL, JINJU-SI, GYEONGSANGNAM-DO, REPUBLIC OF KOREA. IN PAKISTAN APARTMENT 804 B, 17TH FLOOR, CENTAURUS RESIDENCIA, JINNAH AVENUE SECTOR F-8, ISLAMABAD.	5,219,985	
MIN, BYEONG SOO	M03699409	MIN, CHOUNG SIK	KOREA (SOUTH)	SERVICE	IN KOREA 26, JEONGWANGSINGIL RO 49BEON GIL, SIHEUNG SI, GYEONGGI DO, REPUBLIC OF KOREA. IN PAKISTAN 7C, G8 MARKAZ, ISLAMABAD.	5	
CHOI, HOON TAE	M96807349	CHOI, KYU SIK	KOREA (SOUTH)	SERVICE	IN KOREA APARTMENT NO. 605/1203, CHUNGHEUNG APARTMENT, JINJUSI, GYUNGSANGNAMDO, REBUBLIC OF KOREA. IN PAKISTAN 7C, G8 MARKAZ, ISLAMABAD.	5	
KIM, MIN YOUNG	M19162342	KIM, CHONG-OK	KOREA (SOUTH)	SERVICE	IN KOREA BUSINESS 314-804 12, BYEORYANG RO GWACHEON-SI, GYEONGGI DO, REPUBLIC OF KOREA. IN PAKISTAN 7C, G8 MARKAZ, ISLAMABAD.	5	
Total number of shares taken (Five Million Two Hundred Twenty Thousand Only)						**5,220,000**	

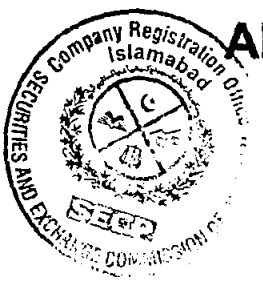
Dated the 10th day of March 2022.

Company Registration Office Islamabad
SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
SECP

19/04/2022

THE COMPANIES ACT, 2017 (XIX of 2017)

(COMPANY LIMITED BY SHARES)



ARTICLES OF ASSOCIATION

OF

KA POWER LIMITED

PRELIMINARY

PUBLIC COMPANY

1. The Regulations contained in Table 'A' to the First Schedule to the Companies Act, 2017 (the "Act") shall be the regulations of **KA POWER LIMITED** (the "Company") so far as these are applicable to a private company.
2. The Company is a "Public Company" within the meaning of Section 2(1)(52) of the Act and accordingly:

   The number of the members of the Company (exclusive of persons in the employment of the Company), shall not be limited, provided that for the purpose of this provision. Where two or more persons hold one or more shares in the company jointly, they shall be treated as single member, and

   The right to transfer shares of the Company shall not be restricted in the manner and to the extent herein appearing.
3. The authorized capital of the company is Rs.528,000,000 (Rupees Five Hundred Twenty-Eight Million Only) divided into 5,280,000 (Five Million Two Hundred Eighty Thousand Only) Ordinary Shares of Rs.100/- (Rupees Hundred Only) each with powers to increase and reduce the Capital of the Company and to divide the shares in the Capital for the time being into several classes in accordance with the provisions of Companies Act, 2017.
4. The minimum subscription upon which the directors may proceed to make the first allotment has been fixed as Rs. 522,000,000 (Rupees Five Hundred Twenty-Two Million Only).
5. (1) In these regulations—

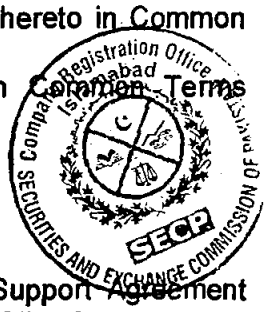
   1. In these Articles, unless the context or the subject matter otherwise requires:
   2.
   a) —the Company means **KA POWER LIMITED**.
   b) —the office means the registered office for the time being of the company.
   c) —the directors mean the directors for the time being of the company.
   d) —the seal means the common seal or official seal of the company as the case may be.
   e) —the Act means the Companies Act, 2017.
   f) —the Commission means the Securities and Exchange Commission of Pakistan.
   g) —the registrar means the registrar of companies as defined in the Companies Act, 2017.
   h) —the register means the register of the members to be kept in pursuant to section 119 of the Act.
   i) —chief executive means the chief executive of the company.
   j) —secretary means the company secretary of the company.
   k) —memorandum means the memorandum of association of the company.
   l) —person includes an individual, company, corporation and body corporate.
   m) —articles means the articles of association of the company.
   n) —board means the board of directors of the company.

o) —year used in the context of financial matters shall mean financial year of the company.
p) Expressions referring to writing shall be construed as including references to typewriting, printing, lithography, photography and other modes of representing or reproducing words in visible form.
q) Words importing the singular number include the plural number and vice versa and words importing the masculine gender include the feminine gender.
r) Unless the context otherwise requires words or expressions contained in these Articles shall be of the same meaning as in the Act or any statutory modification thereof in force at the date at which these Articles become binding on the company.
s) — **Interpretations**

1) **Affiliate** means any entity (including any person, firm, corporation, association or partnership) which (a) is owned and controlled, directly or beneficially, singly or collectively, by one or more Initial Shareholders, (b) owns and controls, directly or beneficially, one or more Initial Shareholders, or (c) is under common ownership and control, directly or beneficially, by an entity which owns and controls, directly or beneficially, one or more Initial Shareholders. For the purposes of this definition, "own and controls" by an entity or entities or another entity shall mean direct or beneficial ownership of fifty one percent (51%) or more interest in, and management control over, such other entity;
2) **Commercial Operation Date** means the meaning ascribed thereto in the Power Purchase Agreement;
3) **Complex** means the meaning ascribed thereto in the Power Purchase Agreement;
4) **Common Terms Agreement** means the Common Terms Agreement dated the Signing Date among the Company and the Finance Parties.
5) **Finance Parties** bears the meaning ascribed thereto in Common Terms Agreement.
6) **Financiers** bear the meaning ascribed thereto in Common Terms Agreement.
7) **GOP** bears the meaning ascribed thereto in the GOP Implementation Agreement.
8) **GOP Implementation Agreement** or **GOP IA** means the Implementation Agreement dated the Signing Date by and between the GOP and the Company entered into in relation to the Project, as may be amended by the parties thereto from time to time.
9) **Initial Shareholders** means (i)- **M/s. Korea South-East Power Co. Ltd.,** a company incorporated under the laws of Republic of Korea with its principal office at 32, Sadeul-Ro, 123 Beon-Gil, Jinju-Si, Gyeongsangnam-Do, Republic of Korea, (ii) - **Mr. Min, Byeong Soo** having Passport No. M03699409, (iii) - **Mr. Choi, Hoon Tae** having Passport No. M96807349, (iv) - **Mr. Kim, Min Young** having Passport No. M19162342 and all other shareholders as ascribed under the Sponsors' Support Agreement as well as under the Common Terms Agreement, with their permitted assigns, permitted transferee and successors;
10) **Main Sponsor** means **Korea South-East Power Co. Ltd.,** a company incorporated under the laws of Republic of Korea with its principal office at 32,

Sadeul-Ro, 123 Beon-Gil, Jinju-Si, Gyeongsangnam-Do, Republic of Korea with permitted assigns, permitted transferees and successors;

11) **Power Purchase Agreement** means the Power Purchase Agreement entered into by and between the Power Purchaser and the Company, for the purchase and sale of electric generation capacity and electric power generated by the Complex, as may be amended by the parties thereto from time to time; and
12) **Power Purchaser** means the Central Power Purchasing Agency (CPPA-G) is a Company incorporated under the Companies Ordinance, 1984 and wholly owned by the Government of Pakistan (the "GOP"), with its principal office located at CPPA-G, Shaheen Plaza, Plot No. 73-West, Fazal-e-Haq Road, Blue Area, Islamabad., Pakistan or any successor or substitute board or agency that assumes the responsibilities of the Central Power Purchasing Agency.
13) **PPIB** means the Private Power & Infrastructure Board of, a body corporate established under the Ministry of Water and Power, Government of Pakistan PPIB Act, 2012, with the principal office at Ground & 2nd Floors, Emigration Tower, Plot No. 10, Mauve Area, Sector G-8/1, Islamabad-Pakistan or any successor or substitute board or agency that assumes the responsibilities of the Private Power & Infrastructure Board.
14) **PEDO** means Pakhtunkhwa Energy Development Organization is an autonomous body of the Government of Khyber Pakhtunkhwa under the Pakhtunkhwa Energy Development Organization (Amendment) Act, 2014, with the principal office at Plot # 38, Sect B-2, Phase-5, Hayatabad, District Khyber Pakhtunkhwa, Peshawar-Pakistan or any successor or substitute board or agency that assumes the responsibilities of the Pakhtunkhwa Energy Development Organization.
15) **Project Completion Date** bears the meaning ascribed thereto in Common Terms Agreement.
16) **Release Date** bears the meaning ascribed thereto in Common Terms Agreement.
17) **Signing Date** bears the meaning ascribed thereto:
    a)-in Common Terms Agreement;
    b)-in GOP Implementation Agreement or GOP IA; and
    c)-in Sponsors Support Agreement.
18) **Sponsors Support Agreement** means the Sponsors Support Agreement dated the Signing Date among the Company, Sponsors' of the Company and the Finance Parties.



(2) Unless the context otherwise requires, words or expressions contained in these regulations shall have the same meaning as in this Act; and words importing the singular shall include the plural, and vice versa, and words importing the masculine gender shall include feminine, and words importing persons shall include bodies corporate.

BUSINESS

6. The directors shall have regard to the restrictions on the commencement of business imposed by section 19 if, and so far as, those restrictions are binding upon the company.

SHARES

7. In case of shares in the physical form, every person whose name is entered as a member in the register of members shall, without payment, be entitled to receive, within thirty days after allotment or within fifteen days of the application for registration of transfer, a certificate under the seal specifying the share or shares held by him and the amount paid up thereon:

   Provided that if the shares are in book entry form or in case of conversion of physical shares and other transferable securities into book-entry form, the company shall, within ten days after an application is made for the registration of the transfer of any shares or other securities to a central depository, register such transfer in the name of the central depository.

8. The company shall not be bound to issue more than one certificate in respect of a share or shares in the physical form, held jointly by several persons and delivery of a certificate for a share to one of several joint holders shall be sufficient delivery to all.

9. If a share certificate in physical form is defaced, lost or destroyed, it may be renewed on payment of such fee, if any, not exceeding one hundred rupees, and on such terms, if any, as to evidence and indemnity and payment of expenses incurred by the company in investigating title as the directors think fit.

10 Except to the extent and in the manner allowed by section 86, no part of the funds of the company shall be employed in the purchase of, or in loans upon the security of, the company's shares.

TRANSFER AND TRANSMISSION OF SHARES

The instrument of transfer of any share in physical form in the company shall be executed both by the transferor and transferee, and the transferor shall be deemed to remain holder of the share until the name of the transferee is entered in the register of members in respect thereof, provided that the following provisions/conditions apply to all shares issued by the Company:

(a) The transfer of such shares to persons of a nationality that is specifically prescribed by the laws of Pakistan shall not be registered by the Company.

(b) The Company shall have the right and power to investigate the declaration of nationality stated on any application for registration or transfer of such shares if, as a result of such transfer, the transferee would hold five percent (5%) or more of Ordinary Share Capital of the Company.

(c) The Company cannot issue any such shares and Initial Shareholder cannot transfer any such shares owned directly or beneficially by it at any time prior to the Commercial Operations Date or for a period of six (6) years after the Commercial Operations Date, if following such issuance or such transfer the Initial Shareholder will own directly, indirectly or beneficially less than fifty-one percent (51%) of the outstanding Ordinary Share Capital, except for a transfer of shares:

   (i) to another Initial Shareholder

   (ii) subject to national security interests of Pakistan as such interests shall be determined in the sole but reasonable discretion of the GOP, to an Affiliate of any Initial Shareholder;

(iii) required by any law(s) of Pakistan or by the operation of the law(s) of Pakistan or by order of a court, tribunal, or governmental authority or agency with appropriate jurisdiction;

(iv) resulting from the creation or enforcement of a security interest in or over any such shares in accordance with the financing documents entered into by the Company in relation to its power generation complex; or

(v) to which the Government of Pakistan (including any of its relevant authority or agency) has given its prior written approval.

(d) The Main Sponsor shall own directly or beneficially at all times prior to the Commercial Operations Date and for a period of six (6) years after the Commercial Operations Date, not less than twenty percent (20%) of the then outstanding Ordinary Share Capital, except where the reduction of ownership of Ordinary Share Capital below twenty percent (20%) by the Main Sponsor results from a transfer of Ordinary Share Capital:

(i) required by any laws of Pakistan or by the operation of the laws of Pakistan or by order of a court, tribunal, or governmental authority or agency with appropriate jurisdiction;

(ii) resulting from the creation or enforcement of a security interest in or over any Ordinary Share Capital in accordance with the financing documents entered into by the Company in relation to its power generation complex; or

(iii) the Government of Pakistan (including any of its relevant authority or agency) has given its prior written approval.

(e) The restrictions set out in Articles 6(c) and 6(d) above shall be noted on all share certificates by affixing thereon a prominent legend as follows: "Subject in all respects to the restrictions on transfers of these shares set out in Articles 6(c), and 6(d) of the Company's Articles of Association". After the completion of the time period, provided in Articles 6(c) and 6(d), any share certificates to which the legend set out in Article 6(e) is still affixed may be returned to the Company and exchanged for a new certificate in accordance with Article 5.

12. Shares in physical form in the company shall be transferred in the following form, or in any usual or common form which the directors shall approve:—

Form for Transfer of Shares

(First Schedule to the Companies Act, 2017)

I..... s/o .....r/o..... (hereinafter called the transferor) in consideration of the sum of..... paid to me by..... s/o .....r/o..... (hereinafter called the transferee), do hereby transfer to the said transferee.....the share (or shares) with distinctive numbers from .....to.....inclusive, in the **KA POWER LIMITED**, to hold unto the said transferee, his executors, administrators and assigns, subject to the several conditions on which I held the same at the time of the execution hereof, and I, the said transferee, do hereby agree to take the said share (or shares) subject to the conditions aforesaid.

As witness our hands this..... day of....., 20.....

Signature		Signature	
Transferor Full Name,	_____	Transferee Full Name,	_____
Father's / Husband's Name	_____	Father's / Husband's Name	_____
CNIC Number (in case of foreigner, Passport Number)	_____	CNIC Number (in case of foreigner, Passport Number)	_____
Nationality	_____	Nationality	_____
Occupation	_____	Occupation and Usual Residential Address	_____
Usual Residential Address	_____	Cell number	_____
		Landline number, If any Email address	

Bank Account Details of Transferee for Payment of Cash Dividend
(Mandatory in case of a listed company or optional for any other company)

It is requested that all my cash dividend amounts declared by the company, may be credited into the following bank account:

Tile of Bank Account	
Bank Account Number	
Bank's Name	
Branch Name and Address	

It is stated that the above mentioned information is correct and that I will intimate the changes in the above-mentioned information to the company and the concerned Share Registrar as soon as these occur.

.....
Signature of the Transferee(s)

13. (1) Subject to the restrictions contained in regulation 10 and 11, the directors shall not refuse to transfer any share unless the transfer deed is defective or invalid. The directors may also suspend the registration of transfers during the ten days immediately preceding a general meeting or prior to the determination of entitlement or rights of the shareholders by giving seven days' previous notice in the manner provided in the Act. The directors may, in case of shares in physical form, decline to recognize any instrument of transfer unless—

(a) a fee not exceeding fifty rupees as may be determined by the directors is paid to the company in respect thereof; and

(b) the duly stamped instrument of transfer is accompanied by the certificate of the shares to which it relates, and such other evidence as the directors may reasonably require to show the right of the transferor to make the transfer.

(2) If the directors refuse to register a transfer of shares, they shall within fifteen days after the date on which the transfer deed was lodged with the company send to the transferee and the transferor notice of the refusal indicating the defect or invalidity to the transferee, who shall, after removal of such defect or invalidity be entitled to re-lodge the transfer deed with the company.

Provided that the company shall, where the transferee is a central depository the refusal shall be conveyed within five days from the date on which the instrument of transfer was lodged with it notify the defect or invalidity to the transferee who shall, after the removal of such defect or invalidity, be entitled to re-lodge the transfer deed with the company.

TRANSMISSION OF SHARES

14. The executors, administrators, heirs, or nominees, as the case may be, of a deceased sole holder of a share shall be the only persons recognized by the company to deal with the share in accordance with the law. In the case of a share registered in the names of two or more holders, the survivors or survivor, or the executors or administrators of the deceased survivor, shall be the only persons recognized by the company to deal with the share in accordance with the law.
15. The shares or other securities of a deceased member shall be transferred on application duly supported by succession certificate or by lawful award, as the case may be, in favour of the successors to the extent of their interests and their names shall be entered in the register of members.
16. A person may on acquiring interest in a company as member, represented by shares, at any time after acquisition of such interest deposit with the company a nomination conferring on a person, being the relatives of the member, namely, a spouse, father, mother, brother, sister and son or daughter, the right to protect the interest of the legal heirs in the shares of the deceased in the event of his death, as a trustee and to facilitate the transfer of shares to the legal heirs of the deceased subject to succession to be determined under the Islamic law of inheritance and in case of non-Muslim members, as per their respective law.
17. The person nominated under regulation 12 shall, after the death of the member, be deemed as a member of company till the shares are transferred to the legal heirs and if the deceased was a director of the company, not being a listed company, the nominee shall also act as director of the company to protect the interest of the legal heirs.
18. A person to be deemed as a member under regulation 11, 12 and 13 to a share by reason of the death or insolvency of the holder shall be entitled to the same dividends and other advantages to which he would be entitled if he were the registered holder of the share and exercise any right conferred by membership in relation to meetings of the company.

ALTERATION OF CAPITAL

19. Subject to the provisions of Article 6(c) and 6(d), the company may, by special resolution—

    (a) -increase its authorized capital by such amount as it thinks expedient;

    (b) consolidate and divide the whole or any part of its share capital into shares of larger amount than its existing shares;

    (c) -sub-divide its shares, or any of them, into shares of smaller amount than is fixed by the memorandum;

(d) -cancel shares which, at the date of the passing of the resolution in that behalf, have not been taken or agreed to be taken by any person, and diminish the amount of its share capital by the amount of the share so cancelled.

20. Subject to the provisions of the Act, all new shares shall at the first instance be offered to such persons as at the date of the offer are entitled to such issue in proportion, as nearly as the circumstances admit, to the amount of the existing shares to which they are entitled. The offer shall be made by letter of offer specifying the number of shares offered, and limiting a time within which the offer, if not accepted, will deem to be declined, and after the expiration of that time, or on the receipt of an intimation from the person to whom the offer is made that he declines to accept the shares offered, the directors may dispose of the same in such manner as they think most beneficial to the company. The directors may likewise so dispose of any new shares which (by reason of the ratio which the new shares bear to shares held by persons entitled to an offer of new shares) cannot, in the opinion of the directors, be conveniently offered under this regulation.
21. The new shares shall be subject to the same provisions with reference to transfer, transmission and otherwise as the shares in the original share capital.
22. The company may, by special resolution—

(a) consolidate and divide its share capital into shares of larger amount than its existing shares;
(b) sub-divide its existing shares or any of them into shares of smaller amount than is fixed by the memorandum of association, subject, nevertheless, to the provisions of section 85;
(c) cancel any shares which, at the date of the passing of the resolution, have not been taken or agreed to be taken by any person.

23. The company may, by special resolution, reduce its share capital in any manner and with, and subject to confirmation by the Court and any incident authorized and consent required, by law.

GENERAL MEETINGS

24. The statutory general meeting of the company shall be held within the period required by section 131.
25. A general meeting, to be called annual general meeting, shall be held, in accordance with the provisions of section 132, within sixteen months from the date of incorporation of the company and thereafter once at least in every year within a period of **one hundred and twenty days** following the close of its financial year.
26. All general meetings of a company other than the statutory meeting or an annual general meeting mentioned in sections 131 and 132 respectively shall be called extraordinary general meetings.
27. The directors may, whenever they think fit, call an extra-ordinary general meeting, and extra-ordinary general meetings shall also be called on such requisition, or in default, may be called by such requisitions, as provided by section 133. If at any time there are not within Pakistan sufficient directors capable of acting to form a quorum, any director of the company may call an extra-ordinary general meeting in the same manner as nearly as possible as that in which meetings may be called by the directors.
28. The company may provide video-link facility to its members for attending general meeting at places other than the town in which general meeting is taking place after considering the geographical dispersal of its members:

Provided that in case of listed companies if the members holding ten percent of the total paid up capital or such other percentage of the paid up capital as may be specified, are resident in any other city, the company shall provide the facility of video-link to such members for attending annual general meeting of the company, if so required by such members in writing to the company at least seven days before the date of the meeting.

NOTICE AND PROCEEDINGS OF GENERAL MEETINGS

29. Twenty-one days' notice at the least (exclusive of the day on which the notice is served or deemed to be served, but inclusive of the day for which notice is given) specifying the place, the day and the hour of meeting and, in case of special business, the general nature of that business, shall be given in manner provided by the Act for the general meeting, to such persons as are, under the Act or the regulations of the company, entitled to receive such notice from the company; but the accidental omission to give notice to, or the non-receipt of notice by, any member shall not invalidate the proceedings at any general meeting.
30. All the business transacted at a general meeting shall be deemed special other than the business stated in sub-section (2) of section 134 namely; the consideration of financial statements and the reports of the board and auditors, the declaration of any dividend, the election and appointment of directors in place of those retiring, and the appointment of the auditors and fixing of their remuneration.
31. No business shall be transacted at any general meeting unless a quorum of members is present at that time when the meeting proceeds to business. The quorum of the general meeting shall be—

    (a) in the case of a public listed company, not less than ten members present personally, or through video-link who represent not less than twenty-five per cent of the total voting power, either of their own account or as proxies;
    (b) in the case of any other company having share capital, two members present personally, or through video-link who represent not less than twenty-five per cent of the total voting power, either of their own account or as proxies.
32. If within half an hour from the time appointed for the meeting a quorum is not present, the meeting, if called upon the requisition of members, shall be dissolved; in any other case, it shall stand adjourned to the same day in the next week at the same time and place, and, if at the adjourned meeting a quorum is not present within half an hour from the time appointed for the meeting, the members present, being not less than two, shall be a quorum.
33. The chairman of the board of directors, if any, shall preside as chairman at every general meeting of the company, but if there is no such chairman, or if at any meeting he is not present within fifteen minutes after the time appointed for the meeting, or is unwilling to act as chairman, any one of the directors present may be elected to be chairman, and if none of the directors is present, or willing to act as chairman, the members present shall choose one of their number to be chairman.
34. The chairman may, with the consent of any meeting at which a quorum is present (and shall if so directed by the meeting), adjourn the meeting from time to time but no business shall be transacted at any adjourned meeting other than the business left unfinished at the meeting from which the adjournment took place. When a meeting is adjourned for fifteen days or more, notice of the adjourned meeting shall be given as in the case of an original meeting. Save as aforesaid, it shall not be necessary to give any notice of an adjournment or of the business to be transacted at an adjourned meeting.

35. (1)-At any general meeting a resolution put to the vote of the meeting shall be decided on a show of hands unless a poll is (before or on the declaration of the result of the show of hands) demanded. Unless a poll is so demanded, a declaration by the chairman that a resolution has, on a show of hands, been carried, or carried unanimously, or by a particular majority, or lost, and an entry to that effect in the book of the proceedings of the company shall be conclusive evidence of the fact, without proof of the number or proportion of the votes recorded in favour of, or against, that resolution.

(2)-At any general meeting, the company shall transact such businesses as may be notified by the Commission, only through postal ballot.

36. A poll may be demanded only in accordance with the provisions of section 143.

37. If a poll is duly demanded, it shall be taken in accordance with the manner laid down in sections 144 and 145 and the result of the poll shall be deemed to be the resolution of the meeting at which the poll was demanded.

38. A poll demanded on the election of chairman or on a question of adjournment shall be taken at once.

39. In the case of an equality of votes, whether on a show of hands or on a poll, the chairman of the meeting at which the show of hands takes place, or at which the poll is demanded, shall have and exercise a second or casting vote.

40. Except for the businesses specified under sub-section (2) of section 134 to be conducted in the annual general meeting, the members of a private company or a public unlisted company (having not more than fifty members), may pass a resolution (ordinary or special) by circulation signed by all the members for the time being entitled to receive notice of a meeting. The resolution by circulation shall be deemed to be passed on the date of signing by the last of the signatory member to such resolution.

VOTES OF MEMBERS

41. Subject to any rights or restrictions for the time being attached to any class or classes of shares, on a show of hands every member present in person shall have one vote except for election of directors in which case the provisions of section 159 shall apply. On a poll every member shall have voting rights as laid down in section 134.

42. In case of joint-holders, the vote of the senior who tenders a vote, whether in person or by proxy or through video-link shall be accepted to the exclusion of the votes of the other joint-holders; and for this purpose seniority shall be determined by the order in which the names stand in the register of members.

43. A member of unsound mind, or in respect of whom an order has been made by any court having jurisdiction in lunacy, may vote, whether on show of hands or on a poll or through video link, by his committee or other legal guardian, and any such committee or guardian may, on a poll, vote by proxy.

44. On a poll votes may be given either personally or through video link, by proxy or through postal ballot:

Provided that nobody corporate shall vote by proxy as long as a resolution of its directors in accordance with the provisions of section 138 is in force.

45. (1)-The instrument appointing a proxy shall be in writing under the hand of the appointer or of his attorney duly authorized in writing.

(2)-The instrument appointing a proxy and the power-of-attorney or other authority (if any) under which it is signed, or a notarially certified copy of that power or authority, shall be

deposited at the registered office of the company not less than forty-eight hours before the time for holding the meeting at which the person named in the instrument proposes to vote and in default the instrument of proxy shall not be treated as valid.

46. An instrument appointing a proxy may be in the following form, or a form as near thereto as may be:

INSTRUMENT OF PROXY

KA POWER LIMITED

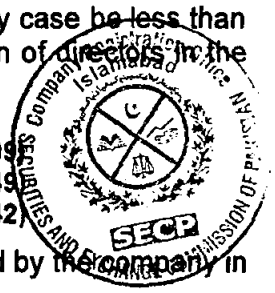
I ..... s/o ..... r/o.....being a member of the ..... Limited, hereby appoint..... s/o.....r/o .....as my proxy to attend and vote on my behalf at the (statutory, annual, extra-ordinary, as the case may be) general meeting of the company to be held on the.... day of....., 2.... and at any adjournment thereof.

47. A vote given in accordance with the terms of an instrument of proxy shall be valid notwithstanding the previous death or insanity of the principal or revocation of the proxy or of the authority under which the proxy was executed, or the transfer of the share in respect of which the proxy is given, provided that no intimation in writing of such death, insanity, revocation or transfer as aforesaid shall have been received by the company at the office before the commencement of the meeting or adjourned meeting at which the proxy is used.

DIRECTORS

48. The following subscribers of the memorandum of association shall be the first directors of the company, so, however, that the number of directors shall not in any case be less than that specified in section 154 and they shall hold office until the election of directors in the first annual general meeting:

1	MR. MIN, BYEONG SOO	(PASSPORT NO. M03699409)
2	MR. CHOI, HOON TAE	(PASSPORT NO. M96807349)
3	MR. KIM, MIN YOUNG	(PASSPORT NO. M19162342)



49. The remuneration of the directors shall from time to time be determined by the company in general meeting subject to the provisions of the Act.
50. Save as provided in section 153, no person shall be appointed as a director unless he is a member of the company.

POWERS AND DUTIES OF DIRECTORS

51. The business of the company shall be managed by the directors, who may pay all expenses incurred in promoting and registering the company, and may exercise all such powers of the company as are not by the Act or any statutory modification thereof for the time being in force, or by these regulations, required to be exercised by the company in general meeting, subject nevertheless to the provisions of the Act or to any of these regulations, and such regulations being not inconsistent with the aforesaid provisions, as may be prescribed by the company in general meeting but no regulation made by the company in general meeting shall invalidate any prior act of the directors which would have been valid if that regulation had not been made.
52. The directors shall appoint a chief executive in accordance with the provisions of sections 186 and 187.
53. The amount for the time being remaining un-discharged of moneys borrowed or raised by the directors for the purposes of the company (otherwise than by the issue of share capital) shall not at any time, without the sanction of the company in general meeting, exceed the issued share capital of the company.

54. The directors shall duly comply with the provisions of the Act, or any statutory modification thereof for the time being in force, and in particular with the provisions in regard to the registration of the particulars of mortgages, charges and pledge affecting the property of the company or created by it, to the keeping of a register of the directors, and to the sending to the registrar of an annual list of members, and a summary of particulars relating thereto and notice of any consolidation or increase of share capital, or sub-division of shares, and copies of special resolutions and a copy of the register of directors and notifications of any changes therein.

MINUTE BOOKS

55. The directors shall cause records to be kept and minutes to be made in book or books with regard to—

(a) all resolutions and proceedings of general meeting(s) and the meeting(s) of directors and Committee(s) of directors, and every member present at any general meeting and every director present at any meeting of directors or Committee of directors shall put his signature in a book to be kept for that purpose;
(b) recording the names of the persons present at each meeting of the directors and of any committee of the directors, and the general meeting; and
(c) all orders made by the directors and Committee(s) of directors:

Provided that all records related to proceedings through video-link shall be maintained in accordance with the relevant regulations specified by the Commission which shall be appropriately rendered into writing as part of the minute books according to the said regulations.

THE SEAL

56. The directors shall provide for the safe custody of the seal and the seal shall not be affixed to any instrument except by the authority of a resolution of the board of directors or by a committee of directors authorized in that behalf by the directors and in the presence of at least two directors and of the secretary or such other person as the directors may appoint for the purpose; and those two directors and secretary or other person as aforesaid shall sign every instrument to which the seal of the company is so affixed in their presence.

DISQUALIFICATION OF DIRECTORS

57. No person shall become the director of a company if he suffers from any of the disabilities or disqualifications mentioned in section 153 or disqualified or debarred from holding such office under any of the provisions of the Act as the case may be and, if already a director, shall cease to hold such office from the date he so becomes disqualified or disabled:

Provided, however, that no director shall vacate his office by reason only of his being a member of any company which has entered into contracts with, or done any work for, the company of which he is director, but such director shall not vote in respect of any such contract or work, and if he does so vote, his vote shall not be counted.

PROCEEDINGS OF DIRECTORS

58. The directors may meet together for the dispatch of business, adjourn and otherwise regulate their meetings, as they think fit. A director may, and the secretary on the requisition

of a director shall, at any time, summon a meeting of directors. Notice sent to a director through email whether such director is in Pakistan or outside Pakistan shall be a valid notice.

59. The directors may elect a chairman of their meetings and determine the period for which he is to hold office; but, if no such chairman is elected, or if at any meeting the chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to act as chairman, the directors present may choose one of their number to be chairman of the meeting.
60. At least one-third (1/3rd) of the total number of directors or two (2) directors whichever is higher, for the time being of the company, present personally or through video-link, shall constitute a quorum.
61. Save as otherwise expressly provided in the Act, every question at meetings of the board shall be determined by a majority of votes of the directors present in person or through video-link, each director having one vote. In case of an equality of votes or tie, the chairman shall have a casting vote in addition to his original vote as a director.
62. The directors may delegate any of their powers not required to be exercised in their meeting to committees consisting of such member or members of their body as they think fit; any committee so formed shall, in the exercise of the powers so delegated, conform to any restrictions that may be imposed on them by the directors.
63. (1)-A committee may elect a chairman of its meetings; but, if no such chairman is elected, or if at any meeting the chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to act as chairman, the members present may choose one of their number to be chairman of the meeting.

    (2)-A committee may meet and adjourn as it thinks proper. Questions arising at any meeting shall be determined by a majority of votes of the members present. In case of an equality of votes, the chairman shall have and exercise a second or casting vote.
64. All acts done by any meeting of the directors or of a committee of directors, or by any person acting as a director, shall, notwithstanding that it be afterwards discovered that there was some defect in the appointment of any such directors or persons acting as aforesaid, or that they or any of them were disqualified, be as valid as if every such person had been duly appointed and was qualified to be a director.
65. A copy of the draft minutes of meeting of the board of directors shall be furnished to every director within seven working days of the date of meeting.
66. A resolution in writing signed by all the directors for the time being entitled to receive notice of a meeting of the directors shall be as valid and effectual as if it had been passed at a meeting of the directors duly convened and held.

FILLING OF VACANCIES

67. At the first annual general meeting of the company, all the directors shall stand retired from office, and directors shall be elected in their place in accordance with section 159 for a term of three years.
68. A retiring director shall be eligible for re-election.
69. The directors shall comply with the provisions of sections 154 to 159 and sections 161, 162 and 167 relating to the election of directors and matters ancillary thereto.
70. Any casual vacancy occurring on the board of directors may be filled up by the directors, but the person so chosen shall be subject to retirement at the same time as if he had become a director on the day on which the director in whose place he is chosen was last elected as director.

71. The company may remove a director but only in accordance with the provisions of the Act.

DIVIDENDS AND RESERVE

72. The company in general meeting may declare dividends but no dividend shall exceed the amount recommended by the directors.
73. The directors may from time to time pay to the members such interim dividends as appear to the directors to be justified by the profits of the company.
74. Any dividend may be paid by a company either in cash or in kind only out of its profits. The payment of dividend in kind shall only be in the shape of shares of listed company held by the distributing company.
75. Dividend shall not be paid out of unrealized gain on investment property credited to profit and loss account.
76. Subject to the rights of persons (if any) entitled to shares with special rights as to dividends, all dividends shall be declared and paid according to the amounts paid on the shares.
77. (1)-The directors may, before recommending any dividend, set aside out of the profits of the company such sums as they think proper as a reserve or reserves which shall, at the discretion of the directors, be applicable for meeting contingencies, or for equalizing dividends, or for any other purpose to which the profits of the company may be properly applied, and pending such application may, at the like discretion, either be employed in the business of company or be invested in such investments (other than shares of the company) as the directors may, subject to the provisions of the Act, from time to time think fit.

(2)-The directors may carry forward any profits which they may think prudent not to distribute, without setting them aside as a reserve.

78. If several persons are registered as joint-holders of any share, any one of them may give effectual receipt for any dividend payable on the share.
79. (1)-Notice of any dividend that may have been declared shall be given in manner hereinafter mentioned to the persons entitled to share therein but, in the case of a public company, the company may give such notice by advertisement in a newspaper circulating in the Province in which the registered office of the company is situate.

(2)-Any dividend declared by the company shall be paid to its registered shareholders or to their order. The dividend payable in cash may be paid by cheque or warrant or in any electronic mode to the shareholders entitled to the payment of the dividend, as per their direction.

(3)-In case of a listed company, any dividend payable in cash shall only be paid through electronic mode directly into the bank account designated by the entitled shareholders.

80. The dividend shall be paid within the period laid down under the Act.

ACCOUNTS

81. The directors shall cause to be kept proper books of account as required under section 220.
82. The books of account shall be kept at the registered office of the company or at such other place as the directors shall think fit and shall be open to inspection by the directors during business hours.
83. The directors shall from time to time determine whether and to what extent and at what time and places and under what conditions or regulations the accounts and books or papers of the company or any of them shall be open to the inspection of members not being directors, and no member (not being a director) shall have any right of inspecting any account and

book or papers of the company except as conferred by law or authorized by the directors or by the company in general meeting.

84. The directors shall as required by sections 223 and 226 cause to be prepared and to be laid before the company in general meeting the financial statements duly audited and reports as are referred to in those sections.

85. The financial statements and other reports referred to in regulation 80 shall be made out in every year and laid before the company in the annual general meeting in accordance with sections 132 and 223.

86. A copy of the financial statements and reports of directors and auditors shall, at least twenty-one days preceding the meeting, be sent to the persons entitled to receive notices of general meetings in the manner in which notices are to be given hereunder.

87. The directors shall in all respect comply with the provisions of sections 220 to 227.

88. Auditors shall be appointed and their duties regulated in accordance with sections 246 to 249.

NOTICES

89. (1)-A notice may be given by the company to any member to his registered address or if he has no registered address in Pakistan to the address, if any, supplied by him to the company for the giving of notices to him against an acknowledgement or by post or courier service or through electronic means or in any other manner as may be specified by the Commission.

(2)-Where a notice is sent by post, service of the notice shall be deemed to be effected by properly addressing, prepaying and posting a letter containing the notice and, unless the contrary is proved, to have been effected at the time at which the letter will be delivered in the ordinary course of post.

90. A notice may be given by the company to the joint-holders of a share by giving the notice to the joint-holder named first in the register in respect of the share.

91. A notice may be given by the company to the person entitled to a share in consequence of the death or insolvency of a member in the manner provided under regulation 85 addressed to them by name, or by the title or representatives of the deceased, or assignees of the insolvent, or by any like description, at the address, supplied for the purpose by the person claiming to be so entitled.

92. Notice of every general meeting shall be given in the manner hereinbefore authorized to (a) every member of the company and also to (b) every person entitled to a share in consequence of the death or insolvency of a member, who but for his death or insolvency would be entitled to receive notice of the meeting, and (c) to the auditors of the company for the time being and every person who is entitled to receive notice of general meetings.

WINDING UP

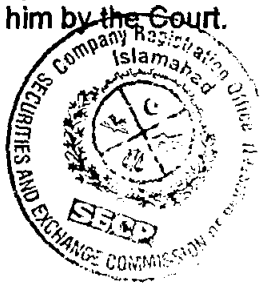
93. (1)-In the case of members' voluntary winding up, with the sanction of a special resolution of the company, and, in the case of creditors' voluntary winding up, of a meeting of the creditors, the liquidator shall exercise any of the powers given by sub-section (1) of section 337 of the Act to a liquidator in a winding up by the Court including inter-alia divide amongst the members, in specie or kind, the whole or any part of the assets of the company, whether they consist of property of the same kind or not.

(2)-For the purpose aforesaid, the liquidator may set such value as he deems fair upon any property to be divided as aforesaid and may determine how such division shall be carried out as between the members or different classes of members.

(3)-The liquidator may, with the like sanction, vest the whole or any part of such assets in trustees upon such trusts for the benefit of the contributories as the liquidator, with the like sanction, thinks fit, but so that no member shall be compelled to accept any shares or other securities whereon there is any liability.

INDEMNITY

94. Every officer or agent for the time being of the company may be indemnified out of the assets of the company against any liability incurred by him in defending any proceedings, whether civil or criminal, arising out of his dealings in relation to the affairs of the company, except those brought by the company against him, in which judgment is given in his favour or in which he is acquitted, or in connection with any application under section 492 in which relief is granted to him by the Court.



We, the several persons whose names and addresses are subscribed below, are desirous of being formed into a company, in pursuance of this **Articles of Association**, and we respectively agree to take the number of shares in the capital of the company as set opposite our respective names:

Name and surname (present & former) in full (in Block Letters)	NIC No. (in case of foreigner, Passport No.) Father's	Father's/ Husband's Name in full	Nationality (ies) with any former Nationality	Occupation	Usual residential address in full or the registered/ principal office address for a subscriber other than natural person	Number of shares taken by each subscriber (in figures and words)	Signatures
KOREA SOUTH-EAST POWER CO., LTD. THROUGH CHOI, HOON TAE	Reg. No. 120-86-19151 M96807349	NA CHOI, KYU SIK	KOREA (SOUTH) KOREA (SOUTH)	BUSINESS	IN KOREA 32, SADEUL-RO, 123 BEON-GIL, JINJU-SI, GYEONGSANGNAM-DO, REPUBLIC OF KOREA. IN PAKISTAN APARTMENT 804 B, 17TH FLOOR, CENTAURUS RESIDENCIA, JINNAH AVENUE SECTOR F-8, ISLAMABAD.	5,219,985	
MIN, BYEONG SOO	M03699409	MIN, CHOUNG SIK	KOREA (SOUTH)	SERVICE	IN KOREA 26, JEONGWANGSINGIL RO 49BEON GIL, SIHEUNG SI, GYEONGGI DO, REPUBLIC OF KOREA. IN PAKISTAN 7C, G8 MARKAZ, ISLAMABAD.	5	
CHOI, HOON TAE	M96807349	CHOI, KYU SIK	KOREA (SOUTH)	SERVICE	IN KOREA APARTMENT NO. 606/1203, CHUNGHEUNG APARTMENT, JINJUSI, GYUNGSANGNAMDO, REBUBLIC OF KOREA. IN PAKISTAN 7C, G8 MARKAZ, ISLAMABAD.	5	
KIM, MIN YOUNG	M19162342	KIM, CHONG-OK	KOREA (SOUTH)	SERVICE	IN KOREA BUSINESS 314-804 12, BYEORYANG RO GWACHEON-SI, GYEONGGI DO, REPUBLIC OF KOREA. IN PAKISTAN 7C, G8 MARKAZ, ISLAMABAD.	5	
Total number of shares taken (Five Million Two Hundred Twenty Thousand Only)						**5,220,000**	

Dated the 10th day of March 2022.

Company Registration Office Islamabad
SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
SECP

19/04/2022

KA POWER LIMITED

23rd Floor, Ufone Tower,
Jinnah Avenue, Blue Area,
Islamabad.
Tel: +92 51 2726703
Fax: +92 51 2726703

ANNEX-D

DETAILS OF AUTHORIZED, ISSUED, AND PAID-UP CAPITAL

238 MW KALAM ASRIT HYDROPOWER PROJECT

Inc . Form - II

COMPANIES (INCORPORATION) REGULATIONS, 2017
[See Section 16 of the Act and Regulation 6]

APPLICATION FOR COMPANY INCORPORATION

Close

PART- I

1.1 Name of the Company	KA POWER LIMITED	
1.2 Fee Payment Details	1.2.1 Challan No	E-2022-926430
	1.2.2. Challan Amount (Rs.)	660.0

PART- II

Section - A - Company Information

2.1 Correspondence Address*	Plot 7C,, G8 Markaz,, Islamabad, Islamabad Islamabad Urban, ISLAMABAD, Islamabad Capital Territory (I.C.T.)				
City	Islamabad Urban	District	ISLAMABAD	Province	Islamabad Capital Territory (I. C.T.)
Telephone Number	0092518735923		Email Address	tariq@koakpower.com	
Mobile Number	03181545945				

* Information regarding Correspondence address is to be provided only if company does not have a place at its registered office at the time of incorporation of the company

2.2 Registered office Address, if any					
City		District		Province	
Telephone Number			Website (if any)		
Mobile Number			Email Address		

2.3 Principal line of business (Brief object as per clause 3(i) of the Memorandum may be mentioned)	--HYDEL

Section - B - Capital Structure

	Class / Kind	Face Value	No of Shares	Total Amount
2.4 Authorised Capital	ORDINARY	100	5,280,000	528,000,000
2.5 Paid Up Capital	ORDINARY	100	5,220,000	522,000,000

Section - C - Special Business Information*

(Applicable in case of Banking Company, Non-banking Finance Company, Insurance company, Modaraba management company, Stock Brokerage business, forex, real estate business, managing agency, business of providing the services of security guards and any other business restricted under any other law or as may be notified by the commission)

2.6 Nature of business in case of specialized business requiring licence / permission / approval (please specify and also attach NOC / approval of the relevant authority)	To develop, construct, operate and maintain Kohala, Azad, Hydroelectric Power Generation Project at Swat River. Please see MOU, PEDO, and NOC for EOI in the name of Korea South East Power Co., Ltd.

(Additional documents will be required by the Registrar)

Company Registration Office
SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
SECP

Section - D - Company subscribers, directors, chief executive officer and in case of sinlge member company, nominee

2.7 State Number of directors fixed by subscribers:

[Please note that as per law a company must have minimum director as follows:]

Kind of company	Minimum number of directors required by law	No. of proposed directors
Single Member Company	01	
Private Limited Company	02	
Public Limited Company	03	3

2.8 Details of subscribers, directors and chief executive officer*

Name And Surname (Present and Former) in Full	Father/Husband Name in Full	CNIC/NICOP (In Case of Pakistani National) or Passport No (In Case of Foreigner)	**Incorporation/Registration No	Nationality (with former nationality and nationality of the origin, if different)	***Occupation	Residential Address/Registered Office Address Or Principle Office (In Case of a Subscriber Other Than A Natural Person)	NTN (In Case of Director Where Applicable)	Designation (Director/Subscriber/CEO) Please	Nature of Directorship (appointed, nominee/independent/other)	Name of Entity Nominating the Director	No. of Shares Subscribed (For Subscribers)	****Signatures
CHOI HOON TAE	S/O CHOI KYU SIK	M96807349		Korea South	SERVICE	APARTMENT 804 B, 17TH FLOOR, CENTAURUS RESIDENCIA, ISLAMABAD	4541410	Chief Executive				
CHOI HOON TAE	S/O CHOI KYU SIK	M96807349		Korea South	SERVICE	APARTMENT 804 B, 17TH FLOOR, CENTAURUS RESIDENCIA, ISLAMABAD	4541410	Director And Subscriber	Nominee	KOREA SOUTH-EAST POWER CO LTD	5	Electronically signed by CHOI HOON
KIM MIN YOUNG	S/O KIM CHONG OK	M19162342		Korea South	SERVICE	BUSINESS 314 804 12, BYEORYANG RO GWACHEON-SI	7491168	Director And Subscriber	Nominee	KOREA SOUTH-EAST POWER CO LTD	5	Electronically signed by KIM MIN YOUN
MIN BYEONG SOO	S/O MIN CHOUNG SIK	M03699409		Korea South	SERVICE	28, JEONGWANG SINGIL RO 49BEON GIL, SIHEUNG SI, GYEONGGI		Director And Subscriber	Nominee	KOREA SOUTH-EAST POWER CO LTD	5	Electronically signed by MIN BYEO NG
KOREA SOUTH-EAST POWER CO LTD. through	S/O CHOI KYU SIK	M96807349	120-86-19151	Korea South	BUSINESS	APARTMENT 804 B, 17TH FLOOR, CENTAURUS RESIDENCIA, ISLAMABAD		Subscriber (Company)	Other	NA	5218985	Electronically signed by KORE A

*Add details as applicable

** Applicable on subscribers other than natural persons

***Please also mention names of other companies where directorship is held.

**** Signature of subscribers and consent to act as director or chief executive as the case may be. In case of online submission, the document will be signed electronically

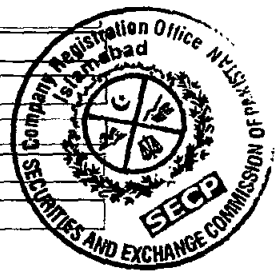
Company Registration Office Islamabad SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN SECP

2.9 Details of Nominee (only in case of single member company- Nominee shall not be a person other than relatives of the member- namely, a spouse, father, mother, brother, sister and son or daughter)

Name of Nominee

NIC of Nominee

Residential address of Nominee	
Telephone number of Nominee	
Email address of Nominee	
Relationship of Nominee with subscriber	
Signature of nominee	



Section - E - If the company intends to adopt tables contained in First Schedule to the Companies Act, 2017 (XIX of 2017) as its articles of association

☑ Table A- Part I (Articles of association of company limited by shares)

☐ Table A- Part II (Articles of association of single member company limited by shares)

Section - F - The company limited by shares in case it has not adopted articles contained in First Schedule to the Act company limited by guarantee and unlimited company shall attach the articles of association.

PART- III

Declaration under section 16

3.1 Declarant's Name	Mr CHOI HOON TAE
3.2 Declarant Profession / Designation	☐ Authorized Intermediary ☑ a person named in the articles as Director of the proposed company
3.3 Declaration	I do hearby solemnly and sincerely declare that: a) I have been authorized as declarant by the subscribers; b) all the requirements of the Companies Act, 2017, and the regulations made there under in respect of matters precedent to the registration of the said Company and incidental thereto have been complied with c) necessary information about the ultimate beneficial owners of the proposed company, if any, as specified in regulation 9, has been obtained and is available on record. d) I make this solemn declaration conscientiously believing the same to be true.
3.4 Declarant Signature	
3.5 Registration No of authorized intermediary, if applicable	
3.6 Date(dd/mm/yyyy)	28/03/2022

ENCLOSURES

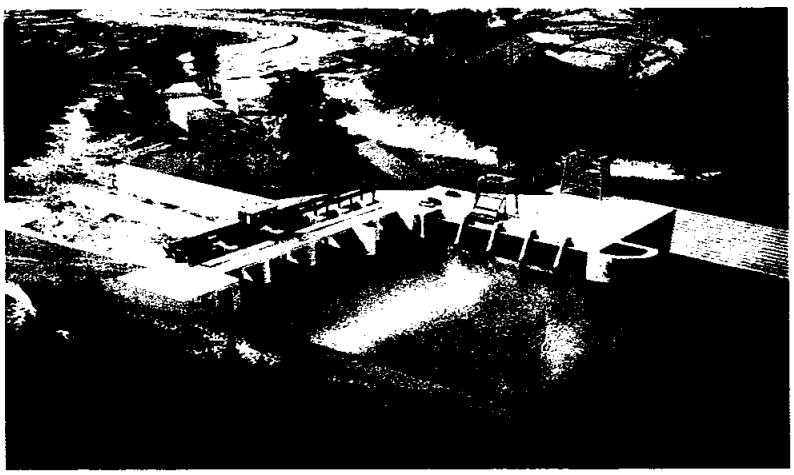
(i) Original paid bank challan evidencing payment of fee;
(ii) Memorandum of Association;
(iii) Articles of Association, where applicable;
(iv) Copies of valid CNIC/NICOP of the subscribers/directors/chief executive officer or copy of Passport in case of a foreigner;
(v) Copy of valid CNIC/NICOP of Nominee only in case of single member company or copy of Passport in case of a foreigner;
(vi) Copy of valid CNIC of witness in case of physical filing;
(vii) NOC/Letter of intent/ License (if any) of the relevant regulatory authority in case of specialized business;
(viii) Authority letter for filing of documents for the proposed company on behalf of the subscribers as per requirement of clause (vi) of sub-regulation (2) of regulation 5.
(ix) Copy of valid CNIC/Passport of person duly authorized by the Board of directors of a body corporate which is a subscriber. Further, along with copy of Board resolution along with and attendance sheet duly authorizing the representative. In case of a subscriber which is a limited liability partnership, copy of valid NIC/ Passport of designated partner empowered to act as such, along with copy of instrument empowering him;
(x) In case the subscriber is a foreign company or a foreign body corporate, the profile of the company, detail of its directors, their nationality and country of origin, certified copy of its charter, statute or memorandum and articles etc.
(xi) In case of foreign subscriber/ officer, an undertaking on stamp paper of requisite value duly signed, notarized and witnessed to the effect that in case name of subscriber/officer is not security cleared by MoI, the subscriber/officer and the company, shall take immediate steps for replacement and shall transfer shares if any, held by the subscriber.

Company Registration Office
SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
SECP

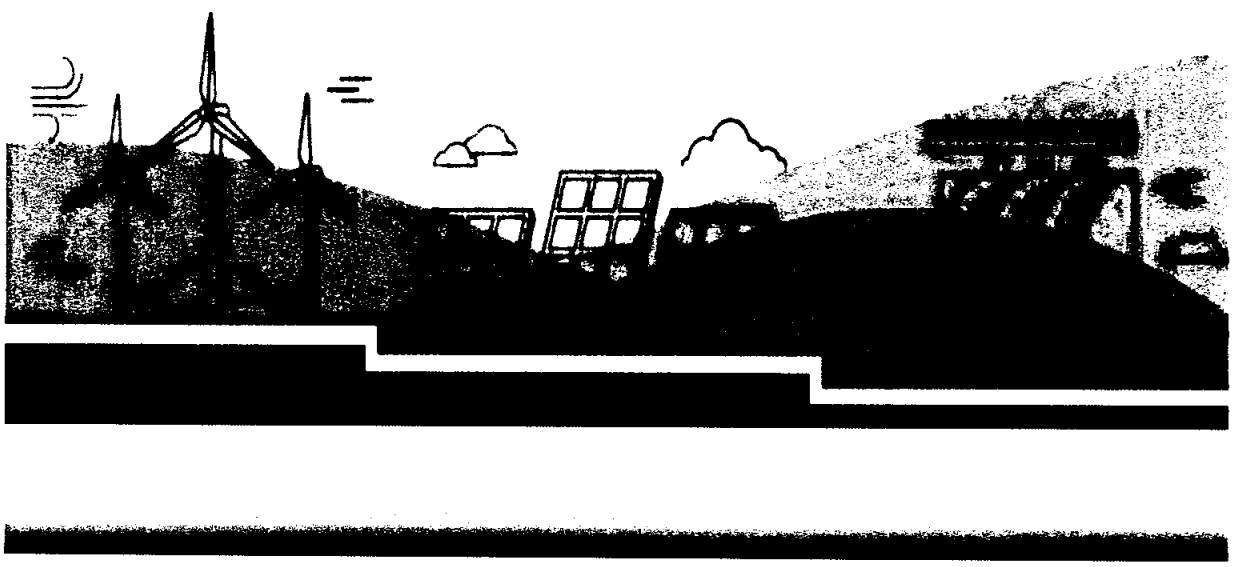
19/04/2022

TECHNICAL AND FINANCIAL PROPOSAL

238MW KALAM ASRIT HYDROPOWER PROJECT



KA POWER LIMITED



A. PROJECT OVERVIEW

Kalam-Asrit Hydropower Project (the "Project") is located on Swat River in Swat district of Khyber Pakhtunkhwa. The project concept is run-of-river scheme with bypass tunnel of a partial flow from Swat River using a diversion weir, and through a power tunnel system connecting to the downstream, the powerhouse releases water to Swat River.

B. TECHNICAL DETAILS

The feasibility study has planned the power tunnel route in the right bank of Swat River as it is advantageous to workability and economy. The weir position will be at Kalam village about 2 km downstream from the confluence of Gabral and Ushu Rivers where the beginning point of Swat River. The HRT route is parallel to Swat River's flow direction, straight down to Asrit village. The powerhouse will be at near Asrit village before reaching the confluence of Asrit Khwar and Swat River, about 12 km downstream from the intake.

The project has the following major components:

- Gated weir structure near Kalam village
- Natural desander between Debris dam (U/S Coffer dam) and Weir
- Bypass Tunnel (Diversion Tunnel)
- Power Intake in the right bank adjacent to Headrace tunnel
- Headrace tunnel with a length of around 12 km
- Surge shaft
- Vertical pressure shaft
- Horizontal pressure tunnel
- Steel penstock & branches
- Surface type powerhouse
- Tailrace channel
- The recommended installed capacity is 238 MW as of the expected role from the project in Pakistan's power system.
- The project is expected to deliver average annual generation of 945.8 GWh with the plant factor of 45.37%.
- The mean annual flow is about 88.4 m3/s. The estimated flow is using the local gauging station data. While there is some uncertainties due to the available information.
- Francis turbine with vertical shaft has been selected as the most appropriate turbine type for this project. Due to suspended sediments in the water, the turbine parts such as runner, guide vanes, etc. shall be considered an abrasion resistance coating.
- Main power supply scheme at powerhouse is that the applied connection scheme between the generators and four respective step-up transformers will be of

conventional arrangement, with generator circuit-breaker and with tap-off to the excitation transformers and to the station service transformer.

- The main environmental issues will be related with the construction period concerns and the effect of the reservoir on the existing terrestrial habitat. The reservoir area will be affected by deforest from human activities.
- Social impacts will include effects on local population due to economic activities while the construction is ongoing. Some resettlement will take place for people currently living in the reservoir area and for people affected by some construction sites. The project will bring some significant change of lifestyle for all inhabitants of the area. A possible positive impact will be improved access to health, education and other public services.
- The key environmental issues during design, construction and operation phases of the project include bank stability of the river, dam safety and safety hazards for the staff requiring site specific ESMP.
- The overall findings of the environmental and social impact assessment show that the project is environmentally and socially viable provided that the mitigation measures are completely and effectively implemented.
- Construction is expected to require 5 years.

The salient features of major structures are as following.

Item		Unit	Pre-F/S, 2018	F/S, 2022	Remark
Location	River		Swat River	Swat River	
	Administrative District		Swat District	Swat District	
	Intake Area		Kalam Village	Kalam Village	
	Powerhouse Area		Asrit Village	Asrit Village	
Hydrology	Catchment Area	km²	2,030	2,030	Weir Site
	Annual Average Run-off	m³/s	88.4	88.4	Weir Site
Power Generation & Energy Estimation	Plant Discharge	m³/s	120.0	130.0	
	Gross Head	m	210.0	222.1	
	Head Loss	m	12.6	18.1	
	Plant Gross Capacity	MW	212.0(4 Units)	238 (4 Units) 68.4 MW x 3 Units 33.0 MW x 1 Unit	(after turbine, generator & transformer efficiencies)
	Annual Average Power Generation	GWh /year	835.8	945.8	
	Plant factor	%	45.0	45.37	
Diversion Tunnel	Diversion Discharge	m³/s	390.5	400.4	2 Year return period
	Size	m	D-shaped, 7.6 x 6.6 x 3.8	D-shaped, 7.5x 7.5x3.75	B x H x R
	Length	m	402.5	484.0	Excluding portal of Inlet & outlet
Upstream Cofferdam	Type		Rockfill Dam With secant pile	Concrete Dam with secant pile	

Item		Unit	Pre-F/S, 2018	F/S, 2022	Remark
	Dam Crest Level	EL. m	1,960	1,944 (1,940)	During Construction (During Operation)
Downstream Cofferdam	Type		Rockfill Dam with secant pile	Rockfill Dam	
	Dam Crest Level	EL. m	1,940	1,935	
Weir & Spillway	Type		CGD	CGD	Concrete Gravity Dam
	Design Discharge	m^3/s	749.9 (200yr)	1,258.3 (1,000yr)	
	Safety Check Discharge	m^3/s	1,284.9	1948.0	10,000yr including GLOF
	Weir Crest Level	EL. m	1,956.0	1,947.0	
	Spillway Crest Level	EL. m	1,949.0	1,939.0	
	Length	m	77.3	90.3	
	Height	m	17.3	23.0	
	Spillway Gate	m	10.0 x 6.0 x 3	10.0 x 6.0 x 3	B x H x Nos.
	Sluiceway Gate	m	5.0 x 4.5 x 2	5.0 x 4.5 x 2	B x H x Nos.
Desander Basin	Type		Natural Type Desander	Design Particle 0.2 mm	
	Width	m	11.5 5 chambers (1 spare)	Var.	Natural Desander Volume : 199,104 m^3
	Height	m	15.5	12	
	Length	m	130.0	230	
Intake	Type		Bellmouth circular	Bellmouth circular	Box shape
	Invert Elevation	EL. m	1,935.7	1930.0	
	Inlet Diameter	m	7.4	7.4	Trash-rack W 8.0 × H 10.9 for FS
	Length	m	15.0	29.2	
Headrace Tunnel	Type		Circular	Circular	Excavation : Modified Horse Shoe
	Diameter	m	7.4	7.4	
	Length	m	10,981	11,589.6	
Vertical Pressure Shaft	Type		Circular	Circular	
	Diameter	m	7.4 (Con'c)	7.4 (Con'c)	
	Height	m	174.0	125.9	
Surge Shaft	Type		Restricted Orifice	Restricted Orifice	
	Size	m	D 15.0	D18.0	
	Height	m	68.0	81 (incl. Orifice)	
	Orifice size	m	D 2.5	D5.0	
	Max. up-surging water level	EL. m	1,978.0	1,969.6	
	Min. down-surging water level	EL. m	1,928.0	1,903.8	
Penstock (Manifold)	Type		Circular Steel lined	Circular Steel lined	Excavation : Modified Horse Shoe
	Diameter	m	5.6 ~ 2.2	5.6 ~ 2.1	
	Length	m	312 (straight distance) D 5.6, L 277.1, D 4.7, L 5.6, D 3.7, L 15.2, D 3.0, L 82.4, D 2.2, L 27.9	339.5 (straight distance) D5.6, L 296.9, D3.0, L 29.06, D2.1, L 10.45	

Item		Unit	Pre-F/S, 2018	F/S, 2022	Remark
Powerhouse	Type		Surface	Surface	
	Size	m	30.5 x 72.0 x 32.2	41.7 x 100.65 x 50.9	W x L x H
	Turbine Type		Francis	Francis	
	Plant Gross Capacity	MW	212	238 MW 68.4 MW x 3 Units 33.0 MW x 1 Unit	(after turbine, generator & transformer efficiencies)
	Turbine-Center Level	EL. m	1,738.0	1,713.7	
Construction Period		month	60.0	60.0	Including 8 month of testing period
Project Cost	Cost level		Dec. 2017 (1USD=Pak.Rs 105.39)	Dec, 2021 (1USD=Pak.Rs 178.5)	
	EPC cost	Million USD	399.6	365.96	
	Total Cost	Million USD	533.5	489.33	

C. FINANCIAL OVERVIEW

1.1. CAPITAL COSTS

The cost estimates, presented below, are established based on the feasibility level design of the Project. The estimates have been made based on the skill, experience, and international best practices in context of similar hydropower projects in Pakistan to surmise all the cost components of the proposed hydropower scheme.

COST HEAD	AMOUNT (US$)
EPC Costs	365,958,331
Non-EPC Cost	86,173,259
Base Project Cost	452,131,590
Interest During Construction	37,201,428
Total Project Cost	489,333,018

1.2. EPC COSTS

The EPC Cost of the Project will be finalized after reception of firm bids from local and international EPC Contractors through international competitive bidding at later stage. The EPC Contract will be awarded on the base of quality and cost rankings as per guidelines provided by NEPRA for this purpose. Currently following cost is approved by POE under the Feasibility Study:

COST HEAD	AMOUNT (US$)
Civil works	228,911,461
Electrical and Mechanical	105,398,764
Preliminary works & EPC Camp establishment	31,648,106
Total Construction Cost	**365,958,331**

1.3. NON-EPC COSTS

Non-EPC Costs are the non-construction capital costs and comprise all the overheads, already incurred and expected to be incurred during project development and construction phases, for developing the Project efficiently and complete it positively in timely and prudent manner. The development costs include all non-construction costs and have been computed warily by the consultants keeping in view the international and local best practices. While calculating these costs NEPRA's tariff guidelines are observed and explanations are provided where required.

The breakup of non-EPC cost is as follows,

COST HEAD	AMOUNT (US$)
Owner Administration/ Overheads	9,000,000
Engineering and Supervision	20,001,023
Insurance during Construction	9,148,958
Financing/ Lender Fees	10,399,780
Custom Duties and Taxes	5,185,619
Owner's Advisors	3,573,209
Land Acquisition and Resettlement	5,052,367
Environment & Ecology	1,999,440
O&M Mobilization	2,500,000
Feasibility, Technical Studies/Tendering	3,000,000
Lenders Advisors & Agents	4,470,686
Sales Tax on Service	8,526,528
Government Fees and Approval	1,207,674
E&M LC Commission	2,107,975
Total - Non-EPC	**86,173,259**

These cost estimates are based on preliminary assessments and may need revision based on conditions prevailing on EPC stage tariff of the Project.

1.4. PROJECT TARIFF

The tariff of the Project is calculated keeping in view the following.

1. Rule 3 of the National Electric Power Regulatory Authority Tariff (Standard and Procedure) Rules, 1998 for determination of Feasibility Stage Reference Tariff.
2. Applicable provisions of GoKPK Hydropower Policy 2016 & Federal Power Policy 2015.
3. Mechanism for the Determination of Tariff for Hydropower Projects 2008 by NEPRA.
4. Tariff Determinations by NEPRA for similar projects.

According to Section 3 of Policy, the tariff for hydropower projects is calculated and presented in two sections i.e., two-tier tariff as follows:

TIER	TARIFF COMPONENTS
Energy Purchase Price	Water Use Charges + Variable O&M
Capacity Purchase Price	Fixed O&M + Insurance + ROE + ROEDC + Debt Service

Project Tariff Structure as per Policy

In the following sections detail of every component of the above Tariff is explained with summary figures during and after debt repayment.

1.4.1. ENERGY PURCHASE PRICE

The Energy Purchase Price (EPP) comprises Water Use Charge (WUC), Variable O&M and any other variable component determined by NEPRA. The EPP will be paid based on the amount of kWh (PKR/kWh) supplied by the Project Company at the point of delivery.

1.4.1.1. WATER USE CHARGES

As mentioned in Section 5 of the Policy, WUC are assumed to be payable @ Rs. 0.425/kWh by the Company to GoKPK. As per Policy the rate of WUC will be reviewed every five years by the GoKPK to determine if an increase in WUC is necessary.

For the calculation of reference tariff of the Project, it is assumed that WUC will stay the same and any change in rate will be considered as a pass-through item.

WUC make 75% of the total EPP cost of the electricity as shown in Table of Energy Purchase Price Breakdown below.

1.4.1.2.VARIABLE O&M

Variable O&M is estimated at US$ 0.734 million per annum which is 5.5% of total annual Operations & Maintenance costs of the Project.

Tariff component is calculated as PKR 0.139/ kWh out of which 40% i.e., PKR 0.055/ kWh is estimated as local currency cost and 60% i.e., PKR 0.083/ kWh is in foreign currency, both during and after the debt repayment period.

1.4.1.3.TOTAL ENERGY PURCHASE PRICE

Total EPP during and after the loan repayment period is shown below. Please note that amounts in US$ million are the total annual payments under respective tariff component.

TARIFF COMPONENT	DURING LOAN REPAYMENT			AFTER LOAN REPAYMENT		
	US$ Million	US¢/kWh	PKR/kWh	US$ Million	US¢ /kWh	PKR/kWh
Water Use Charges	2.252	0.238	0.425	2.252	0.238	0.425
Variable O&M	0.734	0.078	0.139	0.734	0.078	0.139
Foreign	0.440	0.047	0.083	0.440	0.047	0.083
Local	0.294	0.031	0.055	0.294	0.031	0.055
Total EPP	**2.986**	**0.316**	**0.564**	**2.986**	**0.316**	**0.564**

Energy Purchase Price Breakdown

1.4.2.CAPACITY PURCHASE PRICE

The Capacity Purchase Price (CPP) comprises fixed O&M, insurance during operations, return on equity (ROE), ROE during development & construction and debt servicing (both principal and interest charges). The CPP expressed in PKR/kW/month is payable by power purchaser to the Company, provided the Project is made available for despatch by the Company as per the standards defined in the agreed PPA.

1.4.2.1.FIXED O&M

Fixed O&M cost is 90% of total operations & maintenance cost and amounts to US$ 6.61 million per annum. It is estimated that 60% of this cost i.e., US$ 3.96 million will be incurred in foreign currency & therefore treated as foreign part. Remaining amount of US$ 2.64 million i.e., 40% of total fixed O&M will be incurred in local currency.

Tariff component is calculated as PKR 412.87/ kW/Month out of which 60% i.e., PKR 247.72/kW/Month is estimated as foreign currency cost and 40% i.e., PKR 165.15/kW/Month,

both during and after the debt repayment period.

1.4.2.2. INSURANCE DURING OPERATIONS

Insurance during operations cost has been assumed at 1% of the EPC cost of the Project. This amounts to US$ 3.66 million per annum. The insurance cost based on these assumptions translates into PKR. 228.72 per kilowatt per month.

1.4.2.3. RETURN ON EQUITY

Based on Project cost, the total equity of the Company results into US$ 97.87 million. Redemption of equity starts after repayment of loan i.e., from year 13 onward, and hence ROE component of the tariff during loan repayment period (year 1 - year 12) is lower than after loan repayment period (year 13- year 30).

Based on IRR of 17%, ROE during loan repayment period is calculated as PKR 1,039.83 per kilowatt per month and PKR 1,105.32 per kilowatt per month after loan repayment period. In absolute terms US$ 16.64 million per year during loan repayment period and US$ 17.69 million per year after loan repayment period will be received by the Company on account of return on equity.

1.4.2.4. ROE DURING CONSTRUCTION

ROE during development and construction amounts to US$ 35.45 million. This amount includes ROE during development for 30 months before financial close and ROE during construction period of 60 months.

Tariff component under this head is calculated as PKR 380.07 per kilowatt per month both during and after loan repayment period. In absolute terms this amounts to US$ 6.08 million per annum for 30 years of concession periods.

1.4.2.5. DEBT SERVICE

Expected total loan (including IDC) of the Company will be US$ 391.47 million (US$ 361.71 million as base debt and US$ 29.76 million as IDC share), which will be repaid in twelve (12) years in the form of annuity payments. Tariff component of loan repayment amounts to PKR 2,699.47 per kilowatt per month.

D. DEVELOPMENT PLAN

The Project will be implemented through a carefully designed ownership structure, project structure, risk structure, and financial structure and will be tied together in the Project's legal structure which, in turn, will form a foundation for funding the project on a limited recourse basis.

1) OWNERSHIP STRUCTURE

The ownership structure is how the special purpose company (SPC) is organized. KOAK is registered as limited liability company in Pakistan under local laws and regulations. KOEN is the major shareholder of the company and other shareholders will be invited to participate in the Project at later stages of the development.

2) RISK STRUCTURE

Risk structure is the prioritization and mitigation of risks after the identification, assessment, and allocation process is completed. There may be circumstances where the Lenders will be exposed to the risk of adverse events which may affect Company's ability to meet its obligations in respect of its scheduled debt service and to pay dividends to shareholders.

These risks may arise

i). during the construction period if the Project is not completed to schedule, to specification and within the cost estimates; and

ii). during the operating period if the Project is unable to generate revenue in accordance with Base Case assumptions or incurs higher operating costs than assumed/estimated and approved by the Power Purchaser.

whether by reason of events within or outside the Company's control. Company's management structure and resources are intended to ensure that it manages its affairs with efficiency and economy. However, Company will be exposed to the risks occasioned by events outside its control including:

i). default by the parties to the Project Agreements, including GOP;

ii). the effect of force majeure Natural Events or Political Events which are outside the control of Company and other parties to the Project Agreements;

iii). external events such as adverse interest or exchange rate changes

3) LEGAL STRUCTURE

The Project's legal structure is the web of contracts and agreements negotiated to make financing possible. The project contract structure requires the weaving of enforceable contracts and agreements to make the project bankable and provide adequate protection of

shareholder interests. In cases where a host government authority participates in the project, the implementation or ceding agreements are a key part of the legal framework.

Government of Pakistan and its departments have developed the capacity to handle these large infrastructure projects during last 30 years. The power market is mature and all departments understand their role in development of these kind of projects. Standard agreements are available to define the roles and responsibilities of all stakeholders. These agreements involve decisions in every area they cover and when negotiated, they define the following:

i). The duration of the project life, licenses and permits required, and termination clauses

ii). The roles and responsibilities of the parties involved

iii). The project implementation arrangements that include bidding and procurement qualifications and project specifications

iv). The host government's guarantees, and other kinds of support

v). The governing law and funding provisions and conditions precedent

vi). The value of the project company assets at the end of the project agreement

Other elements of the project contract structure include several important parts, each of which entails decisions about acceptable levels of desired outcomes. Namely:

i). An EPC contract with an appropriate completion date, price, performance guarantees, and liquidated damages for delays and nonperformance

ii). A sound offtake contract with quantity targets and price increases to offset inflation, equipment upgrades, and changes in tax treatment or tax rate increases.

iii). Wide-ranging supply contracts for production inputs, supplies, and power and other utilities with price stability and quality clauses

iv). Private and ECA and multilateral institution insurance contracts for risks not allocated or absorbed and third-party insurance policies

v). Credit support agreements, guarantees, counter-guarantees, hedging contracts, and other credit enhancements

vi). A decent O&M agreement with performance, output, and quality clauses

4) FINANCIAL STRUCTURE

Financial structure refers to the mix of financing used to fund a project, which includes equity, short- and long-term loans, bonds, trade credits, etc. and the cash flows to equity providers and the lenders.

At this stage of Project it is estimated that 80% of total cost will be financed through debt financing through multilateral development banks. Contacts with leading banks have been developed and LOIs have been received from some banks in this regard. KOEN as main sponsor of the Project will be responsible to contribute the equity required for the successful commissioning. It is however planned that other shareholders will be included after issuance of LOS of the Project.

1) IMPLEMENTATION STAGES

The Company's activities will evolve through three overlapping stages:

i. Development

ii. Construction

iii. Operation.

1.1. DEVELOPMENT STAGE

The development phase of the Project is being undertaken by the Company and the actions completed and/or to be completed includes:

i). Undertaking of surveys and geophysical studies of the Site

ii). Completion of the feasibility update and approval

iii). Recruitment of staff for key positions

iv). Tariff determination by regulator

v). Raising of finance

vi). Acceptance of ESIA by IFC, ADB and relevant Government authorities

vii). Execution of the following principal agreements:

- Implementation Agreement with Government of Pakistan
- Power Purchase Agreement
- Water Use Agreement
- Engineering Procurement and Construction Contract
- Operation & Maintenance Contract
- Owner's Engineer Contract
- Financing Agreements
- Inter-creditor Agent Agreement
- Sponsor's Support Agreement
- Land Lease Agreements

viii). Placement of Insurances before construction start

ix). Development of Financial Model

x). Arrangement of Letter of Credit for Power Purchaser

xi). Appointment of Company's Advisors

xii). Completion of Basic and Detail Design and mobilization of EPC Contractor and commencement of construction.

1.2. CONSTRUCTION STAGE

The construction phase of the Project covers design, construction, manufacture, erection, testing, commissioning and completion of the Complex and its handover by the EPC Contractor to the Company. The Company expects to start the construction activities by third quarter of 2023 and will perform the following activities:

i). Supervision of EPC Contractor's activities by the Owner's Engineer and the Company

ii). Management by Company to ensure compliance of Project Documents

iii). Administration by the Company of loan draw-downs, equity disbursements and payment of all Project expenditures

iv). Maintenance of a comprehensive insurance program

v). Familiarization by the operator with the Complex and its equipment and training of the operator for taking-over operations of the Complex

vi). Testing and commissioning of the Complex and bringing it into commercial operation

vii). Monitoring by the Company that NTDC undertake its obligations with respect to the interconnection and transmission facilities in accordance with the terms of Power Purchase Agreement.

1.3. OPERATIONS STAGE

The operation phase of the Project will start from Commercial Operations Date (scheduled for 60 months from the construction start). This phase will include:

i). Continuous liaison by Company and O & M Operator with NPCC for dispatch

ii). Supervision by the Company of operator's performance

iii). Maintenance of a comprehensive insurance program

iv). Operation and administration of all tariff revenues

v). Operation and maintenance of debt service and dividends

2) METHODOLOGY

i). KOEN has requisite experience and capability for fast track project development which is evident from the fast track implementation of Gulpur Hydropower Project. Additionally, KOEN has a very experienced and strong local team who played key role in the development of Gulpur Hydro and New Bong Escape Hydropower Project (1st Hydro IPP of Pakistan).

ii). KOEN already has strong foothold in Pakistan and understand the sensitivities to work in Pakistani market and local environment.

iii). KOEN work philosophy revolves around the maximum participation of local human resource and materials into the project. In Gulpur Hydropower Project more than 95% labour and staff is Pakistan national. KOEN believes to procure all those materials locally which are available in local markets;

iv). KOEN considers local community as partners in progress. Therefore, we implement a comprehensive and need based Corporate Social Responsibility programs and allocate upfront budgets and date specific target for such program;

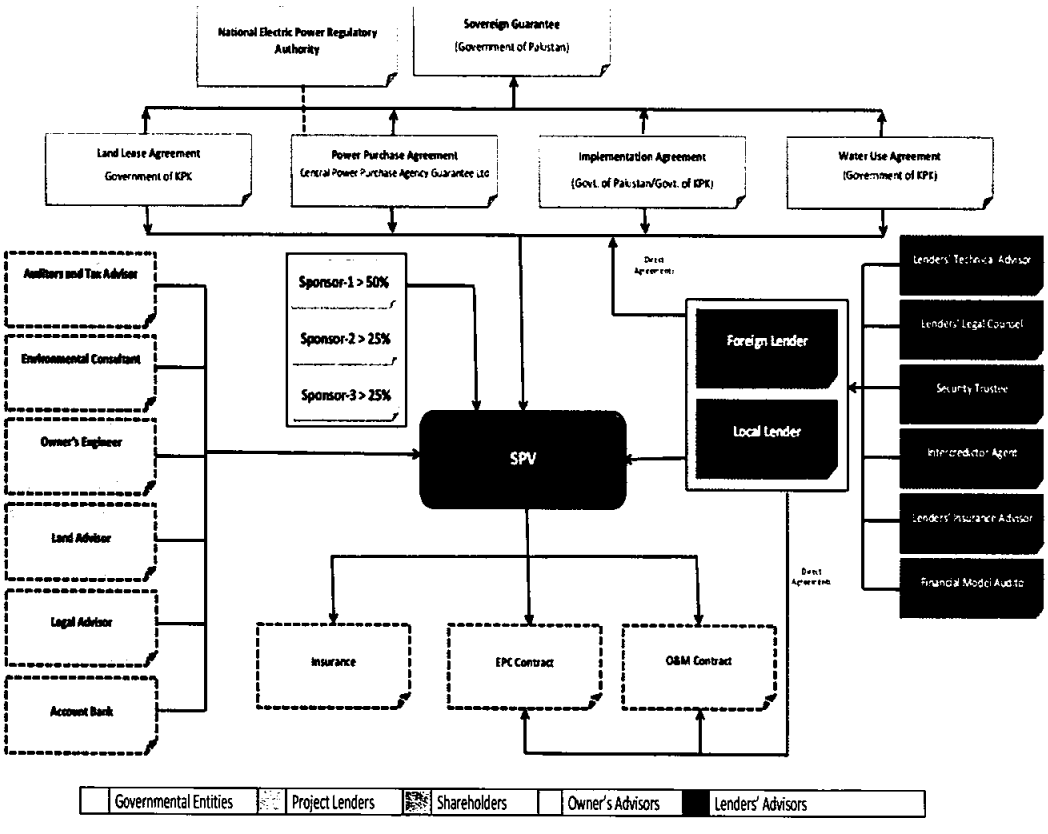
v). Track record of Korean companies shows that they believe in fast track project development and progress. Our philosophy is to complete the project within time and allocated budgets.

vi). The construction quality of Korean companies is at par with European Companies and preference is given to European turbines and generators to ensure durability and long life of the projects.

vii). KOEN has very positive reputation worldwide and has the capability to raise debt financing at favorable conditions.

viii). KOEN fully understand the provisions of KP Hydropower Policy 2016 and will not require any additional benefits or concessions to bring this investment to KPK.

A) PROJECT CONTRACTUAL STRUCTURE:



The methodology for development of the Project would include the various activities and the 10 major areas of control and responsibility are:

a) Financing arrangements;
b) EPC Contractor;
c) Owners Engineer arrangements
d) Concession Agreements
e) Power Purchase Agreement;
f) Tariff arrangements & NEPRA approval;
g) Land Acquisition & Resettlement entitlement framework
h) O&M Contract & arrangements
i) Placement of Project Insurances;
j) Environment, health and safety approvals and compliance;

I) FINANCING

KOEN has planned to get lending amount through international financial institutions like Asian Development Bank, International Finance Corporation, Korean Export Import Bank and CDC UK based on its precedent investment in Gulpur Hydropower Project. In this regard, International Finance Corporation will be invited for loan of 20% of the Project Cost. KOEN will try to arrange 20% of the loan through Korean Export Import Bank. Some of the international banks have already shown their interests to collaborate with KOEN in its future transaction due to its earlier performance and standards. Additionally, the Sponsors may also consider bringing in local banks, subject to its impact on the tariff. The prime activities involved in the financing are:

- ✓ Arrangement of financing of the Project
- ✓ Appointment of Lenders Technical Advisor, Legal Counsel, Insurance Advisors, E&S Advisor and Financial Model Auditors
- ✓ Managing the due diligence (technical, financial, E&S and legal) by the Lenders
- ✓ Preparation of Information Memorandum and development of Financial Model
- ✓ Negotiations and finalization of Term sheets
- ✓ Negotiations and finalization of all Finance and Security Documents
- ✓ Satisfaction of conditions precedents to achieve the Financial Closing

II) EPC CONTRACT

As customary in limited recourse project financing, the construction of the Project shall be carried out based on "fixed price, time certain and turnkey" EPC Contract. The EPC Contractor shall be selected and appointed through "competitive bidding process" to ensure transparency and competitiveness. To make the bidding process transparent and meaningful, a standard RFP/Tender Documents/Project Requirements will be issued to all the bidders and bidders shall be required to include at the minimum following information in their bids (i) Technical Proposal, (ii) Financial Proposal, (iii) any variation from Tender design and detailed Project requirement; (iv) vendors list for the E&M equipment. Following the receipt of bids from contractors, a detailed evaluation (technical as well as financial) shall be carried out by an independent party which shall serve as the basis for selection of EPC Contractor. The key milestones involved are:

- ✓ Issuance of Tender Documents to contractors
- ✓ Independent evaluation following receipt of bids

- ✓ Award Letter to selected EPC Contractor
- ✓ Ensuring all technical specifications are in line with prudent practices and NEPRA Grid Code
- ✓ Negotiations of EPC Price and EPC Contract
- ✓ Approval of the EPC Contract and its terms and conditions from the Gover nment, Power Purchaser and the Lenders
- ✓ Signing of EPC Contract

III) OWNER'S ENGINEER

The Owner's Engineer role is pivotal in successful implementation of a hydropower project. Owner's Engineer role is primarily to carry out design review, construction monitoring, QA/QC and milestone completion certifications after physical check. Owner's Engineer ensures that Project is being constructed according to design, project requirements, EPC Contract and international and prudent practices. The Owner's Engineer role is critical for the fact that each hydropower project has unique site conditions and distinctive features and involves a high content of civil works which demands stringent construction monitoring.

To effectively play its role Owner's Engineer requires strong team of experts and professionals on site (for construction monitoring) and offsite (for design review). The Sponsors shall appoint a consultant consisting of a mix of foreign expats and local expertise for the construction monitoring and design reviews of the Project. The activities to be done for this are:

- ✓ Selection and appointment of most suitable Owner Engineer through com petitive bidding
- ✓ Estimation of budgets and resources
- ✓ Drafting and negotiations of Owners Engineer Contract
- ✓ Getting the approval of OE Cost from the Power Purchaser & NEPRA
- ✓ Approval of the OE structure and contract from the Lenders
- ✓ Signing of OE Contract

IV) CONCESSION DOCUMENTS

Concession Documents will comprise of Implementation Agreement with GOP and Water Use Agreement with Government of KPK. GOP Implementation Agreement provides the framework under which the Company will implement the Project and sets out fundamental obligations of the Company and GOP with respect to implementation of the Project. In the event that the GOP terminates the Implementation Agreement it is obliged to pay compensation to the Company, thus securing the investments made in the Project. The Water Use Agreement between

the Company and the Government of KPK primarily is a consent given to the Company to utilize the water for the generation of electricity.

The GOP shall, at Financial Closing, execute and deliver to the Company, the Guarantee. The GOP Guarantee is an irrevocable and unconditional guarantee and the key document in the overall structure. Under this document the GOP guarantees the payment obligations (including monetary damages assessed) of all the Power Purchaser under the Power Purchase Agreement, and the Government of KPK under the Water Use Agreement. The key activities involved in this milestone are:

- ✓ Drafting of Concession Agreements
- ✓ Negotiations of Agreements with the Government
- ✓ Approval of the concession documents from Lenders
- ✓ Signing of Concession Agreements

V) POWER PURCHASE AGREEMENT

The Power Purchase Agreement shall be signed with CPPAG before Financial Closing for a term of 30 years after Commercial Operations Date. Under this Agreement, the Company shall be obligated to make available to the Power Purchaser, the Tested Capacity (as applicable from time to time) from the Plant.

The Power Purchaser is obligated to purchase and the Company is obligated to deliver NEO (the net electrical energy delivered by the Company to the Interconnection Point for sale to the Power Purchaser) produced (i) after Commercial Operations Date at agreed tariff (ii) during testing and commissioning prior to COD, and (iii) during sectional completion at the rate to be mutually agreed. The key activities involved are:

- ✓ Drafting and negotiations of Power Purchase Agreement
- ✓ Ensuring that PPA is consistent with technical and commercial requirements of the Project
- ✓ Approval of all costs and PPA by NEPRA
- ✓ Signing of PPA

VI)TARIFF ARRANGEMENTS

The Tariff structure under the KPK Hydropower Policy 2016 of Government of KPK has two basic components: Energy Purchase Price ("EPP"-Variable Component) and Capacity Purchase Price ("CPP"-Fixed Component). The EPP component of the tariff is based on the actual dispatch of the plant. It comprises of Water Use Charges and variable O&M costs. The CPP is the payment made for components that are independent of the amount of actual generation and ensures the smooth functioning of the plant and returns of the investors. The CPP comprises of (i)

Fixed O&M cost, (ii) Insurance cost, (iii) Return on Equity (ROE), (iv) Return on Equity During Construction (ROEDC), (v) Debt Servicing (Principal and interest). Along with EPP and CPP, certain indexations and one-time adjustments are also allowed under the Power policy 2002 to maintain 17% IRR stream of the investors. The key activities involve are:

- ✓ Development, drafting and finalization of "Tariff Proposal"
- ✓ Negotiations of Tariff with the Power Purchaser and National Electric Pow er Regulatory Authority (NEPRA)
- ✓ Ensuring that Project Tariff covers all the legitimate costs incurred for the benefit of the Project

VII) LAND LEASE

Site/Land acquisition is one of the most critical processes in the development of the Project. The area required for the construction of the Project (as per design criteria) shall be demarcated through installation of monuments. The listing of ownership shall be done to identify the land owned by Government and the land owned by private parties.

The Government land shall be leased to the Company for a period of thirty (30) years after COD i.e. the term of the Project. However, the private land shall be acquired by the Government from the private parties under the provisions of Land Acquisition Act 1894 and thereafter shall be leased to the Company for the term. The key activities to be carried out are:

- ✓ Demarcation of the Land as per required NOL
- ✓ Listing of ownership record of the land with the coordination of local admi nistration of Government
- ✓ Filing of land lease applications and Notification 4
- ✓ Public consultation with the community to take them on board for the Proj ect
- ✓ Negotiations of the rates of the land lease and compensation with the Gov ernment
- ✓ Negotiations and finalization of land lease agreements
- ✓ Ensuring that all land lease costs are part of approved tariff
- ✓ Approval of the lenders for overall land lease arrangements

VIII) INSURANCE ARRANGEMENTS

An overall Project Insurance Program, covering certain risks of construction and operations phase of the Project, shall be arranged by the Company; however, construction phase insurances shall be largely placed offshore. To assist in this, the Company shall appoint and seek guidance of international reputable insurance broker/advisor. The typical insurances placed during construction and operational phase of the Project are given below:

Construction Phase	*Operational Phase*
Construction "All Risks" Insurance	*"All Risks" of Physical Damage Insurance*
Construction Delay in Start-Up Insurance	*Business Interruption Insurance*
Marine Transit Insurance	*Terrorism Asset & Revenue Protection*
Marine Transit Delay in Start-Up Insurance	*Third Party Liability Insurance*
Terrorism Asset & Revenue Protection	
Third Party Liability Insurance	

- ✓ Appointment of Company Insurance Advisor/Broker
- ✓ Arrangement of the insurance of the Project on best suitable rates under advice of the Insurance Advisor
- ✓ Arrangement of all reinsurances of the Project
- ✓ Approval of the insurance terms from the Power Purchaser and the Lend ers

IX) O & M ARRANGEMENTS

KOEN has a versatile Operation and Maintenance and Management track record and would operate the plant itself during the concession period. The KOEN shall mobilize its O&M Team at site six to eight months prior to commercial operations to ensure smooth taking-over of the Plant from the EPC Contractor. During this mobilization phase, the KOEN shall run the individual units (partial completion) under the supervision of the EPC Contractor. However, following COD, the KOEN shall be responsible for all the on-going maintenance and repair works of the Plant and will bear all the cost of routine work. The activities involved in this process are:

- ✓ Circulation of RFP for O&M of the Project
- ✓ NOC of O&M Contract and Contractor from Government
- ✓ Negotiations of the O&M Contract
- ✓ Ensuring the O&M Costs are consistent with the approved tariff and proje ct budgets

- ✓ Approval of O&M Contract and O&M Budget from the Lenders

X) ENVIRONMENT HEALTH & SAFETY

Under Section 11 of the 2000 Act, a Project falling under any category (qualifying IEE or EIA) requires the proponent to file IEE or EIA with the Pak-EPA. The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. Other important policy documents and legal requirements of the project are: National Environmental Quality Standards (NEQS), National Resettlement Policy and Ordinance, The Land Acquisition Act, 1894, The Forest Act, 1927 and the Forest (Amendment) Act 2010, The Motor Vehicles Ordinance, 1965, and Rules, 1969, The Factories Act, 1934, The Pakistan Penal Code, 1860, The Explosives Act, 1884. Besides providing overview of Policy, Legal and Administrative Framework, the section 2 also adumbrates guidelines of ADB and requirements of IFC related to the project. To ensure environmental compliance, various studies to be conducted by the Company are:

i. Environmental and Social Impact Assessment (ESIA Study)
ii. Land and Resettlement Action Plan (LARP)
iii. Ecological Flow Assessment including Drift Model
iv. Health & Safety Plan
v. Contingency Plan
vi. Environment and Social Issue Management Plan

In addition to this, the Company shall be required to:

- ✓ Get approval of above documents from various stake holders including Go vernment and Lenders
- ✓ Ensuring compliance with health and safety requirements for the Project and the Company

Managing community relationships and implementation of the CSR program

E. OPERATIONS MANAGEMENT PLAN

The Operating Management Plan (the **"OMP"**) shall be developed for management of the Complex during operational period. The OMP shall define assumptions regarding communication, management processes and responsibilities of various parties, execution and overall Complex control that would enable the Complex to achieve the following operational goals:

- maximize Electricity generation from the Complex through maximizing the Plant Availability;
- maximize the useful life of the Complex;
  - According to the terms of the feasibility, the concession period is estimate to be 30 years and the Plant will be transferred to the Government of KPK after 30 years however useful life of the Plant is expected to be more than 100 years.
  - minimize operations and maintenance costs consistent with Prudent Operating Practices (as defined in the Operations & Maintenance Agreement (the "O&M");
  - The Company shall make agreement with the Operator for an annual cost on the basis of approved cost from NEPRA, subject to indexation as per approved terms by NEPRA for operations and maintenance of the Plant. The said agreed amount shall also cover the major maintenance required during the operations.
- minimize capacity degradation;
  - The contracted capacity is 238 MW under the PPA and the Company's ultimate objective is to maintain the capacity and try to minimize capacity degradation.
- minimize the possibility of default under the various project agreements;
- minimize the incident, severity and duration of Forced or Partial Forced Outages, Maintenance Outages and Scheduled Outages;
- maximize availability and reliability of the Complex

The Technical Department of the Company will monitor and review the contracted power plant management of the site under the O&M and other Complex related contracts and agreements. The Operator shall require to ensure that the Company's asset is managed to achieve the Complex's planned plant asset life, with due regard to safety of the plant, its staff and the environment.

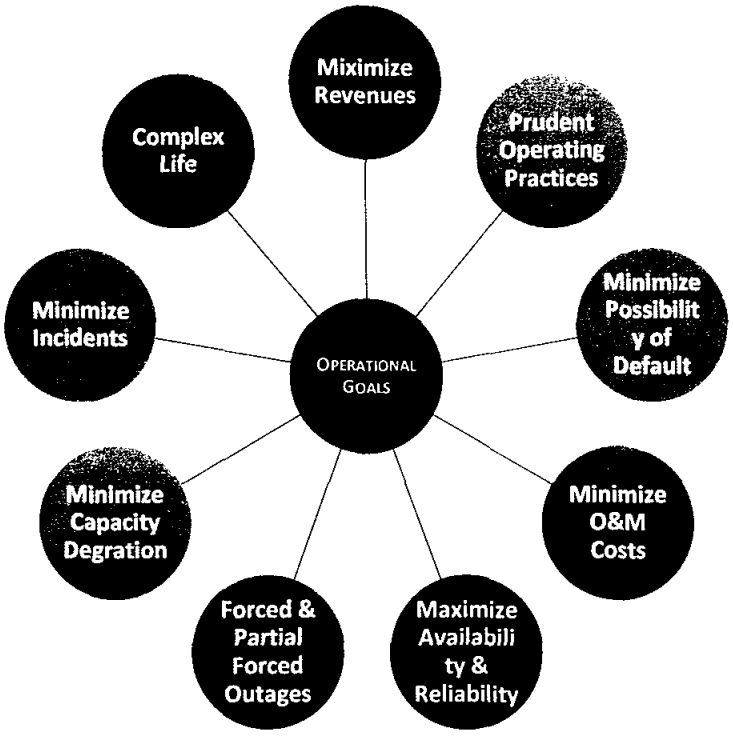
Strategy:

The Company aims to achieve the long-term reliability and availability of the Plant through the appointment of experienced operator, procurement of high-quality Plant and implementation of prudent practices in a coordinated manner among all stakeholders.

Operational Goals

- maximize electricity generation from the Complex through maximizing the Plant Availability;

- maximize the useful life of the Complex;
- minimize operations and maintenance costs consistent with Prudent Operating Practices (as defined in the Operations & Maintenance Agreement (the **"O&M"**);
- minimize Complex and capacity degradation;
- minimize the possibility of default under the Project Agreements;
- minimize the incident, severity and duration of Forced or Partial Forced Outages, Maintenance Outages and Scheduled Outages; and
- maximize availability and reliability of the Complex



Objectives

The Company shall:

- support the Operator in its responsibilities to its site neighbors, customers, employees, contractors, the public and the environment and will take account of local and national legislation in Pakistan and KPK.

- monitor and review the Operators management of the Complex to ensure that it is operated, to fulfill the terms of the PPA, Financing Documents and the Operating Procedures developed with Power Purchaser and NPCC.

- monitor and review the Operators management of the Complex to ensure that it is operated and maintained to fulfill the terms of the O&M and in accordance with the Finance Documents.

- review the engineering management programs and long-term maintenance plans developed by the Operator to achieve and maintain technical plant performance, control of operational costs and management of plant and operational risks effectively.

- monitor that the Operator demonstrates, through Prudent Operating Practices and management practices, a management culture that seeks to create a "continuous improvement" approach in the operation and maintenance of the Complex.

As the Owner, the Company requires that the Operator manages the plant to the standards of a reasonable and prudent operator, makes appropriate management provisions and also operates the plant using specific and acceptable policies with respect to health and safety, environment, procurement and financial management in accordance with the Project Agreements and Lenders requirements.

The Company – Continuous Improvement and Development Objectives

- ***Organization*** – Routine review of Company roles and duties to match Company's office organization and the Operator's activities and organization.

- ***Communication*** – Development of emergency telephone contacts routine reporting within Company and to other groups like Operator, local authorities and head office.

- ***Personnel development*** – Review targets for Company staff technical and management training and ensure the inclusion of such targets into staff personal development programs.

- ***Company staff targets*** – Review annually personal job role and job assignment performance targets as part of the annual assessment process.

- ***Plant technical issue*** – Review the current general plant technical issues, plant improvement proposals to develop over the long-term plans.

- ***Plant technical development*** – To review Operators plant "improvement" proposals and encourage the preparation and improvements in long term proposals to develop the plant over the long term.

- ***Plant risk management*** – Using the plant spares mean time to failure analysis, plant history and maintenance records to develop and update plant risk profile related to the potential for major failures of individual plant items or systems.

- ***Business planning*** – Preparation & development with Operator of future business plans, over a 5 year forward plan period.

- ***Commercial issues*** – Maintain and update all agreements relevant to Company and monitor tariff issues as they affect the Operator's operational policies and procedures.

- ***Operations Group Reports*** – Review of format, content, preparation & timetable for preparing reports to Company Board of Directors, senior management, Lenders and Insurers reports.

- ***Company Office systems*** – Review filing system, mail register, key documents archive Drawings file at site in hard copy as well as electronic form as appropriate and determine any potential for improvement.

- ***Emergency procedures*** – Ensure and involvement in Operator's arrangements for incident reporting into Company, emergency incident planning and site security preparedness for plant and local civil situations, fire system management, first aid and safely management.

- ***CPPAG and Relevant Government Organizations*** – Relations with CPPAG and relevant government organizations department.

- ***Business contacts*** – Review of other company business contacts to maintain existing contacts and develop new contacts.

- ***Insurance of plant*** – Review of Insurance inspections and update reports. Review for adequacy and effectiveness of the Insurances and timely payments of insurance premiums.

- ***Plant spares*** – Current inventory, review plant requirements for additional spares items and carry out routine audit of stores storage environment.

- ***Customs*** – Maintain existing contacts and develop new contacts in conjunction with the Operators procurement specialists.

- ***Environment*** – Review of current environmental issues and the inclusion of other items into the annual environmental report prepared by the Operator. Monitoring and Company internal updating of Pakistan legislation.

- ***Technical plant audits*** – Assist internal audit department to develop and improve the technical audit of the Operator's activities and of the plant.

Operator's Standard of Performance

The Operator shall perform the Services in accordance with the O&M and subject to

- the Prudent Operating Practices;

- the Consents and approvals

- the requirements of the PPA, all other concession documents, financing documents, all insurance policies and Project Agreements;

- the design parameters of the Complex;

- the Standing Instructions and Procedures Manual, the Operation and Maintenance Manual and the Administrative Procedures Manual;

- the requirements of all warranties and guarantees applicable to the Complex provided by the EPC Contractor, sub-contractors, vendors, suppliers, or others, provided that such requirements have been previously disclosed to the Operator in the form of provision of copies of the Project Agreements or otherwise;

- the Plant Availability of the Complex;

- all Laws; and

- any Approvals and/or proper instructions and directions of the Owner given from time to time in accordance with the O&M.

Operations' Limitations:

There are certain limitations which needs to be accounted for while implanting the plant operations. The same are appended hereunder:

- ***Technical Limits*** – The Operator needs to work within the technical limits specified under the Power Purchase Agreement.
- ***Retention of staff*** – Retention of experienced human resource in operator's organization needs to be ensured.
- ***Expectation of Govt. & Local Community*** – Management of expectations of Government and local community by agreeing reasonable percentage of local employment and implementation of comprehensive CSR Plan.

KA POWER
LIMITED

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ANNEX-L

BOARD OF DIRECTORS RESOLUTION AUTHORIZING TO SUBMIT GENERATION LICENSE

238 MW KALAM ASRIT HYDROPOWER PROJECT

KA POWER LIMITED

7C, G-8 Markaz, Islamabad
Tel: +92 51 2726703,
Fax: +92 51 2726703

TRUE EXTRACTS OFTHE RESOLUTION PASSED BY THE BOARD OF DIRECTORS ON 29TH APRIL 2022

TO APPROVE RESOLUTIONS FOR THE SUBMISSION AN APPLICATION FOR GENERATION LICENSE AND TARIFF PETITION TO NEPRA.

Under the conditions of LOI issued by PEDO, company is obligated to apply for Generation License and Tariff Petition to NEPRA and therefore, all Board members resolved following resolutions, unanimously.

"**RESOLVED THAT** KA Power Limited, a company incorporated under the laws of Pakistan with its registered office located at 7C, G-8 Markaz, Islamabad (the "Company") be and is hereby authorized to submit an application for Generation License (including any subsequent modification) and Tariff Petition (including any subsequent modifications) for submission to the National Electric Power Regulatory Authority (the "NEPRA") for the grant of Generation License and Tariff in respect of its 238 MW (Gross) Kalam Asrit Hydropower Project to be located at Swat River, Swat, Khyber Pakhtunkhwa, Pakistan (the "Project") and in relation thereto, enter into and execute all documents, make all filings and pay all applicable fees, In each case, of any nature whatsoever, as required,"

"**RESOLVED FURTHER THAT** in respect of application for the Grant of Generation License (including any modification to the application for the Grant of Generation License) and for the Grant of Tariff (including any modification to the tariff petition for the Grant of Tariff) for submission to NEPRA, Mr. Oh, Inhwan (the "Authorized Representatives"), be and is hereby acting singly empowered and authorized for and behalf of Company to;

i. prepare, review, execute, submit and deliver the Generation License Application and Tariff Petition (including any modification to the application for the Grant of Generation License and Tariff Petition) and related documentation required by National Electric Power Regulatory Authority, including any contracts, documents, power of attorney, affidavits, statements, letters, forms, applications, deeds, guarantees, undertakings, approvals, memoranda, amendments, letters, communications, notices, certificates, requests, statements, and any other instruments in respect to the Generation License and Tariff;

ii. represent the Company in all negotiations, representations, presentations, hearings, conferences and/or meetings of any nature whatsoever with any entity (including, but in no manner limited to NEPRA, any private parties, companies, partnerships, individuals, governmental and/or semi-governmental authorities and agencies, ministries, boards, departments, regulatory authorities and/or any other entity of any nature whatsoever).

KA POWER LIMITED ISLAMABAD

KA POWER LIMITED

7C, G-8 Markaz, Islamabad
Tel: +92 51 2726703,
Fax: +92 51 2726703

iii. sign, certify and execute all necessary documentation, pay the necessary fees, appear before the NEPRA as and when required, and do all acts necessary for the completion and processing of the application for the Generation License and Tariff (including any modification).

iv. do all such acts, matters and things as may be necessary for carrying out the purpose aforesaid and giving full effect to the above resolution/resolutions."

CERTIFIED

Certified further that the above resolutions are included in the minute's book of the Company. It is further stated that the information given above is correct and true to the best of our knowledge and belief.

On behalf of the Company

KA POWER LIMITED ISLAMABAD

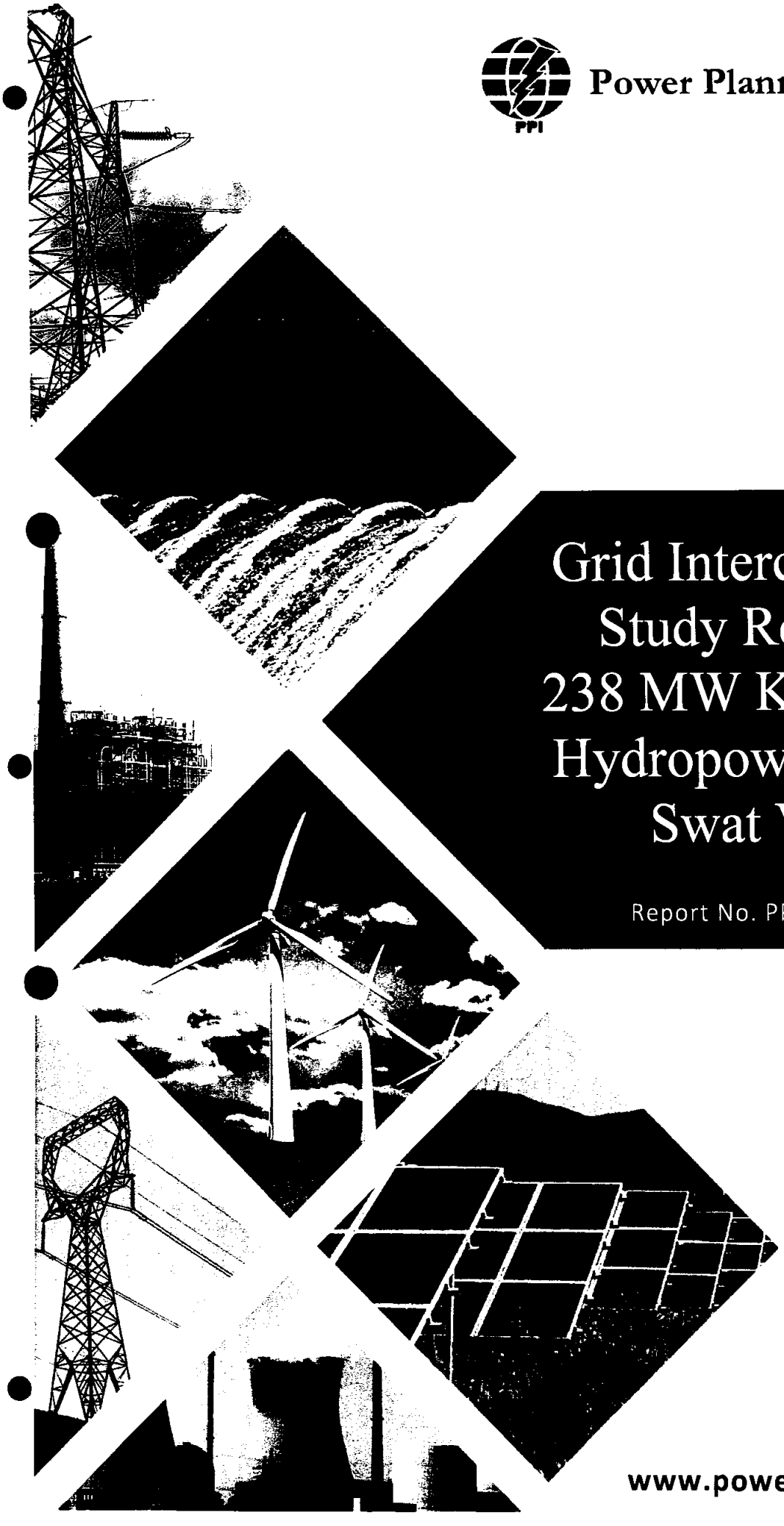
TARIQ MEHMOOD
Company Secretary

Date:29th June 2022
Place: Islamabad

ANNEX-M

INTERCONNECTION STUDY INCLUDING LOAD FLOW, SHORT CIRCUIT AND STABILITY STUDY

238 MW KALAM ASRIT HYDROPOWER PROJECT



Power Planners International

Grid Interconnection Study Report for 238 MW Kalam Asrit Hydropower Plant in Swat Valley

Report No. PPI-448.a-Draft /22

www.powerplannersint.com

Grid Interconnection Study Report for 238 MW Kalam Asrit Hydropower Plant in Swat Valley

By

Korea South East Power Company Ltd. (KOEN)

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2	07/06/2022	Ayesha Haroon Hassan Mushtaq	Umair Bilal	

Executive Summary

- The Draft Report of 238 MW Kalam Asrit Hydro Power Plant by Korea South East Power Company Ltd. (KOEN) in Swat, Khyber Pakhtunkhwa, referred to as Kalam Asrit HPP in the remainder of the report, is submitted herewith.
- The updated generation plan, transmission plan and load forecast from NTDC has been used for the study, vide data permission letter no. ***GMPSP/TRP-300/4287-92 dated 05-11-2021***.
- The study objective, approach and methodology have been described and the plant's data received from the Client is validated.
- The expected commercial operation date of Kalam Asrit is the last quarter of 2027.
- The interconnection scheme for the study hydropower project has been proposed as described in '***The Integrated Study for the Evacuation of Power from 17 Hydropower Projects in the Swat Valley***' (referred to as *The Integrated Study* wherever needed).
- Generation voltage for Kalam Asrit HPP is 11 kV which is stepped up to 220 kV at Kalam Asrit 220 kV G/S. which is further connected with Madyan HPP and Asrit Kedam HPP. The conductor would be 220 kV Quad Bundle Rail with thermal rating of 1348 MVA. While on the other side of Kalam Asrit 220 kV G/S it is stepped down to Kalam Asrit 132 kV G/S via 2x250 MVA Transformers.
- The hydropower projects that are expected to be commissioned in the Swat valley are Daral Khwar HPP, Gorkin Matiltan HPP, Gabral Kalam HPP, Madyan HPP, Kalam Asrit HPP, Asrit Kedam HPP, Artisitic-II HPP, Chokel KhwarHPP, Bankhwar HPP and Gabral Utror HPP.

  Therefore, this study will deal with ten of the 17 hydropower projects identified in the valley.
- Kalam Asrit HPP is located on the main Swat River, a few kilometers north of Bahrain.
- The proposed scheme for Kalam Asrit HPP will require the following bays in their switch yard
  - Two line bays of 220 kV for connection with 220 kV Asrit Kedam HPP and 220 kV Madyan HPP.
  - Four transformer bays for the four GSU transformers (3x80MVA & 1x40MVA)
- In view of the expected Commercial Operation Data (COD) of Kalam Asrit HPP in the last quarter of 2027, the above proposed interconnection scheme has been tested for

the following scenarios using load flow studies:

- Peak Load Summer 2028
- Off-Peak Load Summer 2028
- Peak Load Winter 2028
- Off-Peak Load Winter 2028

- The system conditions of normal and N-1 contingency have been examined for all cases described above to determine the maximum impact of the project.
- Steady state analysis by load flow for all the scenarios described above reveals that the proposed scheme is adequate to evacuate the maximum power of Kalam Asrit HPP under normal as well as contingency conditions.
- The short circuit analysis has been carried out to calculate maximum fault levels at hydropower plant G/S and the substations of 220 kV and 132 kV in its vicinity. We find that the fault currents for the proposed scheme are within the rated short circuit capacities of switchgear proposed at these substations. There are no violations of exceeding the rating of the equipment due to contribution of fault current from the under study HPPs.
- The maximum short circuit levels at 220 kV Kalam Asrit HPP bus bars for the Year 2028 for 3-Phase and 1-Phase are 14.13 kA and 13.83 kA respectively. It would be advisable to go for standard size switchgear of short circuit rating of 50 kA. It would provide large margin for future increase in short circuit levels as generation additions are expected in the valley and network reinforcements will be introduced to accommodate those additions.
- The dynamic stability analysis of proposed scheme of interconnection has been carried out for peak load condition of summer 2028. The stability has been tested for the worst cases, i.e. three phase fault right on the 220 kV bus bar of Kalam Asrit HPP substation followed by trip of a 220 kV single circuit from the faulted bus. The fault has been performed for fault clearing of 5 cycles (100 ms), as understood to be the normal fault clearing time of 220 kV protection system. Also the extreme worst case of stuck breaker (breaker failure) has been studied where the fault clearing time is assumed 9 cycles i.e. 180 ms for single phase fault. The proposed scheme successfully passed the dynamic

stability checks for near and far faults for the most stringent cases. The system is found strong enough to stay stable and recovered with fast damping.

- The proposed scheme of interconnection has no technical constraints or problems and is therefore recommended to be adopted. It meets all the criteria of grid code under steady state load flow, short circuit currents and dynamic/transient conditions given all the proposed requirement of the network are implemented.

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List of Acronyms

PEDO	Pukhtunkhwa Electricity Development Organization
HPP	Hydropower Plant/Project
MW	MegaWatt

MVA	MegaVoltAmpere
G/S	Grid Station
PSS/E®	Power System Simulator for Engineers – A world-renowned simulation software for power system analysis

1. Introduction

1.1. Background

Northern Pakistan, in general, and Khyber Pakhtunkhwa Province, in particular, has rich potential for small and big hydropower projects. Several small hydropower projects, of a couple of MW capacity, are operational and supplying cheap electricity to the local population and a potential for bigger hydropower projects is readily available in the valley.

Pukhtunkhwa Electricity Development Organization (PEDO) has identified several public and private sector projects along the Swat River and its tributaries. These projects include both small and medium-sized hydropower projects. PEDO has facilitated in conducting a comprehensive study to plan for the evacuation of power from all the identified potential in the valley referred to as ***The Integrated Study.*** Power Planners International Pvt. Limited has served as consultants for the said study.

Korea South East Power Company Limited (KOEN) is one such investor which plans to develop a 238 MW Kalam Asrit hydropower plant in the Swat valley. The same sponsor also plans to install a 215 MW hydropower project by the name Asrit Kedam hydropower plant on the same river at about the same time as Asrit Kedam HPP.

The net output planned to be generated from the site of Kalam Asrit HPP is about 238 MW. The electricity generated from this project would be supplied to the grid system of NTDC through the 220 kV grid network proposed in the Integrated Study. Kalam Asrit HPP is expected to start commercial operation by the end of 2027. The approximate location of Kalam Asrit HPP can be seen in the map attached in Appendix – B and the neighboring network is evident from Sketch-2 attached in Appendix - B.

The Integrated Study has proposed a conceptual scheme to evacuate power from the 17 HPPs identified by PEDO. A short summary of the conceptual scheme is presented here:

- A collector station of 220/132 kV is proposed at the site of Kalam Asrit HPP with 3x250 MVA transformers.
- A comprehensive scheme developed consists of the following main circuits running along the length of the corridor:
    - A 132 kV Rail double circuit, carrying power from Artistic-II HPP to Gorkin

Matiltan HPP.

- A 132 kV twin Bundle Rail double circuit, carrying power accumulated at Matiltan HPP to Gabral Kalam HPP.
- A 132 kV Rail double circuit carrying power from Gabral Utror HPP and Bankhwar HPP to Gabral Kalam HPP.
- A 132 kV twin bundle Twin Bundle Rail circuit, carrying power accumulated at Gabral Kalam HPP to the collector and generating station of Kalam Asrit HPP.
- A 220 kV Quad Bundle Rail double circuit of around 110 km length, carrying power from Kalam Asrit HPP to Chakdara-New G/S, with Chokel Khwar HPP and Kalam Asrit HPP and Madyan HPP looped in-out at the circuit.
- A 132 kV Rail double circuit carrying power from Kedam Khwar HPP, Daral Khwar-II HPP and the existing Daral Khwar HPP to 132 kV Madyan G/S.

1.2. Objectives

The overall objective of the Study is to evolve an interconnection scheme between Kalam Asrit HPP and NTDC network, for stable and reliable evacuation of 238 MW of electrical power generated from this plant, fulfilling the N-1 reliability criteria. The specific objectives of this report are:

- To develop scheme of interconnections at 220 kV for which right of way (ROW) and space at the terminal substations would be available.
- To determine the performance of interconnection scheme during steady state conditions of system, normal and N-1 contingency, through load-flow analysis.
- To check if the contribution of fault current from the plant unit increases the fault levels at the adjoining substations at 220 kV voltage levels to be within the rating of equipment of these substations, and also determine the short circuit ratings of the proposed equipment of the substation at Kalam Asrit HPP.
- To check if the interconnection withstands dynamic stability criteria of post fault recovery with good damping

1.3. Planning Criteria

The planning criteria required to be fulfilled by the proposed interconnection scheme is as follows:

Steady State:

Voltage ±5%, Normal Operating Conditions

	± 10 %, Contingency Conditions
Frequency	50 Hz Nominal, continuous
	49.8 Hz to 50.2 Hz variation in steady state
	49.4 - 50.5 Hz, Min/Max Contingency Freq. Band
Power Factor	0.85 Lagging, 0.90 Leading

Short Circuit:

132 kV Substation Equipment Rating 40 kA

220 kV or 500 kV Substation Equipment Rating 50 kA or 63 kA

Dynamic/Transient:

The system should revert to normal condition after transients die out with good damping, without losing synchronism. The system is tested under the following fault conditions:

a) Permanent three-phase fault on any primary transmission element; including: transmission circuit, substation bus section, transformer or circuit breaker. It is assumed that such a fault shall be cleared by the associated circuit breaker action in 5 cycles.

b) Failure of a circuit breaker to clear a fault ("Stuck Breaker" condition) in 9 cycles after fault initiation.

2. Assumptions of Data

As per the data provided by the client following data has been modeled:

2.1. Kalam Asrit HPP Data

Gross Capacity of Power Plant	= 239.6 MW
Net Capacity of the Power Plant	= 238 MW
Lump sum MVA capacity	= 266.2 MVA
Generating Voltage	= 11 kV
No. of Units	= 4 (3x68.8MW & 1x33.2MW)
Power Factor	= 0.85 lagging/0.95 leading
GSU transformers	= 3x80 MVA & 1x40 MVA
Transformer Impedance	= 10%

The detailed generic parameters, which have been used in this study, for all the machines are attached in Appendix – B.

2.2. Network Data

The input data of NTDC has been used in this study vide data permission letter no. GMPSP/TRP-300/4287-92 dated 05-11-2021. The 220 kV and 132 kV network in the area in Swat valley, is shown in Sketches in Appendix-B.

3. Study Approach and Methodology

3.1. Understanding the Problem

In Pakistan, there is huge potential for hydropower generation in the Northern parts of the country whereas the big load centers are located mostly in the Central part of the country. The primary grid of 500 kV runs longitudinally from Peshawar in the North to Karachi in the South, with 220 kV and 132 kV tributaries all along its way.

Another typical feature of hydropower plants is that their output varies seasonally; they produce full power during high water season whereas their output touches the lowest Ebb during the low water period. A mix of thermal power located mainly in the central and Southern parts, offsets these differences in the generation outputs of hydropower plants. It gives rise to different patterns of power flows between North and South in different seasons. Over and above that, lies the peak load and low load power flow patterns during high and low water periods respectively.

Kalam Asrit HPP has a potential to generate about 238 MW of electricity during high water season.

The adequacy of the 220 kV and 132 kV network in and around the Swat valley will be investigated in this study report for absorbing and transmitting this power, fulfilling the reliability criteria.

3.2. Approach to the Problem

The consultant has applied the following approaches to the problem:

- Summer 2028 has been selected for the load flow analysis as per COD of Kalam Asrit HPP because it represents the high water peak load conditions. The lines in the vicinity of this plant will be loaded to the maximum extent, allowing us to judge the complete impact of the plant on the transmission system in its vicinity.
- The network model comprises of all 500 kV, 220 kV and 132 kV system, envisaging the load forecast, the generation additions and transmission expansions for the year 2028.
- Load flow and short circuit studies have also been performed for off peak summer 2028 and peak and off-peak winter 2028 to gauge the performance of the proposed plant in low load and/or low water conditions.

- An interconnection scheme without any physical constraints, such as right of way or availability of space in the terminal substations, have been identified.
- Performed technical system studies to confirm technical feasibility of the interconnection. Proposed scheme has been subjected to standard analysis like load flow, short circuit and transient stability study to check the strength of the machines and the proposed interconnection schemes under disturbed conditions.
- Determine the relevant equipment for the proposed technically feasible scheme.

4. Development of Interconnection Scheme

4.1. The Existing Network

The network, at the time of commissioning of Kalam Asrit HPP, will have Daral Khwar HPP evacuated towards 132 kV Madyan G/S and Gorkin Matiltan HPP, Gabral Kalam HPP, Gabral Utror HPP, Bankhwar HPP, Artistic-II HPP, Asrit Kedam HPP, Chokel Khwar HPP and Madyan HPP in the Swat valley evacuated to 220 kV Chakdara-New G/S.

4.2. The Interconnection Scheme of Kalam Asrit HPP

The interconnection scheme for the Kalam Asrit hydropower project has been proposed as described in *The Integrated Study*.

Generation voltage for Kalam Asrit HPP is 11 kV which is stepped up to 220 kV at Kalam Asrit 220 kV G/S. which is further connected with Madyan HPP and Asrit Kedam HPP. The conductor would be 220 kV Twin Bundle Rail with thermal rating of 1348 MVA. While on the other side of Kalam Asrit 220 kV G/S it is stepped down to Kalam Asrit 132 kV G/S via 2x250 MVA Transformers.

By the 2028, following hydropower projects would have been commissioned in the Swat valley

- Daral Khwar HPP
- Gorkin Matiltan HPP
- Gabral Kalam HPP
- Madyan HPP
- Kalam Asrit HPP
- Asrit Kedam HPP
- Artisitic-II HPP
- Chokel Khwar
- Bankhwar
- Gabral Utror

Therefore, this study will deal with ten of the 17 hydropower projects identified in the valley.

The proposed scheme for Kalam Asrit HPP will require the following bays in their switch yard

- Two line bays of 220 kV for connection with 220 kV Asrit Kedam HPP and 220 kV

Madyan HPP.

- Four transformer bays for the four GSU transformers (3x80MVA & 1x40MVA)

5. Detailed Load Flow Studies

The base cases have been developed for the peak and off-peak conditions of summer 2028 using the network data provided by NTDC. Detailed load flow studies have also been carried out for peak and off-peak load conditions of winter 2028.

5.1. Peak Load Case Summer 2028

The peak load case for summer 2028 has been studied in detail and N-1 contingency scenarios have been analyzed based on the scheme and reinforcements described in Chapter-4.

5.1.1. Without Kalam Asrit HPP and Asrit Kedam HPP

The scenario of summer 2028 is simulated without Kalam Asrit HPP and Asrit Kedam HPP to assess the network performance without both the hydropower projects. As Kalam Asrit HPP and Asrit Kedam HPP are expected to commission at around the same time, therefore, both the plants have been removed from this analysis. This will allow us to judge the network performance during the summer load conditions when the power output from all surrounding hydropower plants will be maximum due to high water levels.

This scheme has been simulated in PSS/E load flow the results of load flow for this case are plotted in Exhibit 0.0 of Appendix-C.

The power flows on the circuits under normal conditions are seen well within the rated capacities. Also, the voltages on the bus bars are within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on the 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit 0.1	G-Matiltan to Gabral Kalam 132kV Single Circuit Out
Exhibit 0.2	Kalam Asrit to Chokel Khwar 132kV Single Circuit Out
Exhibit 0.3	Madyan HPP to Chokel Khwar 132kV Single Circuit Out
Exhibit 0.4	Chakdara New to Noshera 220kV Single Circuit Out
Exhibit 0.5	Chakdara New to Mardan 220kV Single Circuit Out

We find that power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the

nominal for contingency conditions' criteria. We find no capacity constraints on 220 kV circuits under normal and contingency conditions.

5.1.2. With Kalam Asrit HPP and Asrit Kedam HPP

In order to simulate the scenario when both Kalam Asrit HPP and Asrit Kedam HPP commission by 2028, the base case developed for section 5.1.1 has been used and both the hydropower plants are modelled as per the data given in section 4. In this scenario, the 220/132 kV transformer at Madyan HPP will be transported back to Kalam Asrit switchyard and Madyan would be evacuating power at 220 kV voltage level because the 220 kV circuit between Asrit Kedam HPP and Chakdara-New HPP will have been energized at 220 kV.

This scheme has been simulated in PSS/E load flow the results of load flow for this case are plotted in Exhibit 1.0 of Appendix-C.

The power flows on the circuits under normal conditions are seen well within the rated capacities. Also, the voltages on the bus bars are within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on the 132 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as follows:

Exhibit 1.1	Kalam Asrit to Asrit Kedam 220kV Single Circuit Out
Exhibit 1.2	Asrit Kedam to Chakdara New 220kV Single Circuit Out
Exhibit 1.3	Chokel Khwar to Madyan HPP 220kV Single Circuit Out
Exhibit 1.4	Gabral Kalam to Kalam Asrit 132 kV Single Circuit Out
Exhibit 1.5	Madyan HPP to Chakdara New 220 kV Single Circuit Out
Exhibit 1.6	Chakdara New to Nowshera 220 kV Single Circuit Out
Exhibit 1.7	Chakdara New to Mardan 220 kV Single Circuit Out

We find that power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the nominal for contingency conditions' criteria. We find no capacity constraints on 220 kV circuits under normal and contingency conditions.

5.2. Off-Peak Load Case Summer 2028

The scenario of Asrit Kedam and Kalam Asrit with off-peak load of about 80% has been studied. The results of load flows under normal conditions have been plotted in Exhibit 2.0 in Appendix-C.

The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on 220 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as for the previous scenario. The list of contingencies has not been repeated here to avoid redundancy.

We find that power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the nominal for contingency conditions' criteria. We find no capacity constraints on 220 kV circuits under normal and contingency conditions.

5.3. Peak Load Case Winter 2028

The scenario of peak winter 2028 has been studied for the interconnection of Asrit Kedam HPP as the hydropower plants are at their low generation potential. The loads in the system have been reduced to 64% in this case. Similarly, the hydropower plants in the system are at their peak winter dispatches. The generation of Kalam Asrit HPP has been reduced to roughly 33% to depict winter dispatch. The results of load flows with Kalam Asrit HPP under normal conditions have been plotted in Exhibit 3.0 in Appendix-C.

The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on 220 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as for the previous scenario.

We find that power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the

nominal for contingency conditions' criteria. We find no capacity constraints on 220 kV circuits under normal and contingency conditions.

5.4. Off-Peak Load Case Winter 2028

The scenario of off-peak winter 2024 has been simulated using off-peak winter loads, which have been further reduced to 70% of peak winter loads. Similarly the hydropower plants in the system are at their off-peak winter dispatches. The generation of Kalam Asrit HPP has been reduced to roughly 25% to depict off-peak winter dispatch. The results of load flows with Kalam Asrit HPP under normal conditions have been plotted in Exhibit 4.0 in Appendix-C.

The power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 5 % off the nominal. We find no capacity constraints on 220 kV circuits under normal conditions i.e. without any outages of circuits.

N-1 contingency analysis has been carried out and the plotted results are attached in Appendix – C as for the previous scenario.

We find that power flows on the circuits are seen well within the rated capacities and the voltages on the bus bars are also within the permissible operating range of ± 10 % off the nominal for contingency conditions' criteria. We find no capacity constraints on 220 kV circuits under normal and contingency conditions.

5.5. Conclusion of Load Flow Analysis

From the analysis discussed above, we conclude that the proposed interconnection scheme is adequate to evacuate the 215 MW power of Asrit Kedam HPP and 238 MW power of Kalam Asrit HPP under normal and contingency conditions. The interconnection ensures reliability and availability under all events of contingencies, i.e. planned or forced outages studied in this report for the base year 2028. The bus bar voltages remain well within the permissible limits in all the contingency events.

Hence, the proposed interconnection scheme of Asrit Kedam HPP has no constraints according to the Load Flow Analysis.

6. Short Circuit Analysis

6.1. Methodology and Assumptions

The methodology of IEC 909 has been applied in all short circuit analyses in this report for which provision is available in the PSS/E software used for these studies.

The maximum fault currents have been calculated with the following assumptions under IEC 909:

- Set tap ratios to unity
- Set line charging to zero
- Set shunts to zero in positive sequence
- Desired voltage magnitude at bus bars set equal to 1.10 P.U. i.e. 10 % higher than nominal, which is the maximum permissible voltage under contingency condition.

For evaluation of maximum short circuit levels we have assumed contribution in the fault currents from all the installed generation capacity of hydel, thermal and nuclear plants in the system in the year 2028 i.e. all the generating units have been assumed on-bar in fault calculation's simulations.

The assumptions about the generator and the transformers data are the same as mentioned in Chapter 2 of this report.

6.2. Fault Current Calculations Year 2028 - without Asrit Kedam HPP and Kalam Asrit HPP

In order to assess the short circuit strength of the 220 kV network without Asrit Kedam HPP and Kalam Asrit HPP, three-phase and single-phase fault currents have been calculated for NTDC in the vicinity of the site of the Plant. The results are attached in Appendix – D.

The short circuit levels have been calculated and plotted on the bus bars of 220 kV of substations lying in the electrical vicinity of our area of interest and are shown plotted in the Exhibit 5.0 attached in Appendix-D. Both 3-phase and 1-phase fault currents are indicated in the Exhibit 5.0 which are given in polar coordinates i.e. the magnitude and the angle of the current. The total fault currents are shown below the bus bar.

The tabular output of the short circuit calculations is also attached in Appendix-D for the 220 kV and 132 kV bus bars of our interest. The total maximum fault currents for 3-phase and 1-phase short circuit at these substations are summarized in Table 6.1. We see that the

maximum fault currents do not exceed the short circuit ratings of the equipment at these 220 kV and 132 kV substations.

Table 1 - Maximum Short Circuit Levels without Asrit Kedam HPP and Kalam Asrit HPP - Year 2028

Substation	3-Phase fault current, kA	1-Phase fault current, kA
Kalam Asrit 220kV	15.21	13.34
Kalam Asrit 132kV	15.08	15.65
Madyan 220 kV	11.98	10.40
Chakdara-New 220 kV	16.90	14.14
Nowshehra 220 kV	43.07	30.22
Chokel Khawar 220 kV	14.20	12.40
Chakdara 132 kV	17.98	15.18
Chakdara-New 132 kV	18.91	16.65
Gabral Kalam 132 kV	14.67	15.67
Gabral Utror 132 kV	11.61	11.40
Bankhawar 132 kV	13.78	14.32

6.3. Fault Current Calculations with Asrit Kedam HPP and Kalam Asrit - Year 2028

Maximum fault currents have been calculated for the electrical interconnection of proposed scheme. Fault types applied are three phase and single-phase at the 220 kV bus bar of Asrit Kedam HPP and Kalam Asrit HPP itself and other bus bars of the 220 kV substations in the electrical vicinity of Asrit Kedam HPP and Kalam Asrit HPP. The graphic results are shown in Exhibit 5.1.

The tabulated results of short circuit analysis showing all the fault current contributions with short circuit impedances on 220 kV bus bars of the network in the electrical vicinity of Asrit Kedam HPP and Kalam Asrit HPP and the 220 kV bus bar of the HPPs themselves are placed in Appendix-D. Brief summary of fault currents at significant bus bars of our interest are tabulated in Table 6.2.

Table 2 - Maximum Short Circuit Levels with Asrit Kedam HPP and Kalam Asrit HPP – Year 2028

Substation	3-Phase fault current, kA	1-Phase fault current, kA
Asrit Kedam 220kV	14.27	13.98
Kalam Asrit 220kV	14.13	13.83
Kalam Asrit 132kV	14.79	15.73
Madyan 220 kV	12.14	11.11
Chakdara-New 220 kV	17.41	14.49
Nowshehra 220 kV	43.16	30.26
Chokel Khawar 220 kV	13.52	12.97
Chakdara 132 kV	18.11	15.28
Chakdara-New 132 kV	19.09	16.80
Gabral Kalam 132 kV	14.45	15.71
Gabral Utror 132 kV	11.47	11.38
Bankhawar 132 kV	13.58	14.33

Comparison of Tables 6.1 and 6.2 show that for some bus bars there is a slight decrease in short circuit levels for both three-phase and single–phase, on the 220 kV bus bars after the connection of Asrit Kedam HPP and Kalam Asrit HPP. This is due to the fact that the 220 kV circuit from the location of Kalam Asrit HPP to Chakdara-New 220 kV is proposed to be operated at 132 kV until the commissioning of Kalam Asrit HPP and Asrit Kedam HPP, which causes a rise in the short circuit levels.

6.4. Conclusion of Short Circuit Analysis

The short circuit analysis results show that for the proposed scheme of interconnection of Asrit Kedam HPP and Kalam Asrit HPP, we don't find any violations of short circuit ratings of the proposed equipment on the 220 kV bus bars in the vicinity of the plant due to fault current contributions from Asrit Kedam HPP and Kalam Asrit HPP.

Therefore, industry standard switchgear of the short circuit rating of 50 kA would be fine to be installed at 220 kV switchyard of Asrit Kedam HPP and Kalam Asrit HPP. It would provide large margin for future increase in short circuit levels as generation additions are expected in the valley and network reinforcements will be introduced to accommodate those additions.

7. Dynamic Stability Analysis

7.1. Assumptions & Methodology

7.1.1. Dynamic Models

The assumptions about the generator and its parameters are the same as mentioned in Chapter 2 of this report.

We have employed the generic dynamic models available in the PSS/E model library for dynamic modeling of the generator, exciter and the governor as follows;

Generator	GENSAL
Excitation System	EXST1
Speed Governing System	HYGOV
Stabilizer	PSS2A

Power System Stabilizer has also been proposed to be installed for damping of oscillations and smooth and stable operation of the power plant.

7.1.2. System Conditions

The scenario of summer 2028 has been selected for the study because it represents the peak load season after the COD of Asrit Kedam HPP and Kalam Asrit HPP and thus the loading on the lines in the vicinity of the HPPs will be maximum, allowing us to judge the full impact of the plant.

The proposed HPPs have been modeled in the dynamic simulation with generic parameters as detailed parameters for these projects is not available. All the power plants of WAPDA/NTDC from Tarbela to Hub have been dynamically represented in the simulation model.

7.1.3. Presentation of Results

The plotted results of the simulations runs are placed in Appendix-E. Each simulation is run for its first one second for the steady state conditions of the system prior to fault or disturbance. This is to establish the pre fault/disturbance conditions of the network under study were smooth and steady. Post fault recovery has been monitored for fourteen seconds. Usually all the transients due to non-linearity die out within a few seconds after disturbance is cleared in the system.

7.1.4. Worst Fault Cases

Three phase faults are considered as the worst disturbance in the system. We have considered 3-phase fault in the closest vicinity of Asrit Kedam HPP i.e. right at the 220 kV bus bar of Kalam Asrit HPP substation, cleared in 5 cycles, as normal clearing time for 220 kV i.e. 100 ms, followed by a permanent trip of a 220 kV single circuit from the faulted buses. Also to fulfil the Grid Code criteria case of stuck breaker (breaker failure) single phase fault has also been studied where the fault clearing time is assumed 9 cycles i.e. 180 ms.

7.2. Dynamic Stability Simulations' Results – Summer 2028

The transient stability analysis is carried out for peak load case of summer 2028 with the interconnection of Asrit Kedam HPP and Kalam Asrit HPP.

Results of this analysis are discussed one by one below

7.2.1.

Table 3: 3-Phase Fault at Kalam Asrit for 5 cycles

Fault Type: 3-Phase			
Fault Location: Kalam Arsit 220 kV bus bar			
Fault Duration: 5 cycles (100 ms)			
Line Tripping: Madyan to Kelam Asrit 220 kV single circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Asrit Kalam 220 kV 2. Madyan 220 kV 3. Kelam Asrit 220kV 4. Chakdara-New 220 kV 5. Asrit Kedam 132 kV 6. Gabral Kalam 132 kV	The voltages of all the bus bars recover after fault clearance	1.1
Frequency	Kalam Asrit 220 kV	Recovers after fault clearance	1.2
MW/MVAR Output of the Plant	Kalam Asrit unit-1 11 kV	Recovers after damping down oscillations	1.3
Speed and $P_{mechanical}$ of the Plant	Kalam Asrit unit-1 11 kV	Recovers after damping down oscillations	1.4
Line Flows (MW/MVAR)	Madyan to Kalam Arsit 132 kV intact single circuit	Attains steady state value after damping of oscillations	1.5
Rotor Angles	1. G-Matiltan 11 kV 2. Ghazi Brotha 500 kV 3. Daral Khwar 11 kV 4. Mangla 132 kV 5. Nelum Jehlum 500 kV 6. Guddu-New 500 kV (reference angle)	Damps down quickly and attain a steady state value	1.6

7.2.2.

Table 4: 3-Phase Fault at Kalam Asrit for 9 cycles

Fault Type: 1-Phase			
Fault Location: Kalam Arsit 220 kV bus bar			
Fault Duration: 9 cycles (180 ms)			
Line Tripping: Madyan to Kelam Asrit 220 kV single circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Asrit Kedam 220 kV 2. Madyan 220 kV 3. Kelam Asrit 220kV 4. Chakdara-New 220 kV 5. Kelam Asrit 132 kV 6. Gabral Kalam 132 kV	The voltages of all the bus bars recover after fault clearance	2.1
Frequency	Kalam Asrit 220 kV	Recovers after fault clearance	2.2
MW/MVAR Output of the Plant	Kalam Asrit unit-1 11 kV	Recovers after damping down oscillations	2.3
Speed and $P_{mechanical}$ of the Plant	Kalam Asrit unit-1 11 kV	Recovers after damping down oscillations	2.4
Line Flows (MW/MVAR)	Madyan to Kalam Arsit 132 kV intact single circuit	Attains steady state value after damping of oscillations	2.5
Rotor Angles	1. G-Matiltan 11 kV 2. Ghazi Brotha 500 kV 3. Daral Khwar 11 kV 4. Mangla 132 kV 5. Nelum Jehlum 500 kV 6. Guddu-New 500 kV (reference angle)	Damps down quickly and attain a steady state value	2.6

7.2.3.

Table 5: 3-Phase Fault at Chakdara-New for 5 cycles

Fault Type: 3-Phase			
Fault Location: Chakdara-New 220 kV bus bar			
Fault Duration: 5 cycles (100 ms)			
Line Tripping: Madyan to Chakdara-New 220 kV single circuit			
Variable	**Bus/Line**	**Response**	**Figure No.**
Voltage	1. Chakdara-New 220 kV 2. Asrit Kedam 220 kV 3. Madyan 220 kV 4. Kelam Asrit 220kV 5. Kelam Asrit 132 kV 6. Gabral Kalam 132 kV	The voltages of all the bus bars recover after fault clearance	3.1
Frequency	Chakdara-New 220 kV	Recovers after fault clearance	3.2
MW/MVAR Output of the Plant	Kalam Asrit unit-1 11 kV	Recovers after damping down oscillations	3.3
Speed and $P_{mechanical}$ of the Plant	Kalam Asrit unit-1 11 kV	Recovers after damping down oscillations	3.4
Line Flows (MW/MVAR)	Madyan to Chakdara-New 220 kV intact single circuit	Attains steady state value after damping of oscillations	3.5
Rotor Angles	1. G-Matiltan 11 kV 2. Ghazi Brotha 500 kV 3. Daral Khwar 11 kV 4. Mangla 132 kV 5. Nelum Jehlum 500 kV 6. Guddu-New 500 kV (reference angle)	Damps down quickly and attain a steady state value	3.6

7.3. Conclusion of Dynamic Stability Analysis

The results of dynamic stability carried out for peak load conditions of summer 2028 show that the system is strong and stable enough to damp the oscillations for the proposed scheme in case of severest possible faults of 220 kV systems near to and far of Asrit Kedam HPP and Kalam Asrit HPP. Therefore, there is no problem of dynamic stability for interconnection of Asrit Kedam HPP and Kalam Asrit HPP; it fulfills all the criteria of dynamic stability.

8. Conclusions and Recommendations

- The Draft Report of 238 MW Kalam Asrit Hydro Power Plant by Korea South East Power Company Ltd. (KOEN) in Swat, Khyber Pakhtunkhwa, is submitted herewith.
- The updated generation plan, transmission plan and load forecast from NTDC has been used for the study, vide data permission letter no. ***GMPSP/TRP-300/4287-92 dated 05-11-2021***.
- The expected commercial operation date of Kalam Asrit is the last quarter of 2027.
- Generation voltage for Kalam Asrit HPP is 11 kV which is stepped up to 220 kV at Kalam Asrit 220 kV G/S. which is further connected with Madyan HPP and Asrit Kedam HPP. The conductor would be 220 kV Quad Bundle Rail with thermal rating of 1348 MVA. While on the other side of Kalam Asrit 220 kV G/S it is stepped down to Kalam Asrit 132 kV G/S via 2x250 MVA Transformers.
- Kalam Asrit HPP is located on the main Swat River, a few kilometers north of Bahrain.
- The proposed scheme for Kalam Asrit HPP will require the following bays in their switch yard
    - Two line bays of 220 kV for connection with 220 kV Asrit Kedam HPP and 220 kV Madyan HPP.
    - Four transformer bays for the four GSU transformers (3x80MVA & 1x40MVA)
- In view of the expected Commercial Operation Data (COD) of Kalam Asrit HPP in the last quarter of 2027, the above proposed interconnection scheme has been tested for the following scenarios using load flow studies:
    - Peak Load Summer 2028
    - Off-Peak Load Summer 2028
    - Peak Load Winter 2028
    - Off-Peak Load Winter 2028
- Steady state analysis by load flow for all the scenarios described above reveals that the proposed scheme is adequate to evacuate the maximum power of Kalam Asrit HPP under normal as well as contingency conditions.
- The short circuit analysis has been carried out to calculate maximum fault levels at hydropower plant G/S and the substations of 220 kV and 132 kV in its vicinity. We find that the fault currents for the proposed scheme are within the rated short circuit capacities of switchgear proposed at these substations. There are no violations of

exceeding the rating of the equipment due to contribution of fault current from the under study HPPs.

- The maximum short circuit levels at 220 kV Kalam Asrit HPP bus bars for the Year 2028 for 3-Phase and 1-Phase are 14.13 kA and 13.83 kA respectively. It would be advisable to go for standard size switchgear of short circuit rating of 50 kA. It would provide large margin for future increase in short circuit levels as generation additions are expected in the valley and network reinforcements will be introduced to accommodate those additions.
- The dynamic stability analysis of proposed scheme of interconnection has been carried out for peak load condition of summer 2028. The proposed scheme successfully passed the dynamic stability checks for near and far faults for the most stringent cases. The system is found strong enough to stay stable and recovered with fast damping.
- The proposed scheme of interconnection has no technical constraints or problems and is therefore recommended to be adopted. It meets all the criteria of grid code under steady state load flow, short circuit currents and dynamic/transient conditions given all the proposed requirement of the network are implemented.

LOCATION OF THE PROJECT

ANNEX-N

238 MW KALAM ASRIT HYDROPOWER PROJECT

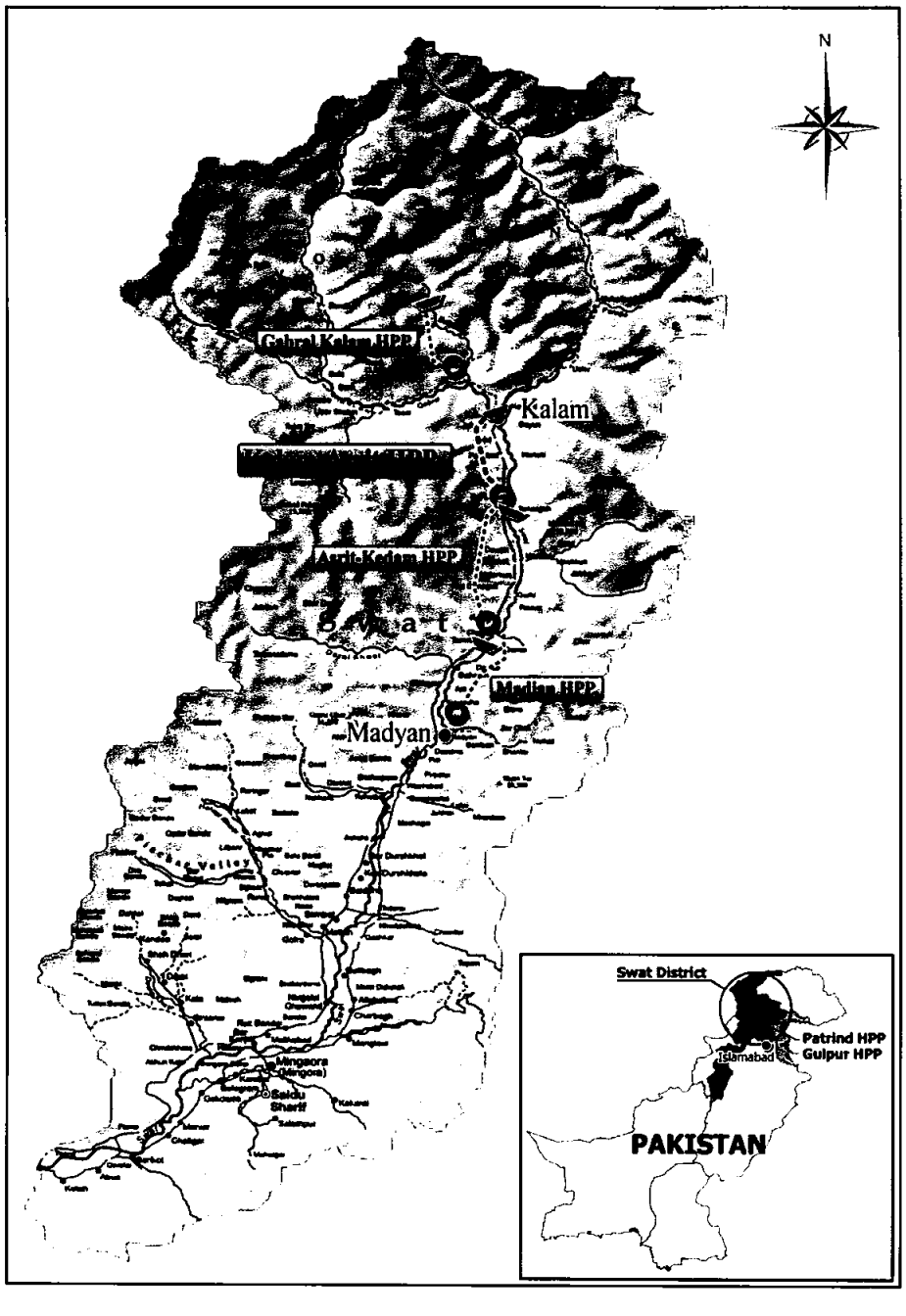
KA POWER LIMITED

23rd Floor, Ufone Tower,
Jinnah Avenue, Blue Area,
Islamabad.
Tel: +92 51 2726703
Fax: +92 51 2726703

Project Location

The Project is located on the Swat River across from the Kalam to the Asrit Villages in District Swat, Khyber Pakhtunkhwa Province, Pakistan.

The project area is accessible from Islamabad by motorway M1 and then Swat Expressway M16 to Chakdarra then from Chakdarra to Site by N95 highway. Both N45 and N95 are metaled roads. The distance of the Project is approximately 350 Km from Islamabad.



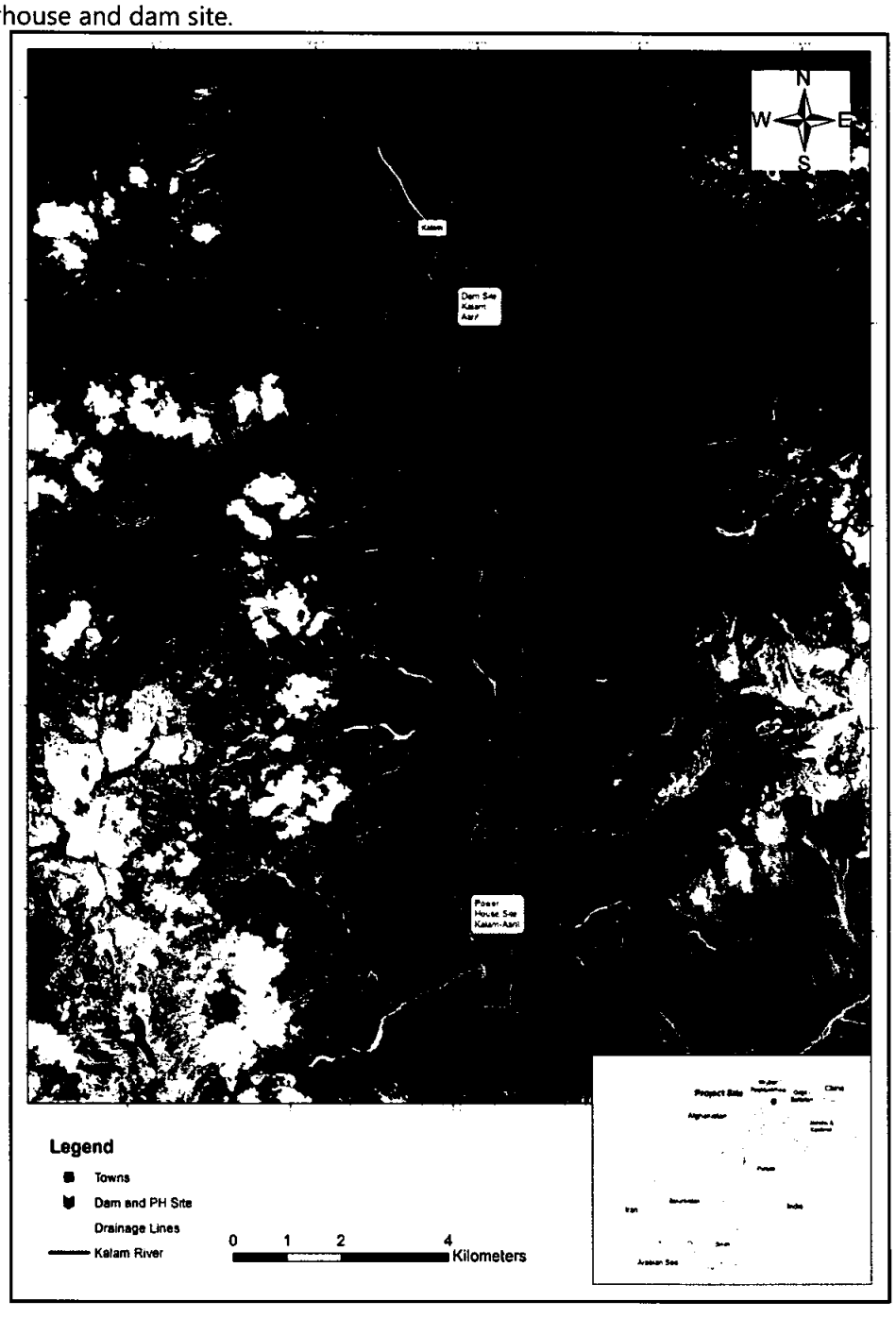
KA POWER LIMITED

23rd Floor, Ufone Tower,
Jinnah Avenue, Blue Area,
Islamabad.
Tel: +92 51 2726703
Fax: +92 51 2726703

The project concept is run-of-river scheme with bypass tunnel of a partial flow from Swat River using a diversion weir, and through a power tunnel system connecting to the downstream, the powerhouse releases water to Swat River.

The proposed dam and intake structure is located three approx. 2 Km downstream of the confluence of Gabral River and Ushu River. The proposed location for the powerhouse is 500 m upstream upstream of the Asrit village. The proposed headrace tunnel is proposed on the right side of Swat river, straight down to the village Asrit.

Following figure shows the location plan of the project site along with the layout of proposed powerhouse and dam site.



KA POWER LIMITED

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Project Location Plan (Image Source: Google Earth)

KA POWER LIMITED

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CONSENTS

ANNEX-O

238 MW KALAM ASRIT HYDROPOWER PROJECT

Letter of Intent issued by PEDO

P E D O

PAKHTUNKHWA ENERGY DEVELOPMENT ORGANIZATION

Government of Khyber Pakhtunkhwa Peshawar

No. 1296-1304/PEDO/DPP/KOEN/LOI
Dated: 24/04/2018

To

M/S Korea South East Power Company (KOEN),
32, Sadeul-ro 123beon-gil, Jinju-si, Gyeongsangnam-do, Korea.
Tel: +82-70-8898-1000

Subject: LETTER OF INTENT (LOI) FOR APPROXIMATELY 197 MW KALAM ASRIT HYDRO POWER PROJECT (the "Project")

WHEREAS

A) The hydel potential raw Site was registered to M/S Korea South East Power Company (KOEN) on first come first serve basis under the KP Hydro Power Policy 2016.

B) Proposal dated 6th December 2017 including the Statement of Qualification (SOQ) (the **"Proposal"**) was submitted by M/S Korea South East Power Company (KOEN) (the **"Main Sponsor"**), having its registered address at 32, Sadeul-ro 123beon-gil, Jinju-si, Gyeongsangnam-do, Korea; (Main Sponsor Korea South East Power Company (KOEN) referred herein as the **"Sponsors");**

C) PEDO issued No Objection Certificate (NOC) dated 26th March 2018; and

D) The Sponsors having delivered an irrevocable, unconditional, on demand bank guarantee No. HMB/LG/9902/06/18 dated 16th April 2018, on terms acceptable to PEDO, issued by Habib Metropolitan Bank Limited, Islamic Banking Branch, Hill View Plaza, Near Fresco Sweets, Jinnah Avenue, Blue Area, Islamabad, in the amount of US $ 197,000/- (United State Dollar seven thousand only) valid up to 16th March 2021 (hereinafter referred to as the **'Performance Guarantee'**) in favour of PEDO.

NOW THEREFORE

In terms of the provisions of the KP Hydro Power Policy 2016 and associated Guidelines (the **"Policy"**), the LOI is issued to the Sponsors for conducting a bankable feasibility study (the **"Feasibility Study"**) for establishing, in private sector, an approximately **197 MW Kalam Asrit Hydropower Project** to be located on Swat River in Swat District, Khyber Pakhtunkhwa (KP), Pakistan (the **"Project"**) and to perform such actions as provided hereinafter in accordance with following terms and conditions:

1. The Sponsors shall be required to carry out the Feasibility Study, complete, at internationally acceptable standards and in accordance with the terms and conditions stipulated in the Policy for the Project, **at no risk and cost to, and without any obligation on**

part of, the GOKP and its agencies, within **24 months** from the date of issuance of this LOI. Indicative Terms of Reference (TOR) for the Feasibility Study at **Annex-A**. The Feasibility Study shall include, but not limited to, an environmental & social impact assessment study, optimized layout of the Project components, detailed design of power house and its allied structures, load flow and stability studies, design of interconnection/transmission lines, details pertaining to infrastructure, detailed bill of quantities and rate analysis of major items, project cost, financing plan, financing terms, tariff calculations and assumptions of financial calculations including economic/financial analysis. You are advised to liaise with the power purchaser while determining your plant size and site, project layout, transmission line and interconnection arrangements, etc. In addition you will also be required to liaise and coordinate with the sponsors of other upstream and downstream projects at Swat River in order to ensure that the design and other parameters/features of the Project do not affect such other projects.

2. The Sponsors shall submit detailed project milestones within one month of signing of this LOI and shall submit monthly progress reports showing progress against these milestones.

3. PEDO will appoint a Panel of Experts (**POE**) to monitor the conduct of the Feasibility Study and its progress, to verify attainment of the aforesaid milestones and to ensure implementation of the project consistent with national and provincial needs.

4. The Sponsors shall be jointly and severally liable for all obligations and liabilities hereunder. Furthermore, the approval of Feasibility Study by PEDO is subject to fulfillment by the Sponsors of the terms and conditions under and in accordance with the Policy and commitment made under SOQ.

5. Within ninety (90) days after the approval of Feasibility Study by GOKP/PEDO, you are also required to finalize and file a complete feasibility stage tariff petition before National Electric Power Regulatory Authority (NEPRA) in accordance with NEPRA's Mechanism for Determination of Tariff for Hydropower Projects. Furthermore, within sixty (60) days after such tariff determination / approval by NEPRA of the feasibility stage tariff, the Sponsors, after meeting all requirements under the Policy including but not limited to posting of an irrevocable, unconditional, on demand bank Guarantee on terms acceptable to PEDO/PPIB in an amount equal to US$ 5000/MW shall apply to PPIB for issuance of Tripartite Letter of Support (LOS).

6. PEDO shall be entitled to encash the Performance Guarantee and the LOI shall stand terminated without any notice. In the event, the Sponsors delays, defaults or fails either to:

i. Complete Feasibility Study within **24 months** from the date of issuance of this LOI in accordance with the terms hereof.
ii. File petition before NEPRA, in accordance with NEPRA's Mechanism for Determination of Tariff for Hydropower Projects, within ninety (90) days of the approval of the Feasibility Study by GOKP/PEDO, for tariff determination.
iii. Apply to PPIB for issuance of Tripartite LOS within sixty (60) days of tariff determination by NEPRA; or

iv. Extend the validity of the Performance Guarantee as and when required.

7. If PEDO acting in its sole discretion determines that any extension is required by the Sponsors in relation to their obligations to achieve any milestone(s) under the LOI, PEDO shall be entitled acting on an application in writing made to it by the Main Sponsors at least thirty (30) days before the expiry of such milestone, to grant in writing to the Sponsors such extension as is prescribed under and subject to such conditions as provided in the Policy.

8. The Performance Guarantee shall secure the Sponsor's obligations under and in accordance with the terms of this LOI. The Performance Guarantee shall remain valid and in full force until the date falling three (3) months beyond the expected date for issuance of Tripartite LOS, If the Performance Guarantee is due to expire within thirty (30) days and is required to be maintained by the Sponsors, the Sponsors shall renew the Performance Guarantee no later than ten (10) days before its expiry, failing which PEDO shall be entitled to encash the Performance Guarantee in full and hold such cash as security for the obligations of the Sponsors under the LOI.

9. The Sponsors shall hold not less than fifty one percent (51%) of the equity during Lock in Period (commencing from the date of issuance of this LOI until the sixth (6th) anniversary of the commissioning of the Project). The Main Sponsor shall hold not less than twenty percent (20%) of the equity during the Lock in Period.

10. This LOI shall be effective from the date hereof, and remain valid till the issuance of Tripartite LOS by PPIB or unless terminated earlier in accordance with the terms hereof. **Nevertheless, this LOI shall lapse if the signed copy is not received at PEDO within fifteen (15) days of its issuance.**

11. This LOI shall in no way be construed as an award of the Project as no such vested legal or contractual rights shall accrue, in your favor, till such time, valid Project Agreements (as defined in the LOS) are executed in accordance with the terms and conditions contained therein.

12. Issuance of this LOI or any act done in terms hereof or its termination, lapse or expiry or Sponsors' conduct of Feasibility Study hereunder cannot form the basis of any claim for compensation or damages by the Sponsors or any party claiming through them against the Government of Khyber Pakhtunkhwa, PEDO or any of its agencies on any grounds whatsoever, during or after the expiration, lapse or termination of the LOI.

13. The obligations and liabilities of the Sponsors under the LOI and the Performance Guarantee shall be joint and several. Any notice or communication by or to the Main Sponsor under this LOI shall be deemed a notice or communication to or by the entire Sponsors.

14. The rights and obligations of the parties pursuant to and under this LOI shall be governed by the laws of Pakistan and the Courts of Pakistan shall have exclusive jurisdiction in

relation to any dispute or matter arising out of or in connection herewith. The court of jurisdiction will be at Peshawar High Court.

This LOI has been issued in duplicate on the date hereof. Kindly sign the attached copy of this LOI at the place indicated and return the same to us no later than fifteen (15) days of its issuance.

Yours sincerely,

KOREA SOUTH-EAST POWER CO., Ltd. KOSEP

Director
Private Power PEDO

Mr. Min, Byeong Soo

CNIC/Passport: M036PP40P

For and on behalf of

M/S KOREA SOUTH EAST POWER Co. Ltd. (KOSEP)

Encl.: 1) Indicative Terms of Reference (TOR) for the Feasibility Study of Hydropower Project (Annex-A)

Cc:

1. Chairman NEPRA, NEPRA Tower, Ataturk Avenue, G-5/1 (east), Islamabad.
2. MD NTDCL, 4th Floor, PIA Tower, Egertorn Road Lahore.
3. CEO, CPPA-G, Shaheed-e-Millat Secretariat, Blue Area Islamabad.
4. MD PPIB, Immigration Tower, G-8/1, Mauve Area Islamabad.
5. CEO PESCO, WAPDA House, Shami Road, Peshawar.
6. PS to Secretary E&P Department, Civil Secretariat, Peshawar.
7. PS to Secretary Environment Department, Civil Secretariat, Peshawar.
8. PS to GM (Hydel), PEDO Peshawar.

Correspondence related to ESIA approval with EPA (KPK)

KOEN KOREA SOUTH-EAST POWER CO.

KOREA SOUTH-EAST POWER CO., LTD.
PAKISTAN BRANCH OFFICE
Plot 7-C, G-8 Markaz, Islamabad-Pakistan.
Tel: +9251 8735923-8735924

Letter No. KOAK- ۱۷ **-2022** **Dated: 11th February 2022**

The Director-General
Environmental Protection Agency (EPA)
Forestry, Environment & Wildlife Department,
Govt. of Khyber Pakhtunkhwa,
Old Courts Building, Khyber Road, Peshawar Cant, KPK.

Subject: **Submission of EIA for 238 MW Kalam Asrit Hydropower – 10 Copies + 2 Soft Copies**

Dear Sir,

Korea South-East Power Co. Ltd. (**"KOEN"**) is the premier State-Owned company of Republic of Korea and initiated its investment of around **US$ 1 billion** (238 MW Kalam-Asrit and 215 MW Asrit-Kedam) in KPK hydropower sector of Pakistan in 2017 following successful commissioning of 102 MW Gulpur Hydropower Project in AJ&K.

238MW Kalam Asrit Hydropower Project (**"Project"**) is being implemented by **KOEN**, through its subsidiary KA Power Limited (**"Company"**). The Letter of Interest (of the Project) was issued by Pakhtunkhwa Energy and Development Organization (**"PEDO"**) following the approval of KPK cabinet on **24.04.2018** under the KPK Hydropower Policy 2016.

The Company started the fast-track development of the Project whereby the bankable Feasibility Study is complete and approved from PEDO while a detailed Environment and Social Impact Assessment (**"EIA"**) has also been completed and ready for submission to KPK Environmental Protection Agency.

In this respect, we like to submit EIA of Kalam Asrit Hydropower Project as per legal and regulatory requirements under Section 13 of The Khyber Pakhtunkhwa Environmental Protection Act, 2014 and the Khyber Pakhtunkhwa Environmental Assessment Rules, 2021. Please find the attached following documents:

(i) Application form as per Schedule-VI of The Khyber Pakhtunkhwa Environmental Assessment Rules, 2021;
(ii) EIA Studies Report (Ten paper copies + two electronic copies); and
(iii) Original receipt of the review fee slip.

In this regard, we appreciate your continued assistance throughout the review and approval process of EIA studies.

Looking forward to your continued support

KOREA SOUTH-EAST POWER CO.

KOREA SOUTH-EAST POWER CO., LTD.
PAKISTAN BRANCH OFFICE
Plot 7-C, G-8 Markaz, Islamabad-Pakistan.
Tel: +9251 8735923-8735924

Yours truly,

Mr. Yoon An Sang
Branch Manager
KOEN

Cc:
Chief Executive Officer (CEO), Pakhtunkhwa Energy Development Organization, PEDO House, 38/B-2, Phase-V, Hayatabad Peshawar, Pakistan.

17-02-022

Attachment-I	Application form
Attachment-II	EIA copies (Ten paper copies + two electronic copies)
Attachment-III	Original receipt of the review fee slip

Environmental Protection Agency
Forestry, Environment & Wildlife Department
Govt. of Khyber Pakhtunkhwa

No. EPA/EIA/HPP/238MW/Asrit-Kalam/Swat/22/4082-83

Date: 11/04/2022

To

Mr. Yoon An Sang,
Chief executive Officer,
KOAK Power Limited
Plot No 7-C, G-8, Markaz, Islamabad
Contact No 051-8735023

Subject: **PRESENTATION ON EIA REPORT OF 238 MW KALAM ASRIT HPP**

I am directed to refer to the subject cited above and to state that the following issues observations were raised during the event which needs further clarification/ justification;

1. Submit comments of Fishery Department that:
   i. Whether flow of 2.6 m^3/s is sufficient for survival of aquatic life or otherwise.
   ii. Whether critically endangered vulnerable species is located in the project footprint or otherwise. If yes, what may be the anticipated impacts on the same and what mitigation measures may be adopted for its protection?
   iii. Any other mitigation plan suggested by the fishery department for protection of aquatic life. Provide details.

2. Provide exact detail about main tunnel/access tunnel length, muck material generated, disposal total area and detail of compaction & retention wall erection by observing safe engineering technique for muck material disposal. Moreover, as per GIS mapping the two disposal site seems to fall in river ROW, hence provide exact ROW of river duly approved by irrigation department.
3. During the construction phase, the project may generate hazardous and non-hazardous waste. Responsibility for disposal of the same fall on part of the proponent. Submit detail of the expected waste generation and mechanism for its disposal.
4. Submit detail of water table in the area, depth of the proposed settling tanks and justification that the same will not contaminate water table of the area. Moreover proper waste water treatment plant shall be installed for permanent colonies and separate approval shall be obtained for the same from this Agency.
5. Provide detail of CSR activity keeping in view the quantum of the project and demands of the locals.
6. Submit detail about composition of chemical mixed effluents generated at tunnel site and treatment mechanism for the same.
7. Provide detail of technique other than blasting to be used for tunnel excavation.
8. Submit plantation plan along with budget allocation and area designated for the same.
9. Separate approval shall be obtained for establishment of crush plants, asphalt plant, permanent colony etc as per provisions of Khyber Pakhtunkhwa Environmental Assessment Rules, 2021. Besides the sites identified for crush plants, asphalt plants shall be located away from the residential area.
10. Submit detail of land to be acquired, structure to be effected and compensation plan for the same.

3rd Floor, SDU Building, Khyber Road, Peshawar Cantt.
Tel: 92(91) 9210263-9210148, Fax: 92 (91) 9210280

Environmental Protection Agency
Forestry, Environment & Wildlife Department
Govt. of Khyber Pakhtunkhwa

No. EPA/EIA/HPP/230MW/Asrit Kalam/Swat/22/

Date: / /2022

11. In the EIA Report it is mentioned that hazardous waste management plan, solid waste management and disposal plan will be developed by the contractor. However, as per Khyber Pakhtunkhwa Environmental Protection Act, 2014 and Rules/Regulations made there under the same is the responsibility of the proponent. Therefore, the above mentioned plans should be prepared by the proponent in consultation with this Agency.
12. River bed mining shall not be exercised till the decision of Honourable Peshawar High Court in the matter. Besides, separate approval shall be obtained for the said activity.
13. The proponent shall arrange an exposure visit for the team of this Agency to Gulpur HPP so that to assess the project impacts and proposed mitigation measure as the proponent is going to implement the same design and structures in this project.
14. What are the international good practices regarding distance criteria between two hydropower projects? What cumulative impacts of cluster of HPPs are anticipated on river morphology and ecology?
15. Submit biodiversity management plan for the area.
16. Submit clarification from Forest Department
17. What are the GLOF findings about the project area.
18. Submit flood protection plan duly approved by PDMA.
19. What criteria have been followed for the 06 sites to be used for dumping of muck material?
20. What is the fish count in the project area? Submit details / number of fish breeding sites to be effected by the project activities and mitigation measures to be adopted for this purpose.
21. What will be the mechanism to ensure the maintenance of buffer zone around the project i.e. whether the land will be acquired or otherwise? In case the land is in the ownership of local community than how the proponent will manage the inference of locals in the buffer zone?

In view of the above, you are directed to submit reply to the above mentioned issues at earliest for further processing the case, please.

Deputy Director (EIA)

Copy for information to the:

- PA to Director General, EPA Govt. of Khyber Pakhtunkhwa.

Environmental Protection Agency
Forestry, Environment & Wildlife Department
Govt. of Khyber Pakhtunkhwa

No. EPA/EIA/HPP/238MW/Asrit-Kalam/Swat/22/5-6

Date: 11/04/**2022**

To

Mr. Yoon An Sang,
Chief executive Officer,
KOAK Power Limited.
Plot No. 7-C, G-8, Markaz, Islamabad.
Contact No. 051-8735923

Subject: **PUBLIC HEARING ON EIA REPORT OF 238 MW KALAM ASRIT HPP**

Kindly, refer to the subject noted above; you are hereby informed that under rule- 11 of the Khyber Pakhtunkhwa Environmental Assessment Rules, 2021, public hearing is a mandatory part of the EIA process and under sub-rule (1) the same shall be advertised with prior information to the District Administration.

Therefore, public hearing of the subject project has been fixed on **11 /05 /2022.** In this connection, you are requested to consult with concerned District Administration as well as EPA Regional Directorate, Malakand prior to the advertisement and submit the newspaper cuttings regarding the public hearing published in any two (02) national/local newspapers (in original) with **minimum 15 days gap** between the advertisement and public hearing date, mentioning the type of project, its exact location, the name, address of the proponent and the date, time & venue for Public Hearing under intimation to this Agency along with 150 copies of brief summary of the EIA Report (in Urdu) at earliest for distribution among the stakeholders.

Furthermore, 03 numbers of banners/penaflix of 5x8 ft size shall be displayed at the eve of the Public Hearing subject to observation of the prevailing SOP's pertaining to COVID-19. Besides, a video recording of the public hearing shall be arranged and two soft copies of the same shall be provided to the Agency.

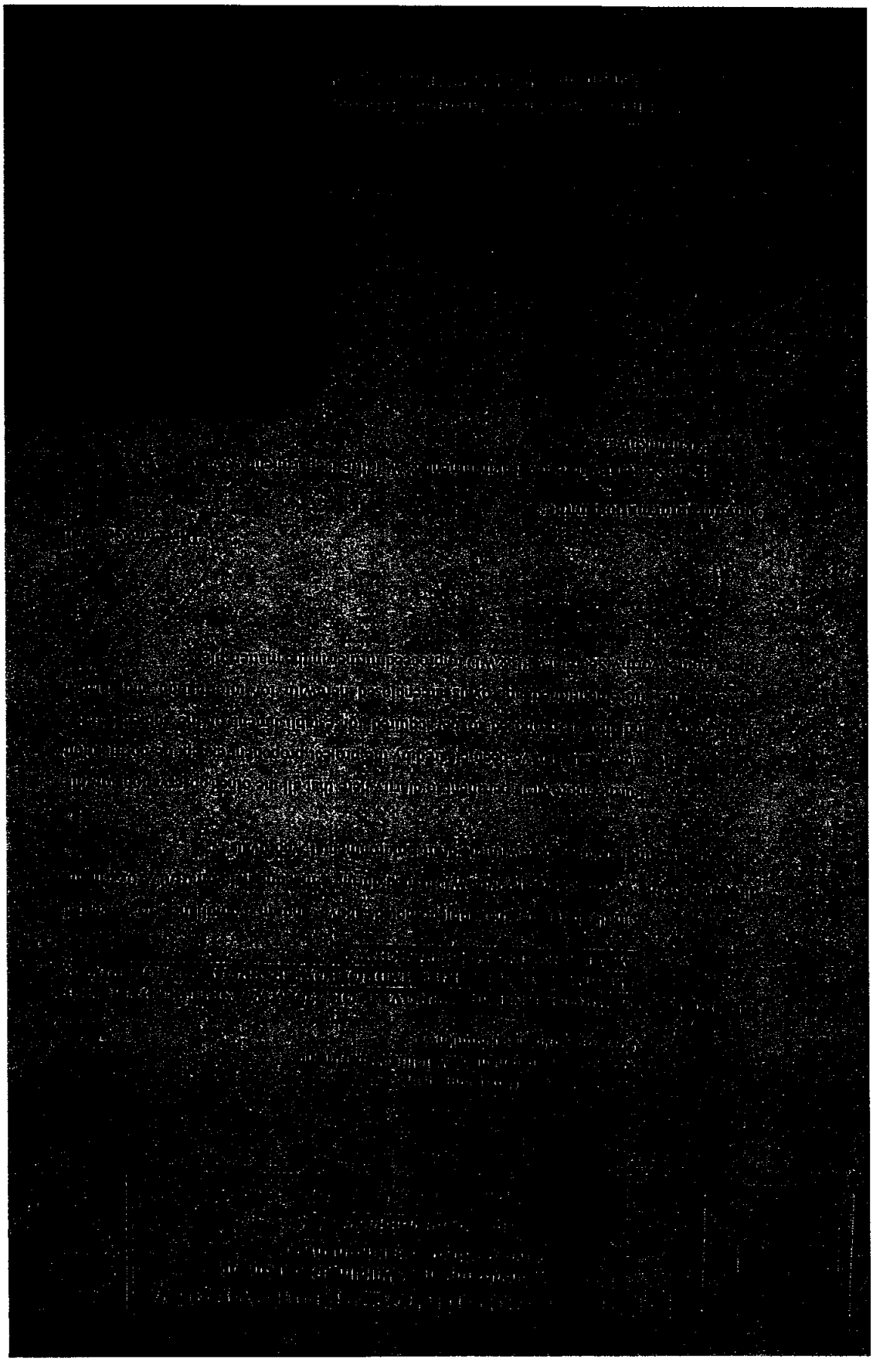
Moreover, the public hearing shall be arranged at the project area with sufficient space for the participants to attend, please.

Director General

Copy forwarded to the:

- Deputy Commissioner Swat for information and necessary action under Rule-11(1) of the Khyber Pakhtunkhwa Environmental Assessment (KPEA) Rules, 2021, please.
- Director Malakand, EPA Regional Directorate swat.

3rd Floor, SDU Building, Khyber Road, Peshawar Cantt.
Tel: 92(91) 9210263-9210148, Fax: 92 (91) 9210280



PEDO approval of Project Feasibility Study

P E D O

PAKHTUNKHWA ENERGY DEVELOPMENT ORGANIZATION

Government of Khyber Pakhtunkhwa Peshawar

No. 64-70/PEDO/DRE/FS/KA
Dated: April 06, 2022

To

Yoon, An Sang,
Branch Manager Pakistan,
Korea South-East Power Company Limited, (KOEN),
Plot 7-C, G-8 Markaz,
Islamabad, Pakistan

Subject: **APPROVAL OF FEASIBILITY STUDY FOR 238 MW KALAM-ASRIT HPP, LOCATED ON SWAT RIVER, DISTRICT SWAT**

References:
i. Letter of Interest (LOI) dated April 24, 2018
ii. Feasibility Study submitted dated April 14, 2020
iii. Minutes of POE Meeting dated December 22, 2021, issued vide PEDO letter no. 52-65/PEDO//DREPP/KOEN/MoM dated February 10, 2022.

PEDO is pleased to communicate following decision of Panel of experts (POE) of PEDO, monitoring the conduct of Feasibility Study for the subject project:

"The feasibility Study for 238 MW Kalam-Asrit Hydropower Project on Swat River, District Swat carried out by the consultants for M/S KOEN is approved in accordance with KP Hydropower Policy 2016 and Associated Guidelines subsequent to NOCs from Environment Protection Agency (EPA) and Power Evacuation Consent from National Transmission & Dispatch Company Limited (NTDCL)."

2. Due to nature of data and resultant conclusion, Panel of Experts jointly and/or individually will not be responsible for reliability of data, contents and conclusions given in the feasibility study.

3. As the feasibility study has been carried out at the risk & cost of the sponsor, the approval of feasibility study shall not form basis of any claim for compensation from Govt. of KP / PEDO in future.

4. In accordance with the KP Hydropower Policy 2016, upon the approval of the feasibility study by the POE, you are requested to process the case for tariff determination with NEPRA within 60 days.

5. PEDO appreciates your efforts to complete the feasibility study and expect the same pace and spirit for negotiation and finalizing tariff with NEPRA.

Manager Renewable Energy
(Private Power)

Copy for information to:

1. Managing Director, NTDCL, Lahore.
2. Managing Director, PPIB, Islamabad.
3. CEO, CPPA-G, Islamabad.
4. Registrar, NEPRA, Islamabad.
5. PS to Secretary, E&P Department, Peshawar.
6. PS to CEO, PEDO, Peshawar.

Manager Renewable Energy
(Private Power)

P E D O

PAKHTUNKHWA ENERGY DEVELOPMENT ORGANIZATION
Government of Khyber Pakhtunkhwa Peshawar

PEDO House, 38/B-2, Phase-V, Hayatabad, Peshawar Tel. (+92-91) 9217246, Fax (+92-91) 9217003

No.2 48-49/PEDO/CEREPP/KA/FS
Dated: May 31, 2022

To

Mr. INHWAN OH,
General Manager,
Korea South-East Power Company Ltd,KOEN,
Plot 7-C, G-8 Markaz,
Islamabad, Pakistan

Subject. **APPROVAL OF FEASIBILITY STUDY FOR 238 MW KALAM – ASRIT HYDROPOWER PROJECT, LOCATED ON SWAT RIVER DISTRICT SWAT.**

I am directed to refer to your letter No. KOEN/KA/PEDO/00515/2022 dated May 17, 2022 on the subject noted above and to state that the 60 days period under clause # 04 of the feasibility study approval granted vide letter No. 64-70/PEDO/DRE/FS/KA dated April 06, 2022 may be read and considered as 90 days.

2. Furthermore, all other terms & conditions remains the same.

Director (Commercial & Tariff)
PEDO, Peshawar

Copy for information to:

- PS to CEO, PEDO, Peshawar.

Director (Commercial & Tariff)
PEDO, Peshawar

Correspondence related to Grid Integration Study

NATIONAL TRANSMISSION & DESPATCH CO. LTD (NTDC)

General Manager Power System Planning, NTDC

No. GMPSP/CETP/TRP-3041/6186-91 Dated: 26-09-2019

M/s Korea South-East Power Co.,Ltd.
1st Floor, 11 Square Plaza, MPCHS,
E-11/1, Islamabad-Pakistan
Phone # +9251 2100985, 2100986
Fax # +9251 2114159

Subject: **Data Permission Request for Grid Interconnection Assessment (GIA) Study of 212MW Kalam-Asrit Hydro Power Project in Swat, KPK, Pakistan.**

Reference: M/s KOEN Letter No. KOEN/BD/KPK/K-A/00324 dated 13-09-2019.

This office has received the request for data permission for the grid interconnection assessment study of 212 MW Kalam Asrit Hydro Power Project vide above referred letter. It is pointed out that the said project was assigned by Pakhtunkhwa Energy Development Organization (PEDO) with its capacity of 197 MW in the list of projects offered to private sector sponsors under KP Hydropower policy 2016.

Morover, it is stated that an integrated interconnection study for the power evacuation of all the HPPs in Khyber Pakhtunkhwa involving Dir, Chitral, Swat, Mansehra, Kohistan regions shall be carried out by a private consultant, which shall involve route/corridor surveys and relevant interconnection studies. This study shall jointly be conducted by PEDO and NTDC in association with other stake holders. After the completion of the said integrated study, the interconnection scheme of the subject Kalam Asrit Hydro Power Project and other HPPs in Khyber Pakhtunkhwa shall be determined. Consequently, it would not be appropriate to initiate study for individual projects.

This office is available for further deliberations in this regard.

(Engr. Salis Usman)
General Manager Power System Planning

Cc:

1. Chief Executive Officer, PESCO, PESCO House, Peshawar, KPK.
2. Chief Technical Officer (CTO), CPPA-G, 73-West Blue Area, Shaheen Plaza, Fazal-e-Haq Road, Islamabad.
3. General Manager (Hydel), PEDO, 38/B2, Phase V, Hayatabad, Peshawar.
4. P.S. to Managing Director NTDC, WAPDA House Lahore
5. M/s. ARCO Energy, 515, 5th Floor, Eden Tower, 82-E/1 Main Blvd, Gulberg III, Lahore..

- Master File

KOREA SOUTH-EAST POWER CO.

KOREA SOUTH-EAST POWER CO., LTD.
PAKISTAN BRANCH OFFICE
Plot # 7-C, G-8 Markaz, Islamabad-Pakistan.
Tel: +9251 8735923, Fax: +9251 8735924

Letter No. KOAK-633-2021 **Dated: 22nd October 2021**

Managing Director (MD),
National Transmission and Dispatch Company (NTDC),
Room No. 414, Wapda House,
Lahore

Subject: **Grid Interconnection Studies of 238 MW Kalam Asrit Hydropower Plant by Korea South-East Power Co., at River Swat, Khyber Pakhtunkhwa.**

Dear Sir,

Korea South-East Power Co. Ltd ("KOEN") is the premier state-owned generation company of South Korea having generation capacity of more than 10,000 MW Worldwide with an asset base of more than USD 10 billion.

Government of Khyber Pakhtunkhwa through PEDO issued the Letter of Intent (the "LOI") to KOEN for the development of 238 MW Asrit Kedam Hydropower Project located on River Swat in Khyber Pakhtunkhwa (the "Project") on 24 April 2018. Under the terms of LOI, the Feasibility study of the Project is progressing fast, and its approval is expected to be completed by mid of November 2021.

Following the approval of the Feasibility Study, KOEN intends to submit the application for the Generation License to NEPRA and for this purpose needs to conduct the Grid Interconnection Studies of the Project to fulfil the requirements of Generation License application. Following the issuance of Generation License KOEN shall submit the petition to NEPRA for the approval Feasibility Stage Tariff so that the project cost can be determined for the consideration and inclusion in next iteration of Indicative Generation Expansion Plan ("the IGCEP").

We have engaged M/s Power Planners International (PPI) as our consultant to perform the Grid Interconnection Studies of the Project. In this respect we need the data of the network in the vicinity of the proposed Project, existing and future, to perform this study. It would be convenient for NTDC and for us if G.M. Planning (Power), NTDC allows PPI to use the system data that is already available with them for performing similar studies.

In addition, we would require the following data to complete the studies.

1. Updated Indicative Generation Expansion Plan prepared by NTDC till the year 2030.

2. Transmission expansion plans involving NTDC's 500 kV and 220 kV network till 2030.

KOREA SOUTH-EAST POWER CO.

KOREA SOUTH-EAST POWER CO., LTD.
PAKISTAN BRANCH OFFICE
Plot # 7-C, G-8 Markaz, Islamabad-Pakistan.
Tel: +9251 8735923, Fax: +9251 8735924

3. Load forecasts of NTDC till 2030.

We look forward for your favorable response in this respect and would request to provide the necessary data as early as possible so that this important international investment can move forward smoothly.

With best regards,

Kim Kyungsik
Branch Manager

Copy to:

I. Managing Director, Private Power & Infrastructure Board (PPIB) Emigration Tower, G 8/1 G-8, Islamabad, Islamabad.

II. CEO, Pakhtunkhwa Energy Development Organization (PEDO) Plot# 38, Sect B-2, Phase-5 Hayatabad Peshawar.

III. Deputy Managing Director (DMD), Planning & Engineering,National Transmission and Dispatch Company (NTDC), Wapda House, Lahore.

IV. General Manager (Master Planning). National Transmission and Dispatch Company 4th Floor, PIA Building, Egerton Road, Lahore

V. Power Planners International 95 - H/2, Wapda Town, Lahore

KOREA SOUTH-EAST POWER CO.

KOREA SOUTH-EAST POWER CO., LTD.
PAKISTAN BRANCH OFFICE
Plot # 7-C, G-8 Markaz, Islamabad-Pakistan.
Tel: +9251 8735923, Fax: +9251 8735924

Letter No. KOAK- 659 **-2021** **Dated: 03rd November 2021**

Managing Director (MD),
National Transmission and Dispatch Company (NTDC),
Room No. 414, Wapda House,
Lahore

Subject: **Grid Interconnection Studies of 238 MW Kalam Asrit Hydropower Plant by Korea South-East Power Co., at River Swat, Khyber Pakhtunkhwa.**

Dear Sir,

Further to our letter dated 22nd October 2021, and our subsequent discussions, we would like to confirm that proposed Commercial Operation Date (COD) for Kalam-Asrit Hydropower Project (the "Project") is **31st March 2029.**

As mentioned previously that we have engaged M/s Power Planners International (PPI) as our consultant to perform the Grid Interconnection Studies of the Project. In this respect we need the data of the network in the vicinity of the proposed Project, existing and future, to perform this study. It would be convenient for NTDC and for us if G.M. Planning (Power), NTDC allows PPI to use the system data that is already available with our consultant for performing similar studies.

In addition, we would require the following data to complete the studies.

1. Updated Indicative Generation Expansion Plan prepared by NTDC till the year 2030.
2. Transmission expansion plans involving NTDC's 500 kV and 220 kV network till 2030.
3. Load forecasts of NTDC till 2030.

We look forward for your favorable response in this respect and would request to provide the necessary data as early as possible so that this important international investment can move forward smoothly.

With best regards,

Kim Kyungsik
Branch Manager

KOREA SOUTH-EAST POWER CO., LTD.
PAKISTAN BRANCH OFFICE
Plot # 7-C, G-8 Markaz, Islamabad-Pakistan.
Tel: +9251 8735923, Fax: +9251 8735924

Copy to:

I. Managing Director, Private Power & Infrastructure Board (PPIB) Emigration Tower, G 8/1 G-8, Islamabad, Islamabad.

II. CEO, Pakhtunkhwa Energy Development Organization (PEDO) Plot# 38, Sect B-2, Phase-5 Hayatabad Peshawar.

III. Deputy Managing Director (DMD), Planning & Engineering National Transmission and Dispatch Company (NTDC), Wapda House, Lahore.

IV. General Manager (Master Planning). National Transmission and Dispatch Company 4th Floor, PIA Building, Egerton Road, Lahore

V. Power Planners International 95 - H/2, Wapda Town, Lahore

NATIONAL TRANSMISSION & DESPATCH CO. LTD (NTDC)

General Manager (Power System Planning)

No. GMPSP/TRP-300/12281 – 86 Dated: 05-11-2021

Branch Manager,
Korean South-East Power Co. Ltd,
Plot # 7-C, G-8 Markaz,
Islamabad.
Tel: 051-8735923

Sub: Grid Interconnection Studies of 238 MW Kalam Asrit Hydropower Plant by Korea South-East Power Co., at River Swat, Khyber Pakhtunkhwa

Ref: M/s Korea South-East Power Co. Ltd office letter no: KOAK-659-2021 dated 03-11-2021.

This office has been requested vide above referred letter by M/s Korea South-East Power Co. Ltd (KOEN) for provision of system data to its selected study consultant, M/s Power Planners International (Pvt.) Ltd. (PPI) in order to conduct the grid interconnection/system impact study for 238 MW Kalam Asrit Hydro Power Plant (HPP).

It is stated in this regard, that the following data shall be provided by this office to M/s PPI:

1. Latest demand forecast of NTDC and Indicative Generation Capacity Expansion Plan (IGCEP), approved by NEPRA on 24-09-2021.
2. The electronic copies of the available base cases/grid system data in PSS/E software for the spot year of 2027 which also includes the incorporation of transmission plan upto that spot year. M/s PPI shall prepare the base cases for the subject study keeping in view of the timeline of the subject HPP and for some future scenarios. M/s PPI is required to have a meeting in this office on 10-11-2021 at 02:30 p.m. in this regard.
3. M/s PPI is suggested to conduct an integrated study for evacuation of power from the subject HPP in integration with other HPPs in the Swat Valley.

M/s PPI is allowed to use the above-mentioned system data/information for the grid interconnection/system impact study of 238 MW Kalam Asrit HPP. However, M/s PPI is advised not to use the system data/information for any other study nor should it be provided to any other company including the sponsor of the subject project without the prior permission of this office.

It is pertinent to mention that the subject 238 MW Kalam Asrit HPP is not included up to year 2030 in the IGCEP 2021 which was approved by NEPRA in September 2021. It is clarified that the project sponsor is conducting the said study at its own cost and risk, whereas, NTDC is giving data permission at this stage solely on the request of project sponsor to carry out the subject grid interconnection/system impact study. It is added that there could be some modification in the proposed interconnection scheme of the subject HPP in future due to change in timeline of the subject HPP or any other HPP in its vicinity or due to any other factor etc. and the study might have to be revised in this regard. Moreover, it should not be considered as any consent of NTDC

that the subject HPP shall definitely be selected in the next version of IGCEP. The subject HPP shall have to compete with other candidate power projects to become part of IGCEP in future as per least cost principle.

This office is available for further deliberations in this regard.

05/11/2021

General Manager (Power System Planning)

Distribution to:

i) Chief Executive Officer, PEDO, Peshawar.
ii) Deputy Managing Director (P&E) NTDC
iii) Chief Engineer (T/L Design) NTDC
iv) Chief Engineer (EHV-I) Islamabad, NTDC
v) M/s PPI, WAPDA Town, Lahore.
- Master File

KA POWER LIMITED

23rd Floor, Ufone Tower,
Jinnah Avenue, Blue Area,
Islamabad.
Tel: +92 51 2726703
Fax: +92 51 2726703

No. KA-PD/GIS-0001-2022

Dated: June 6, 2022

The General Manager (Master Planning),
National Transmission and Dispatch Company (NTDC),
4th Floor, PLA Tower, Egerton Road,
Lahore

Subject: **Grid Interconnection Studies of 238 MW Kalam Asrit Hydropower Project by Korea South East Power Company Limited (KOEN) near Kalam Town, Swat District, Khyber Pakhtunkhwa**

Reference: **NTDC Data Permission Letter: GMPSP/TRP-300/4281-86 dated 05-11-2021**

Dear Sir,

Please find herewith for your review the Draft Report of Grid Interconnection Studies of 238 MW Kalam-Asrit Hydropower Project by Korea South-East Power Co. Ltd. (KOEN) near Kalam, Swat, Khyber Pakhtunkhwa.

We take this opportunity to inform you that KOEN has incorporated a new special purpose company (SPC) for subject Project with Securities and Exchange Commission of Pakistan namely **"KA Power Limited"** on April 8, 2022, therefore, proceeding further through said SPC.

The Report includes all the necessary studies required for the feasibility of interconnection with the main grid. This comprises of;

1. Load flow analysis;
2. Short circuit analysis; and
3. Dynamic and Transient stability analysis

We request you to please expedite the review process as we are moving fast to achieve all the targets of Financial Close to start the project ASAP.

Thanks and best regards.

Oh Inhwan,
Chief Executive Officer

Cc: Power Planners International, 95 – H/2, Wapda Town, Lahore

KA POWER
LIMITED

23rd Floor, Ufone Tower,
Jinnah Avenue, Blue Area,
Islamabad.
Tel: +92 51 2726703
Fax: +92 51 2726703

PROJECT SCHEDULE

ANNEX-P

238 MW KALAM ASRIT HYDROPOWER PROJECT

KA Power Limited
Project Schedule

1	Execution of MOU with KPK Government	15-May-17
2	Issuance of Notice to Proceed by KPK	Oct-17
3	Submission of Qualification Documents	Dec-17
4	Submission of Bank Guarantee for LOI	Mar-18
5	Issuance of LOI	Apr-18
6	Appointment of Consultants for Feasibility Study	Dec-18
7	Expression of Intrest from IFC and ADB	Dec-19
8	Submission of Feasibility	Apr-20
9	Application for Govt. of Korea (KDI) approval	Jun-20
10	KDI & Ministry of Industry, Korea approved Project	Oct-21
11	KOEN Board of Directors approve the Project	Dec-21
12	Approval of Feasibility by POE/PEDO	Apr-22
13	Establishment of SPC "KA Power Ltd"	Apr-22
14	KOEN transferred Equity (USD 3m)	May-22
15	Interconnection Study submission to NTDC	Jun-22
16	Submission of FS Tariff Petition to NEPRA	Jul-22
17	Feasibility Stage Tariff Approval from NEPRA	Dec-22
18	Issuance of Tripartite LOS	Mar-23
19	Completion EPC Bidding Process & Execution of EPC Contract	Apr-23
20	Completion of Financing Arrangements (Finance & Security Documents)	Jun-23
21	Completion of Land Acquisition Process	Sep-23
22	EPC Stage Tariff Approval	Dec-23
23	Execution of Concession Documents	Apr-24
24	Completion of CPs, Financial Closing & Construction Start	Jun-24
25	construction period	Jun-29
26	COD	Jul-29

KA POWER LIMITED

23rd Floor, Ufone Tower,
Jinnah Avenue, Blue Area,
Islamabad.
Tel: +92 51 2726703
Fax: +92 51 2726703

TRAINING AND DEVELOPMENT

ANNEX-Q

238 MW KALAM ASRIT HYDROPOWER PROJECT

238MW KALAM ASRIT HYDROPOWER PROJECT

KA POWER LIMITED

TRAINING AND DEVELOPMENT

KA Power Limited (the Company) being subsidiary of Korea South East Power Co. Ltd. (KOEN) is committed to achieve excellence in people's development in order to maintain and enhance its position as a responsible organization. The Company aims to create a culture of partnership with its employees and community through providing opportunities to learn and grow together. The Company also recognizes the need to develop its employees so that they are fully equipped to deliver the Company's present and future business objectives.

EMPLOYEES TRAINING AND DEVELOPMENT DURING CONSTRUCTION

During the construction phase, the Company shall develop and implement on Site a "hands-on" training program for the its HSE/technical/engineering personnel. The objective of the program shall be to train pre-qualified personnel in the overall health, safety, operation and troubleshooting of equipment & systems contained in the Project. The training program shall be conducted in English/Urdu. The training program includes overall construction, operation and maintenance training program conducted by the EPC and O&M Contractors. The training program shall be implemented as necessary to allow for the construction and operations of the Complex. The Company shall coordinate with the contractors and equipment suppliers to get the relevant information and documents including the arrangement of appropriate trainers from the relevant contractor/suppliers.

- The project personnel will be trained to handle hazardous wastes as per safe practices and trainings on health, safety and environmental protection measures.
- Training to work force will be provided on social and cultural aspects, ethics and advising minimal interaction with communities.
- Train project workers in use of protective equipment.
- Training will on proper handling and disposal of liquid wastes to avoid accidental spills
- Training of staff in HSE, social and security management
- Provision of awareness training to staff and contractors on Disposal of waste in River
- Periodic trainings of the project staff will be conducted on biodiversity conservation issues to sensitize them about the biodiversity and protected areas.
- onsite job trainings can be provided for unskilled labor to developed skill labor.

- Proponent will deliver induction training to provide guidance on requirements for culturally appropriate behaviors, and an overview of the risks to migrant staff and workers.

Awareness training to staff will be provided on:

- Prevention of injury of animals
- Identification of likely species found on site
- Identifications of animal hazards (such as venomous snakes).
- What to do if dangerous animals are encountered.
- Report kills of large mammals and other migratory waterfowls particularly designated

COMMUNITY TRAINING AND DEVELOPMENT

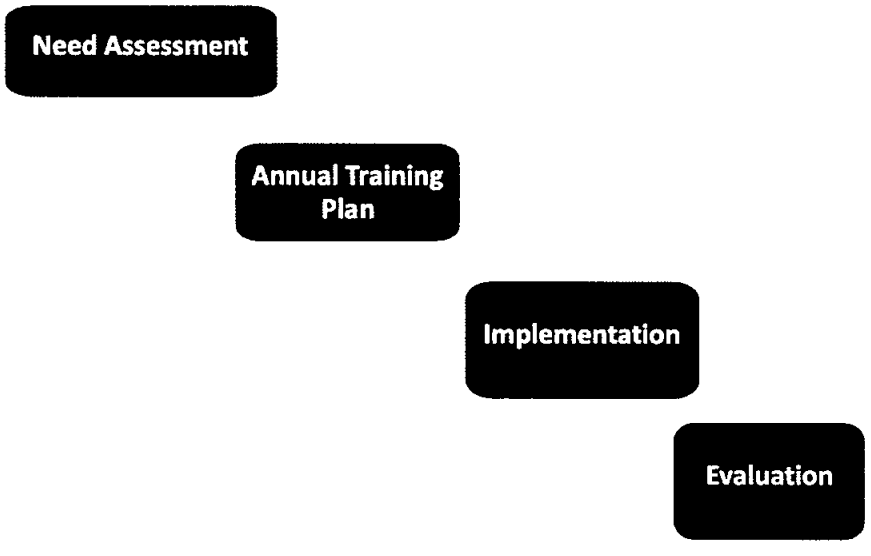
The Company recognizes its responsibility to contribute in the development of the local community through trainings and other development activities. the Company intends to enhance the capabilities and development of local people through:

- Promotion and attaining sustainability in the tourism sector by planning and devising a tourism management plan to facilitate the rising tourism in the area with initiatives such as planning and selection of tourist sites around hydropower project, provision of land to affectees near tourist hot spots within project premises for improving their domestic economics.
- Vocational centers should be opened for women to promote women skills in handicraft and empower then economically which will enhance the tourism area.
- Improve the current educational infrastructure in partnership with NGOs within project premises so students get educated and combat the challenges of 21st century.
- Medical camps shall be initiated to give relief to the surrounding villages of proposed project site.
- Mostly women are active and working in agriculture and livestock activities, so the training and development activities shall be considered in the area of the cultural norms and issues related to gender.
- Employment provision for the locals to eradicate poverty.

- Skill trainings for the women in their specific fields like Traditional Birth Attendants and Health.
- Improving the waste management settings in collaboration with the local district government.
- Vocation training / educations needs to be provided to local women, so that they could support their families by supplementing their household income.
- Educational visits shall be arranged for students of locals schools/Colleges/Universities
- Comprehensive internship programs shall be introduced for the students.

TRAINING AND DEVELOPMENT DURING OPERATIONS PHASE

During Operations phase of the Complex, the Company shall design and utilize processes to analyze training needs.



A. Training Need Assessment

Training Need Assessment process may include but not limited to the following:

- Direct interview of employee(s);
- Questionnaires to all employees designed to cover major training need areas;
- Group meetings structured to reveal group or other training needs;

- Internal evaluation of persistent department problems;
- Analysis of required skills and knowledge of job functions compared with analysis of the skill and knowledge of employee(s) currently holding such jobs;
- Employee performance reports;

B. Annual Training Plan

On the basis of Training Need Assessment, the Company shall make annual training plan in consultation with the international/national consultants in order to finalize Training calendar covering the employee's professional growth.

C. Implementation

While implementing trainings, the Company is committed to a policy of equality of opportunity to all. It aims to ensure that no employee is less fairly treated because of sex, marital status, race (including color, nationality or ethnic origins) disability, religion or any other conditions not justified in law.

D. Evaluation

Following the completion of the training, education or any other learning activity an evaluation process shall be conducted through trainees feedback to enhance the planning and structure of training and development process of the Company.

Executive Summary

Introduction

Kalam Asrit hydropower project (KAHPP) is located in Swat River in Khyber Pakhtunkhwa (KPK). Korea South-East Power Co. Ltd. (KOEN), following successful development of 102 MW Gulpur Hydropower Project in AJ&K, offered and initiated 100% foreign direct investment of around US$ 1 Billion in KPK Province including the subject project and executed a Memorandum of Understanding on 15 May 2017 with KPK Government. Under the provisions of KPK Hydropower Policy 2016 and Guidelines issued thereunder, KOEN submitted Preliminary Proposal on May 24, 2017 and in response KPK through Pakhtunkhwa Energy Development Organization (PEDO) issued a Notice to Proceed to KOEN on 5 October 2017. Then, Saman Corporation completed the preliminary feasibility study in January 2018. KOEN submitted the detailed proposal against the Qualification Documents issued by PEDO under the provisions of KPK Hydropower Policy, 2016. Following detailed scrutiny of Proposal, KOEN was declared as successful Applicant for the development of 197 MW Kalam-Asrit Hydropower Project by (PEDO) through a no objection certificate (NOC) letter dated March 26, 2018. Following NOC, Bank guarantee was submitted and PEDO issued a Letter of Interest for the project on April 24, 2018. Tendering on the feasibility study was found by Saman in July 2018, and KOEN awarded the project to Saman in September 2018.

Saman initiated the feasibility study and submitted the commencement report in September 2018 to KOEN. The meeting with the Panel of Expert (POE) was held in October 2018 for the first time, and Saman's designers visited the field in November 2018. Saman awarded the contract for the field investigations to Engineering Imaginative Association (EIA) in February 2019.

The project further progressed after the field investigation started. The second POE meeting was held in April 2019. Saman entered into Technical advisory contract with Mott Macdonalds, Singapore in May 2019. Saman's designers visited the project area and had an informal POE meeting in May 2019 for further discussions on the project implementation. 3rd POE meeting took place in July, 2019, and 4th POE meeting was held in November 2019 for more discussion on the final layout.

The optimization of the project main components has enabled the minimum cost and maximum benefit. KPMG, Samjong has provided the economic and financial analyses. The objective of the feasibility study is to provide decision on project development on further stage and data to Ministry of Economy and Finance (MOEF), as well as submitting FS report to Pakistan's government agencies (PEDO, PPIB, etc.).

Detailed scrutiny of the FS Report lead to fifth POE Meeting on September 30, 2021 followed by a Site Visit on October 28, 2021. Number of observations were made on the FS Report in addition to cost optimization of the Project. All observations were addressed and last POE Meeting was held on December 22, 2021. Following redressal of all comments raised by POE Members and optimizing cost and levelized tariff, PEDO issued an approval letter of FS Report on April 6, 2022.

Following list and sequencing summarizes the work scopes provided by the client, which enhanced the efficiency of the run-of river power plant. The feasibility study has carried out;

1) Field investigations
2) Evaluation of investigation results and design of optimal layout
3) Environmental impact assessment (Investigation and evaluation of current environmental / social status)
4) Planning for project implementation and construction
5) Calculating project costs
6) Preparing feasibility study report
7) Incorporating international consultant's review on the design optimization.

The salient features of major structures are as following.

Table 1 : Salient Features of Project

Item		Unit	Pre-F/S, 2018	F/S, 2022	Remark
Location	River		Swat River	Swat River	
	Administrative District		Swat District	Swat District	
	Intake Area		Kalam Village	Kalam Village	

Item		Unit	Pre-F/S, 2018	F/S, 2022	Remark
	Powerhouse Area		Asrit Village	Asrit Village	
Hydrology	Catchment Area	㎢	2,030	2,030	Weir Site
	Annual Average Run-off	m³/s	88.4	88.4	Weir Site
Power Generation & Energy Estimation	Plant Discharge	m³/s	120.0	130.0	
	Gross Head	m	210.0	222.1	
	Head Loss	m	12.6	18.1	
	Plant Gross Capacity	MW	212.0(4 Units)	238 (4 Units) 68.4 MW x 3 Units 33.0 MW x 1 Unit	(after turbine, generator & transformer efficiencies)
	Annual Average Power Generation	GWh /year	835.8	945.8	
	Plant factor	%	45.0	45.37	
Diversion Tunnel	Diversion Discharge	m³/s	390.5	400.4	2 Year return period
	Size	m	D-shaped, 7.6 x 6.6 x 3.8	D-shaped, 7.5x 7.5x3.75	B x H x R
	Length	m	402.5	484.0	Excluding portal of Inlet & outlet
Upstream Cofferdam	Type		Rockfill Dam With secant pile	Concrete Dam with secant pile	
	Dam Crest Level	EL. m	1,960	1,944 (1,940)	During Construction (During Operation)
Downstream Cofferdam	Type		Rockfill Dam with secant pile	Rockfill Dam	
	Dam Crest Level	EL. m	1,940	1,935	
Weir & Spillway	Type		CGD	CGD	Concrete Gravity Dam
	Design Discharge	m³/s	749.9 (200yr)	1,258.3 (1,000yr)	
	Safety Check Discharge	m³/s	1,284.9	1948.0	10,000yr including GLOF
	Weir Crest Level	EL. m	1,956.0	1,947.0	
	Spillway Crest Level	EL. m	1,949.0	1,939.0	
	Length	m	77.3	90.3	
	Height	m	17.3	23.0	
	Spillway Gate	m	10.0 x 6.0 x 3	10.0 x 6.0 x 3	B x H x Nos.
	Sluiceway Gate	m	5.0 x 4.5 x 2	5.0 x 4.5 x 2	B x H x Nos.
Desander Basin	Type		Natural Type Desander	Design Particle 0.2 mm	
	Width	m	11.5 5 chambers (1 spare)	Var.	Natural Desander Volume : 199,104 m³
	Height	m	15.5	12	
	Length	m	130.0	230	
Intake	Type		Bellmouth circular	Bellmouth circular	Box shape
	Invert Elevation	EL. m	1,935.7	1930.0	
	Inlet Diameter	m	7.4	7.4	Trash-rack W 8.0 × H 10.9 for FS
	Length	m	15.0	29.2	

Item		Unit	Pre-F/S, 2018	F/S, 2022	Remark
Headrace Tunnel	Type		Circular	Circular	Excavation : Modified Horse Shoe
	Diameter	m	7.4	7.4	
	Length	m	10,981	11,589.6	
Vertical Pressure Shaft	Type		Circular	Circular	
	Diameter	m	7.4 (Con'c)	7.4 (Con'c)	
	Height	m	174.0	125.9	
Surge Shaft	Type		Restricted Orifice	Restricted Orifice	
	Size	m	D 15.0	D18.0	
	Height	m	68.0	81 (incl. Orifice)	
	Orifice size	m	D 2.5	D5.0	
	Max. up-surging water level	EL. m	1,978.0	1,969.6	
	Min. down-surging water level	EL. m	1,928.0	1,903.8	
Penstock (Manifold)	Type		Circular Steel lined	Circular Steel lined	Excavation : Modified Horse Shoe
	Diameter	m	5.6 ~ 2.2	5.6 ~ 2.1	
	Length	m	312 (straight distance) D 5.6, L 277.1, D 4.7, L 5.6, D 3.7, L 15.2, D 3.0, L 82.4, D 2.2, L 27.9	339.5 (straight distance) D5.6, L 296.9, D3.0, L 29.06, D2.1, L 10.45	
Powerhouse	Type		Surface	Surface	
	Size	m	30.5 x 72.0 x 32.2	41.7 x 100.65 x 50.9	W x L x H
	Turbine Type		Francis	Francis	
	Plant Gross Capacity	MW	212	238 MW 68.4 MW x 3 Units 33.0 MW x 1 Unit	(after turbine, generator & transformer efficiencies)
	Turbine-Center Level	EL. m	1,738.0	1,713.7	
Construction Period		month	60.0	60.0	Including 8 month of testing period
Project Cost	Cost level		Dec. 2017 (1USD=Pak.Rs 105.39)	Dec, 2021 (1USD=Pak.Rs 178.5)	
	EPC cost	Million USD	399.6	36596	
	Total Cost	Million USD	533.5	489.33	

Topographic Survey

Following table presents the tasks carried out for detailed geodetic, bathymetric and topographic as well as photogrammetric survey for Kalam Asrit hydropower project.

Table 2 : Scope of Work for Topographic Survey

Item for Investigations	Location	Quantities	Remark
Survey of benchmark	Overall project area Weir site (Up/Down: 2 point) Powerhouse site (UP/Down: 2 point) Surge shaft site (1 point) Headrace tunnel adit area (1 point)	6 point	
Terrestrial topographic survey of the area of the major structure	Weir, Desander and Headrace channel area	Weir axis: 0.5 km^2	Scale 1:1,000 (1m contour)
	Power station area	0.2 km^2	Scale 1:1,000 (1m contour)
	Surge shaft and access roads	0.5 km^2	Scale 1:1,000 (1m contour)
	Whole project area (HD satellite image)	26.0 km^2	Scale 1:5,000 (5m contour)
Terrestrial topographic survey of River cross sections	From the junction point of the Gabral and Ushu River to 1 km downstream of weir site including future resettlement area	4.24 km	Scale 1:1,000 (100m interval)
	From 1 km downstream of weir site to 1km upstream of tailrace channel	9.84 km	Scale 1:1,000 (300m interval)
	From 1 km upstream of tailrace channel to 1 km downstream of tailrace channel	2.0 km	Scale 1:1,000 (100m interval)
Analysis of survey results & preparation of survey report		1 set	Word and Cad files (including X, Y, Z coordinates)

Geological and Geotechnical Investigation

Regional Geology

A composite regional geological of the project area was produced after digitization of these maps and the field observations. This map has been provided as Regional Geological Map of the Project. The variation in orientation of the numbered lineaments was determined for onward plotting their trends. The details of the lineament also including the potential fault zones have been investigated.

This a composite regional geological of the project area was produced after digitization of these maps and the field observations. This map has been provided orientation or directional analysis of the geologic lineaments divulged that the dominant orientation of the extracted geologic lineaments is NE-SW and NW-SE. In the light of lineament study, it is concluded that there is no major disturbance in the project area.

Project Area Geology

At the weir foundation area is covered with the river bed material comprising sandy gravel, cobbles and boulders derived from mostly from igneous rocks lying in catchment area of Swat River. At the weir and coffer dams' sites, mostly material is gravel and cobble sized with occasional boulders in sandy gravelly matrix which is highly permeable. The thickness of the overburden material seems deep (>30m) corresponding to the valley width in this area. The river bed material is loose at top and is likely to be dense to very dense at greater depth due to the overlying load. Provision of grout curtain or blanket or cut-off wall will be helpful in controlling the seepage.

At the headrace tunnel, the rock outcrop is exposed at the tunnel intake portal (0+000-0+070) but, as per surface geology, it is underlain by glaciofluvial deposits from 0+070 to 2+000. These deposits make a terrace along the right bank of the Swat River. From 2+500 to 3+150, the proposed tunnel passes through meta-sedimentary rock of Shou Quartzite which comprises mainly quartzite. The rock is medium strong to strong having foliation same as that of the diorite. From 3+150 to 11+000, the tunnel is again in diorite and gabbro of Kalam Quartz Diorite. These rock units exhibit moderately high to very high strength and are massive to foliated. Along the tunnel route, of rock mass was undertaken to have an assessment of rock mass classification along the proposed tunnel route. The rock mass classification was performed based on RMR and Q value.

At the powerhouse area, mostly the powerhouse area is occupied by the unconsolidated deposits that are believed to be slope wash material extending upslope to the right bank rock outcrops. This material comprises angular to subangular rock fragments from gravel to boulders sized of diorite/ gabbro embedded in fine matrix. Through the invested map, the rock has been interpreted to be at 20-30m depth at the river valley and towards hill side. From the interpreted geology, it is inferred that the rock mass is good massive to foliated under the powerhouse site.

Geotechnical Investigations

- Site Investigation and Geophysical survey plan

Site investigations including the borehole investigations and geophysical explorations are carried out to confirm the depth of bedrock and to check field properties. Laboratory tests and field tests are carried out to estimate the material properties

12 Boreholes(8 for weir site, 4 for P/H), Electrical Resistivity Surveys and Seismic Refraction Surveys are investigated to check ground profiles directly or indirectly.

- Results on site Investigation.

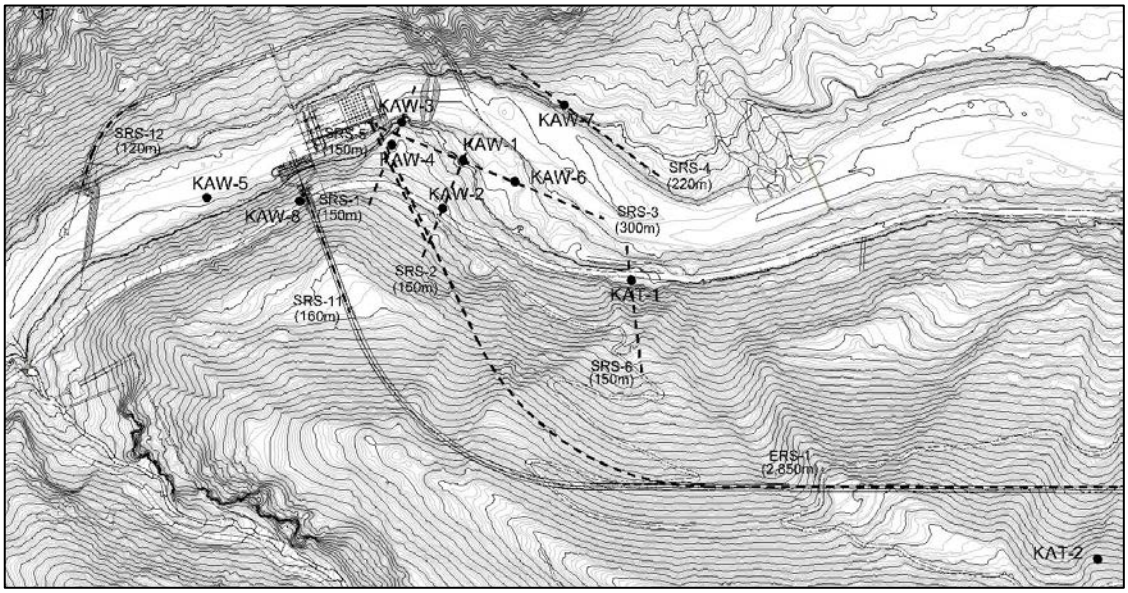


Figure 1 : Geotechnical investigation plan at Weir site

At the weir site, Total 8 boreholes are drilled to check whether the weir axis is proper or not. One borehole [KAW-05] of length 33m is drilled at location of upstream cofferdam and one [KAW-06] may evaluate for downstream cofferdam location. In 5 boreholes, bed rock could not encounter up-to drilled depth. The borehole of final weir axis [KAW-08, KAW-09] are located on exposed bed-rock. Due to unavailability of bed-rock and continuous borehole collapsing, only permeability tests and Standard Penetration Tests could be performed.

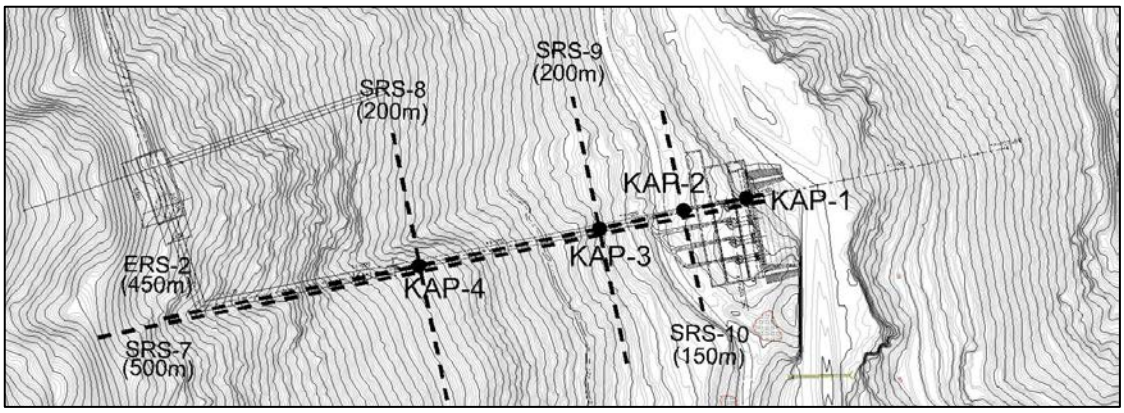


Figure 2 : Geotechnical investigation plan at powerhouse area

At the Power House site,4 boreholes are investigated at Power House site. One is for

the Tailrace channel, another two is for powerhouse structure and the other is for Surge Shaft Access Road. Bedrock encountered at all drilled boreholes. After site investigation, it is suitable for the P/H structure. Lugeon Tests are performed in boreholes KAP-02, KAP-03 & KAP-04 in limited quantities, as grouting of boreholes remained intermittent due to continuous caving issue. Good-man Jack test performed in boreholes KAP-03 & KAP-04, and pressure meter test performed in borehole KAP-02.

Disposal area and construction materials sources survey

Disposal area for the rock mucks produced from excavations of main structures such as weir, headrace tunnel and powerhouse will be situated at the left & right bank with large space. During the site survey, numerous potential disposal areas were confirmed. However, it is judged that existing access road can be utilized, so it is necessary to ensure the available disposal areas of the right bank with favorable accessibility.

It was reported that the sands from Kalam show strong potential for alkali silica reaction with ordinary Portland cement. However, results of other tests performed in some HPP, F/S projects was different. Due to the different results, the sands must be reconfirmed strictly. It is possible to supply the fine aggregates from the low hill that is composed of coarse sand and gravel. The coarse aggregates collected from the riverbed are crushed and screened using the C/P facilities for the improvement and repair work of the access road(N-95), it is easy to ensure the coarse aggregates in the riverbed.

Seismicity of Project Area

Earthquake Record

The spatial distribution of seismic events recorded in the project region. The distribution of observed seismicity on the seismicity map clearly shows that the project is located in a region of high seismicity. The epicenters of three well-studied earthquakes of magnitude 5.9 or above have been recorded in Kohistan island arc east of the Project area. While the Patan earthquake (28.12.1974) is located close to the surface expression of the MMT, the Hamran earthquake of 3.9.1972 and Darel earthquake of 12.9.1981 occurred within the Kohistan Island Arc, east of the Project site. This shows that active tectonic features are present within or below the Kohistan Island Arc in which the project area is located.

Seismic Hazard Analysis

In probabilistic seismic hazard assessment (PSHA), the seismic activity of seismic source (line or area) is specified by a recurrence relationship, defining the cumulative number of events per year versus the magnitude. Distribution of earthquake is assumed to be uniform within the source zone and independent of time. Each seismic source zone is split into elementary zones at a certain distance from the site. Integration is carried out within each zone by summing the effects of the various elementary source zones taking into account the attenuation effect with distance. Total hazard is finally obtained by adding the influence of various sources. The results are expressed in terms of a ground motion parameter associated with return period (return period is the inverse of the annual frequency of exceedance of a given level of ground motion).

In the deterministic procedure, critical seismogenic sources (active or potentially active faults) that represent a threat to the Project are identified and a maximum magnitude is assigned to each of these faults. The capability of the faults is ascertained through observation of historical and instrumental seismic data and geological criteria. The peak horizontal ground acceleration at the site caused by the earthquake of maximum magnitude occurring at the closest distance to fault was then calculated by using the latest attenuation relationships developed by various researchers from worldwide

Selection of Seismic Design Parameters

Design seismic parameters are selected on the basis of the results provided by probabilistic and deterministic approaches, and in compliance with the recommendations of ICOLD Guidelines (Revised 2010).

Based on results of the deterministic analysis, the maximum value of peak horizontal ground acceleration (PGA) obtained at weir site associated with MCE along the fault at closest distance from weir site is of the order of 0.59g (50-percentile). The OBE accelerations are selected from the results of the probabilistic analysis which are presented in below Figure in terms of annual frequency of exceedance of different levels of ground motion for weir site. For all project structures, OBE is recommended to be taken corresponding to 50% probability of exceedance in 100-year project life (i.e. a return period of 145 years) for which PGA value is 0.21g.

For the design of all other appurtenant structures of the project including tunnel and

powerhouse structure, ICOLD recommends to use ground motion having 475 year return period which is termed DBE accelerations (Weiland, 2011). The recommended ground motion for DBE is therefore 0.32g (for very dense gravelly soil foundation condition with Vs30 equal to 600 m/sec).

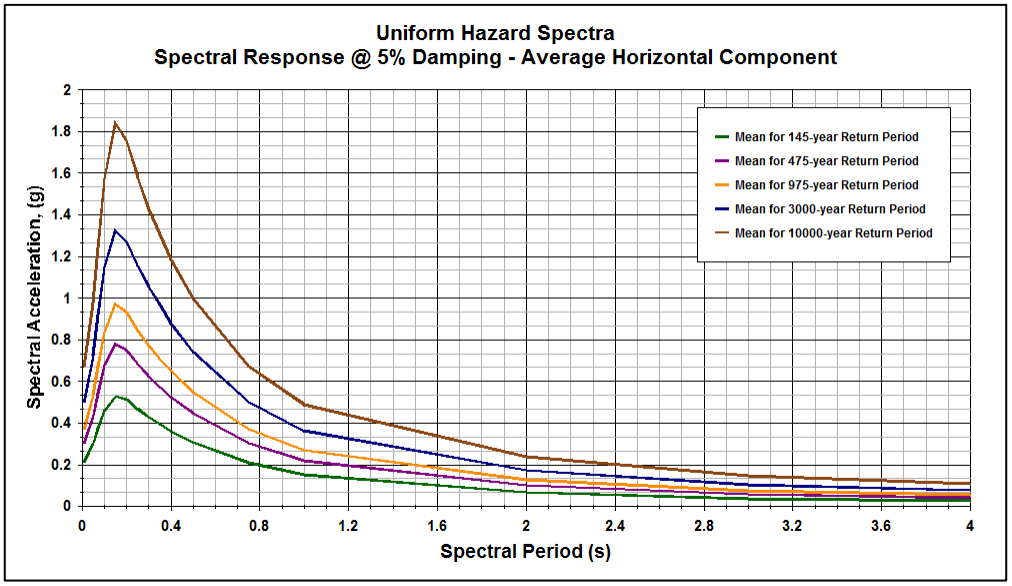


Figure 3 : Uniform Hazard Spectra

Hydrologic Analysis

Flow data extension

In order to check the reliability of the past flow data from 1961 to 2006, flow data at Chakdara gauging station (1961 ~ 20219) and 2 new gauging stations (Apr 2019 ~ Oct 2021), named as Pashmal and Minkial are collected and used for hydrological analysis.

Table 3 : Comparison between Flow Data Estimated by Catchment Area Method and Observed Flow Data at Kalam Gauging Station(2007~2020)

Station	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Remark
Chakdara	117.1	138.3	202.3	290.4	343.5	431.8	409.3	321.5	209.4	155.2	132.3	114.6	238.8	2007~2019 Observed
Kalam	41.0	48.4	70.7	101.6	120.1	151.0	143.1	112.4	73.2	54.3	46.3	40.1	83.5	Estimated by Catchment Area Method
	16.3	15.0	18.5	51.9	143.7	272.7	279.6	182.6	87.4	38.7	24.9	19.3	95.9	1961~2006 Observed
Pashmal Mankiyal	16.2	13.4	19.2	45.0	121.4	235.2	229.1	170.5	160.0	58.5	43.6	34.4	95.6	Average Flow 2020
Variation	-152%	-261%	-269%	-125%	1%	36%	38%	34%	54%	7%	-6%	-17%	13%	Kalam
	0%	-12%	3%	-15%	-18%	-16%	-22%	-7%	45%	34%	43%	44%	0%	Pashmal & Mankiyal

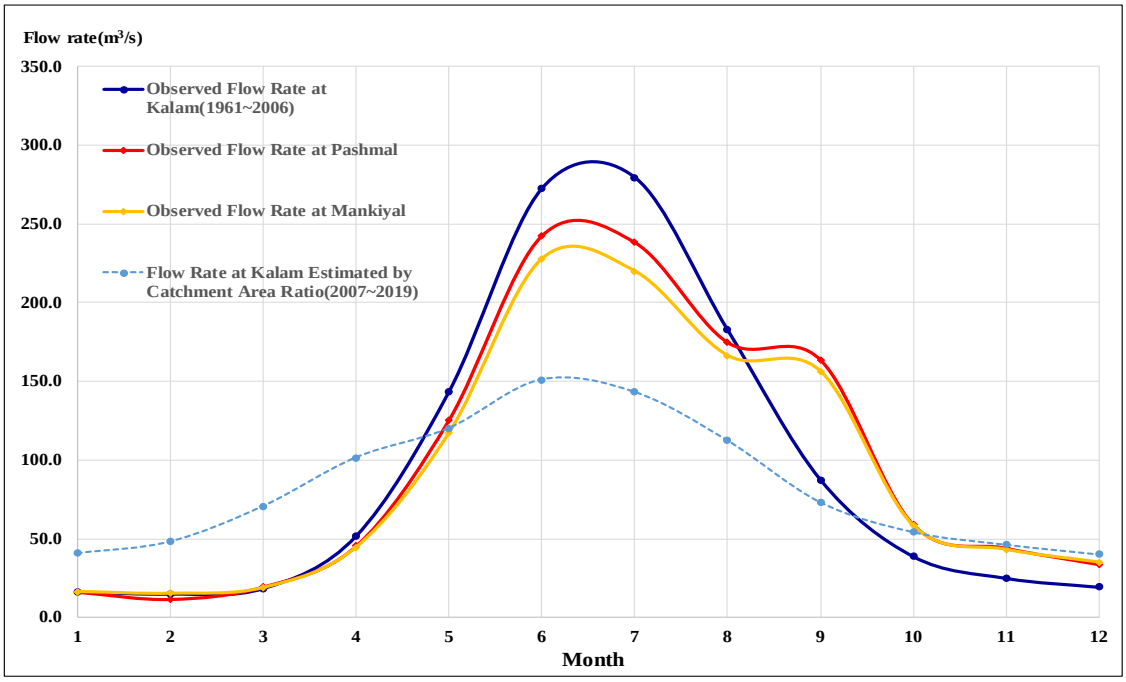


Figure 4 : Monthly Flow Rate at Chakdara and Kalam, and Estimated Flow Rate at Kalam(2007~2020)

As shown in Table 3, the past flow data (1961 ~ 2006) is closer to the current flow rate observed at Pashmal and Mankiyal than of the estimated flow rate using the flow rate at Chakdara gauging station. It is noted that the application of the past flow data for energy generation model is more reasonable than that of the flow data extension by catchment area ratio method.

Flow duration analysis

The study has drawn the flow duration curve using the daily river flow data from 1961 to 2006 at the weir site as following.

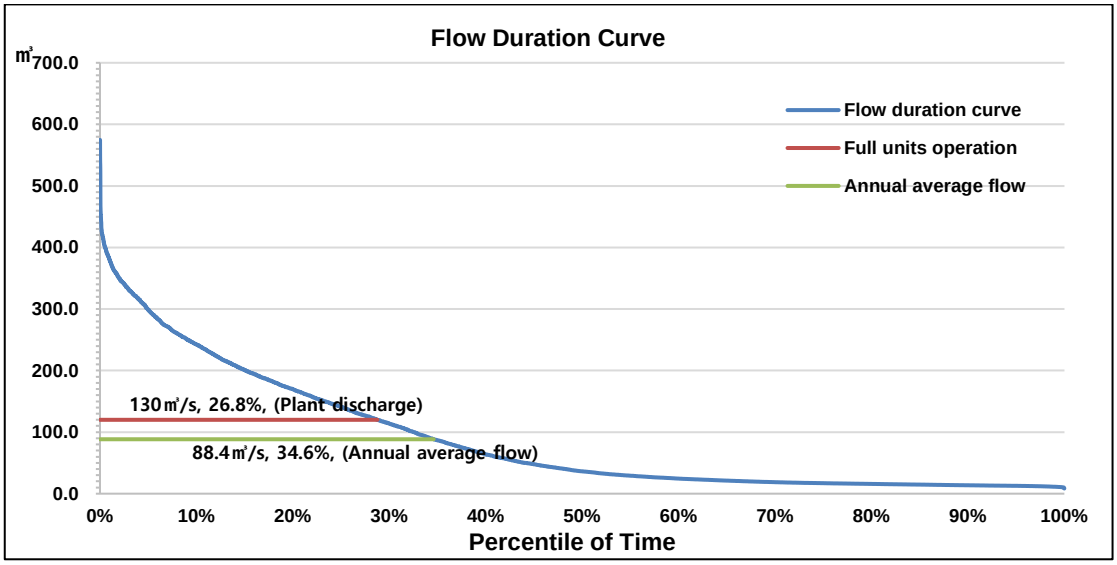


Figure 5 : Flow Duration Curve at the Weir Site

The percentile of the plant discharge, 130 m^3/s and annual average flow, 88.4 m^3/s are 26.8% and 34.6 % respectively. The annual average flow at the weir site is low side, and it is expected that large amount of spillage occurs during flood season.

Table 4 : Percentile of Time at the Weir Site

Percentile of Time (%)	10	50	90	Average
Flow duration curve (m^3/s), (1961~ 2006)	245	46.8	15.2	88.4

Minimum release for ecological discharge

The study adopts the minimum release for ecological flow for 3 m^3/sec of river flow. The following table shows the monthly minimum release for ecological flow.

Table 5 : Estimated Ecological Flow at the Weir Site

Flows	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Flow (m^3/s)	15.4	14.1	17.8	49.7	135.6	250.2	256.4	167.7	79.8	35.6	22.9	17.9
Eco. Flow (m^3/s)	3.0	3.0	3.0	3.0	3.0 with Surplus spill				3.0	3.0	3.0	3.0

Sediment Analysis

The sediment transport at the weir site is estimated with the monthly sediment

concentration and the average flow, 88.4 m³/s at the weir site.

Table 6 : Monthly Average Discharge (m³/s)

Month	Kalam	Weir
Jan	15.3	15.4
Feb	14.0	14.1
Mar	17.7	17.8
Apr	49.4	49.7
May	135.0	135.6
Jun	249.0	250.2
Jul	255.1	256.4
Aug	166.9	167.7
Sep	79.4	79.8
Oct	35.5	35.6
Nov	22.8	22.9
Dec	17.9	17.9
Annual	88.0	88.4

Table 7 shows the estimated total amount of the suspended sediment, and bedload takes 20 % of the suspended sediment amount considering mountainous area.

Table 7 : Monthly Sediment Transport at Weir Site

Month	Suspended (Ton)	Bedload (Ton)	Total Sediment Transport (Ton)
Jan	2,988.4	597.7	3,586.1
Feb	2,803.8	560.8	3,364.6
Mar	3,815.3	763.1	4,578.4
Apr	13,270.3	2,654.1	15,924.4
May	36,135.6	7,227.1	43,362.7
Jun	74,643.0	14,928.6	89,571.6
Jul	123,604.2	24,720.8	148,325.0
Aug	59,503.6	11,900.7	71,404.4
Sep	14,778.8	2,955.8	17,734.5
Oct	9,898.6	1,979.7	11,878.3
Nov	2,802.7	560.5	3,363.3
Dec	2,943.2	588.6	3,531.9
Total	**347,187.4**	**69,437.5**	**416,624.9**

The average annual suspended sediment yield is estimated at 0.35 million metric tons, corresponding to a specific yield of approximately 172 t/km^2. It should be noted that the Swat River carries a small quantity of suspended sediment when compared to other

rivers in Pakistan. Results also indicate that more than 88.9 % of the solid flow occur during the monsoon months (May to September).

Design Flood

The estimated floods by the frequency analysis and GLOFs study, are as shown in Table 8. The maximum flood occurs in summer, and it is expected that the possibility of glacier lake outburst is high. It is highly recommended to consider the estimated GLOF, 249.59 m^3/s for safety check on weir overtopping.

Table 8 : Design Floods Estimated by Frequency Analysis and GLOFs at the Weir site

Return Period Years	Frequency Analysis (m^3/s)	GLOFs (m^3/s)	Design Flood (m^3/s)
100	901.4	-	901.4
200	1001.2	-	1001.2
1,000	1258.3	-	1258.3
10,000	1698.5	249.59	**1,948** for weir safety check

Optimal Project Layout

For the project layout of Kalam Asrit HPP, total 9 project alternatives were compared considering the weir location in Section 7.3 and powerhouse location (Type) in Section 7.4. Alt P/H-3 of underground powerhouse was excluded in the project alternative due to excessive construction cost.

- Alt Project Layout-1 : Alt Weir Site-1 + Alt P/H Location-1 (Pre F/S)
- Alt Project Layout-2 : Alt Weir Site-2 + Alt P/H Location-2
- Alt Project Layout-3 : Alt Weir Site-3 + Alt P/H Location-2
- Alt Project Layout-4 : Alt Weir Site-4 + Alt P/H Location-2

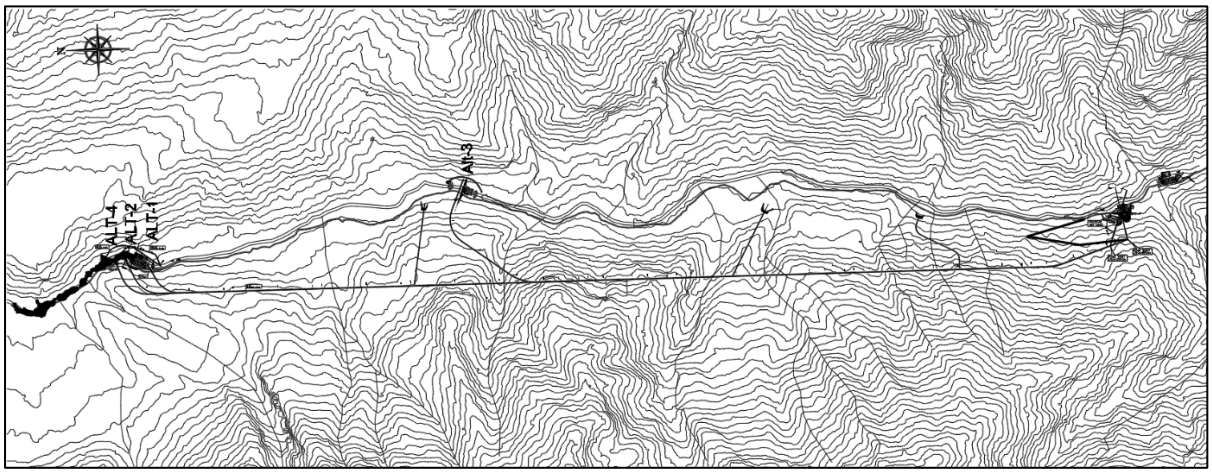


Figure 6 : Layouts of Alternatives

Pre-F/S adopted Alt Project Layout-1 and it uses the large area in the right weir to install the desander, and the intake, headrace tunnel, vertical pressure tunnel, surge tank, horizontal pressure tunnel, steel penstock & Y-Branch, surface type powerhouse and tailrace channel are planned for water conveyance. The total length of the power waterway is 10.95 km.

Pre-F/S adopted Alt Project Layout-1 and it uses the large area in the right weir to install the desander, and the intake, headrace tunnel, vertical pressure tunnel, surge tank, horizontal pressure tunnel, steel penstock & Y-Branch, surface type powerhouse and tailrace channel are planned for water conveyance. The total length of the power waterway is 11.5 km.

Alt Project layout-2 consist of Alt Weir-2 and Alt P/H-2. Alt Project Layout-2 is the same as Alt P/H-2, which adjusted the location of the powerhouse area in the pre-F/S to minimize the large excavation occurring in the powerhouse area.

Alt Project layout-3 consist of Alt Weir-3 and Alt P/H-2. However, Alt Weir-3 has a large land acquisition and resettlement of many houses. Also, the height of weir is almost 60, which is bigger than other alternatives.

Alt Project layout-4 consist of Alt Weir-4 and Alt P/H-2. Alt Project Layout-4 installs a natural type desander to reduce construction cost of desander. The scheme uses the space between the weir and upstream coffer dam. The inflow amount from the upstream coffer dam pass through the natural type desander and flow into intake, headrace tunnel, vertical pressure tunnel & surge tank, horizontal pressure tunnel, steel penstock & Y-Branch, surface type powerhouse and tailrace channel. The total length

of the power waterway is approximately 12.1 km. Alt Weir-4 has better geological condition than other alternative relatively.

The study compared alternative project layouts reviewing power potential, geological risks, construction conditions, environmental & social impacts as well as economic analysis. Alt project layout 4 is not with enough space for constructing a desander therefore a natural type desander was considered. Alt project alyout-1,2,3 and 4 have different locations of weir and existence of desander. The size of weir in Alt project layout-2&4 is less affecting the upstream areas socially and environmentally. While, Alt project layout-1 locates beside private houses and hotel in the right side comparatively having more social and environmental impacts than Alt project layout-2.

Therefore, Alt Project Layout-4 is the optimal layout after comparing with other alternatives.

Project Optimization

Optimization of Installed Capacity

The analysis has found the optimal installed capacity is 238 MW with the design discharge of 130 m^3/s.

The study finds the installed capacity of 238 MW, most suitable for the current terrain and the layout. The installed capacity enables delivering the annual energy generation of 945.8 GWh with a plant factor of 45.37%.

Table 9 : Comparison of Levelized Tariff (D 7.4 m)

Case	Plant Discharge	Installed Capacity	Annual Generation	Plant Factor	EPC Cost	Levelized Tariff
	m^3/s	MW	GWh	%	USD '000	Cent/KWh
1	100	190	780.5	47.0	338,758	8.15
2	110	207	827.3	45.7	348,114	7.89
3	120	223	875.3	44.8	356,236	7.62
4	**130**	**238**	**945.8**	**45.37**	**365,958**	**13**
5	140	254	946.2	42.6	383,734	7.52
6	150	268	974.6	41.6	396,003	7.66

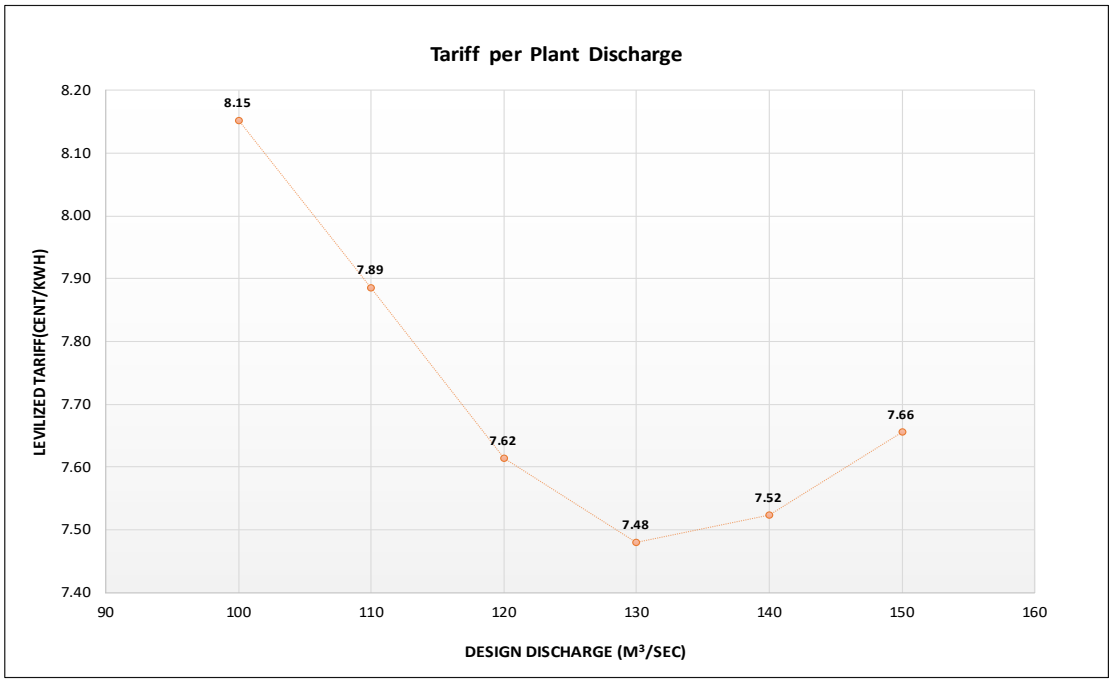


Figure 7 : Levelized Tariff per Discharge

Table 10 : Comparison of Levelized Tariff per Diameter (Q=130 m^3/s)

Case	Diameter	Installed Capacity	Annual Generation	Plant Factor	EPC Cost	Levelized Tariff
	M	MW	GWh	%	USD '000	Cent/KWh
1	7.0	234	902.5	43.9	364,061	7.53
2	7.2	236	908.2	43.8	365,031	7.50
3	**7.4**	**238**	**945.8**	**45.37**	**365,958**	**13**
4	7.6	240	916.9	43.6	368,259	7.49
5	7.8	241	920.3	43.6	370,426	7.50

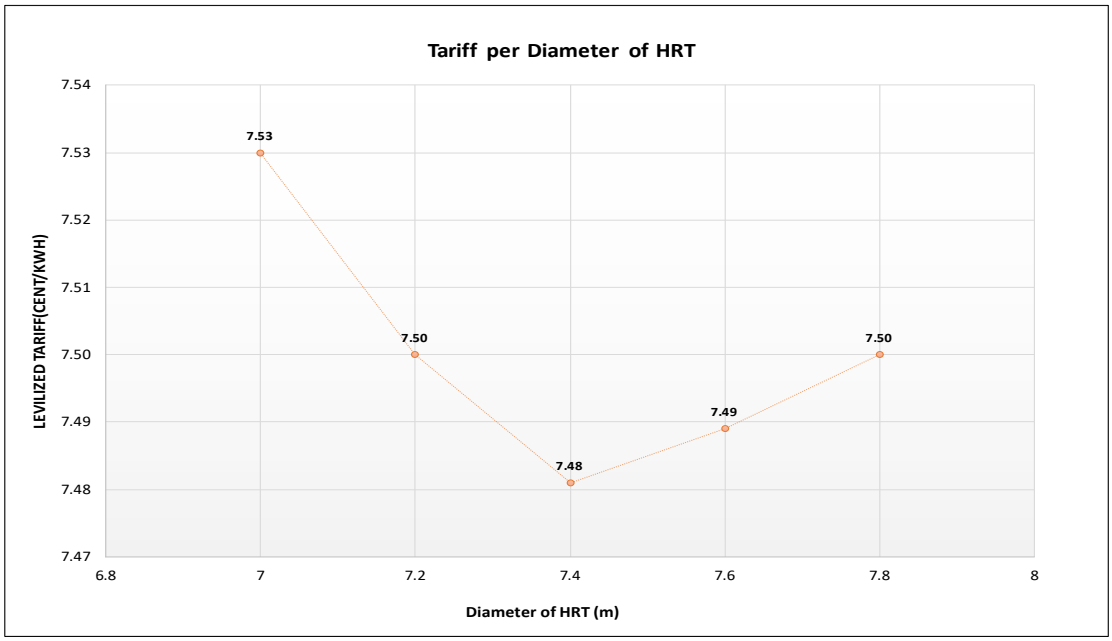


Figure 8 : Levelized Tariff per diameter of headrace tunnel

Selection of Turbine Unit Numbers

The study draws a conclusion of installing three identical turbines with a smaller one having the installed capacity of 243.92 MW (3 x 70.05 MW+ 33.77 MW) for following reasons.

- Such combination is estimated to deliver better energy than the concept with three identical units results in the highest EIRR and the lowest specific generation costs;
- The concept with three identical units requires the minimum operation and maintenance costs. Annual generation for 3 units is estimated as 862.4 GWh/year. Power generation is not possible during the dry season when the minimum flow becomes below 40 % of 43.3 m^3/sec. Therefore, the plant factor also became 40.8 %, which is lower than the scheme with 3 units with a small unit. E&M cost can be slightly lower but deficit in the annual generation brings a reduced economic benefit. The feasibility study has chosen the 3 units with a small unit for better economy.

Reservoir Operation & Annual Energy Generation

Effective delivery of power using the available flows within the site needs to find the optimal plant discharge. The plant discharge is determined as 130 m^3/s for full units,

which is 28.57 % in the exceedance time of the flow duration curve. It appears full units are operated for 104 days in a year. By adopting the small unit of 18 m^3/s, 76 % (277 days) of the year can produce the power.

Reservoir Operation Level

A normal operating level is generally determined by cost efficiency studies on construction costs per normal operating level and the annual energy generation. However, this cascade type scheme has a limitation in planning alternatives including installed capacity and gross head. Hence, the study most importantly considers the topographic conditions for the optimization process.

Site visit found many habitants and houses locate near Swat River affecting the limitation in normal operating water level. The study determines the normal operating water level at EL.1,944 m at the weir site for optimal power generation along with maintaining the gross head of 222.1 m and the tail water level of EL.1,721.9 m, which is approximately 400 m upstream of the proposed weir site in Asrit-Kedam HPP. Such fact is reiterating the importance of well performed topographic and bathymetric survey. Then, the study should determine the normal operating water level with more detail.

- Normal operating level at the weir site : EL. 1,944.0 m

Rating Curve at Tailrace Outlet

The optimization study draws the rating curve at the tailrace outlet assuming the variation of water level per plant discharge without hydraulic simulation on the water level. It should draw the rating curve at the tailrace outlet with detailed bathymetric survey data. The current study draws the rating curve as shown in Figure 8.

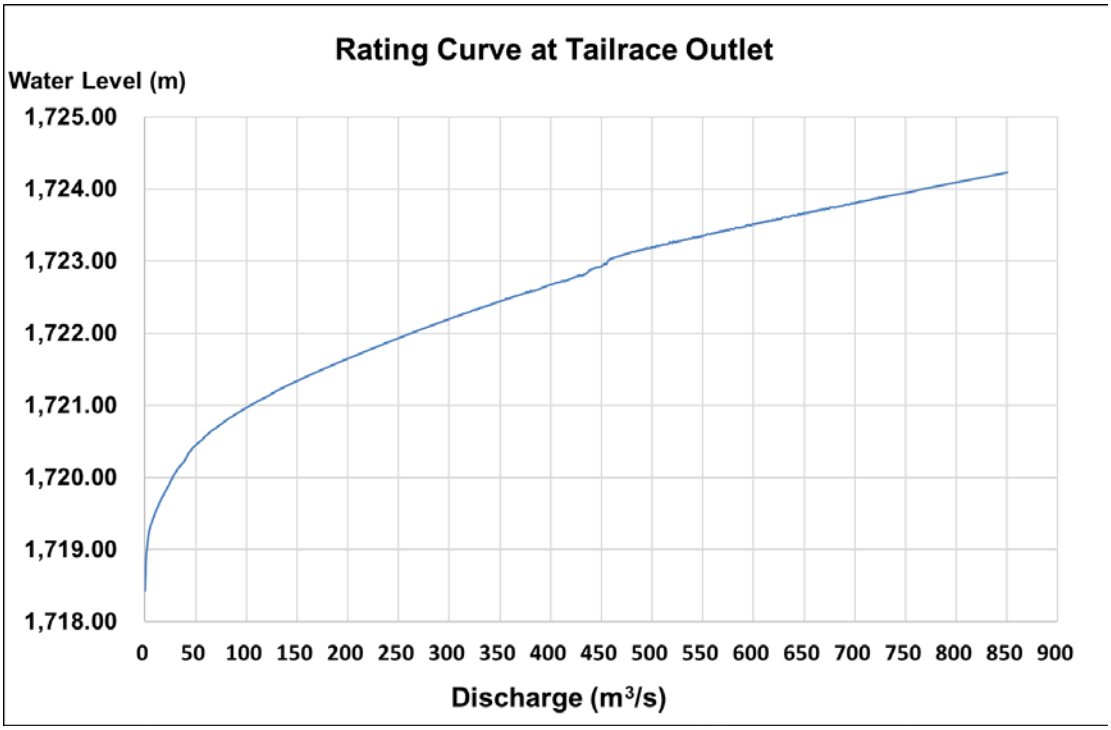


Figure 9 : Rating Curve at the Tailrace Outlet

Scheduled Outage

The study applied the outage in the energy modeling. It is desirable that power plant shut down during 3 days should be considered for large amount of sediments and high sediment concentration during wet season.

Table 11 : Scheduled Outage

Outage	Unit	F/S
Flushing Period	day	3 days
Outage for the flushing	GWh	17.1
Powerhouse Service (Internal Consumption)	%	1.0
Internal consumption	GWh	9.73
Total Outage	**GWh**	**26.83**

Operating Conditions

This run-of-river project has no usable storage in the reservoir for other than hydropower. The operating water level maintains the constant elevation. Furthermore,

in a cascade project, the reservoir operation with seasonal storage is not allowed due to the possible downstream effects such as flow rate variation.

Table 12 : Operating Conditions

Outage		Unit	F/S
Gross Installed Capacity		MW	238 (3+1 Units) [68.4 MW x 3 + 33.0 MW] (after turbine, generator & transformer efficiencies)
Plant Discharge		m^3/s	130
Min. Plant Discharge		%	40 % of unit
Annual Average Daily Flow		m^3/s	88.4
Operating Water Level		EL. m	1,944
Gross Head		m	222.1
Head Loss (Full Units Operation)		m	18.1
Efficiency	Turbine	%	94.0
	Generator	%	98.2
	Transformer	%	99.5
Ecological Flow		m^3/s	3.0
Internal Consumption		%	1.0

Annual Energy Generation

The study estimates the annual energy as 945.8 GWh/year. Considering the minimum release for ecological flow to 3 m^3/sec of river flow, the estimated annual energy seems reasonable.

Design of Civil Structure

Design of Weir

The concrete gravity type was selected considering satisfactory foundation conditions, minimum environmental disruptions and structural stability. The length of weir and the height is planned as 83.5 m and 18.3 m respectively. On top of the weir structure a road is planned to provide access to the intake structure and the control structures. The specifications for the designed weir are as shown below.

- Type : Concrete Gravity Dam
- Max Flood Water level : EL.1,946.0 m
- Normal Operation Water Level : EL.1,944.0 m
- Weir Crest Elevation : EL.1,947.0 m
- Length of the weir : 90.3m
- Height of the weir : 23.0m
- Overflow spillway
  - Size : W10.0 m × H6.0 m × 3 nos
  - Crest : EL.1,939.0 m
- Sluiceway
  - Size : W5.0 m × H4.5 m × 2 nos
  - Crest : EL.1,931.0 m

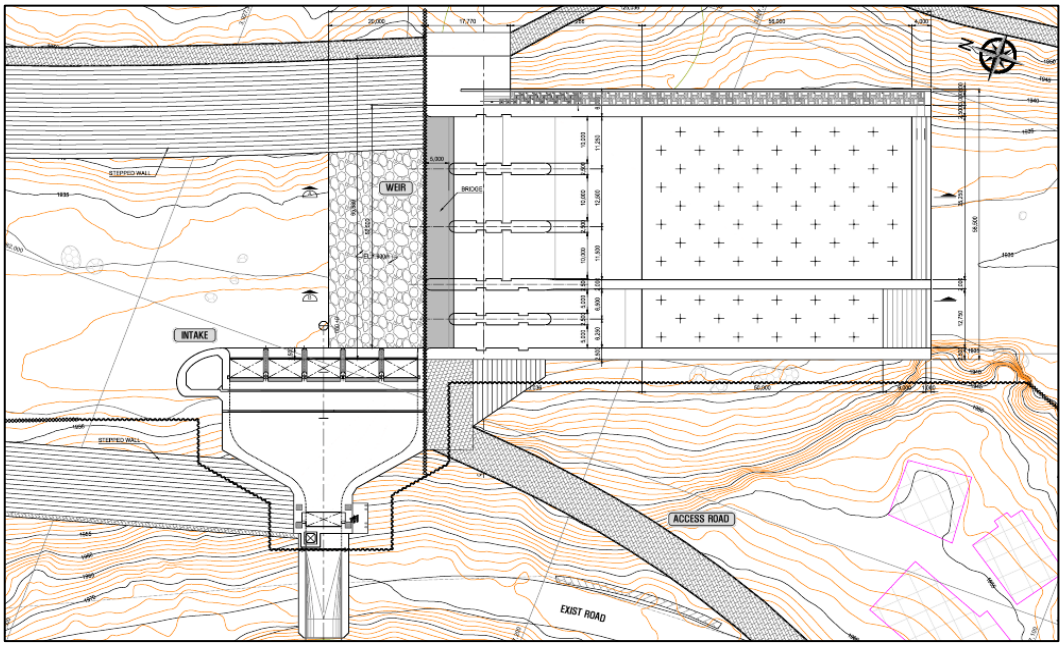


Figure 10 : Plan of Weir & Power Intake

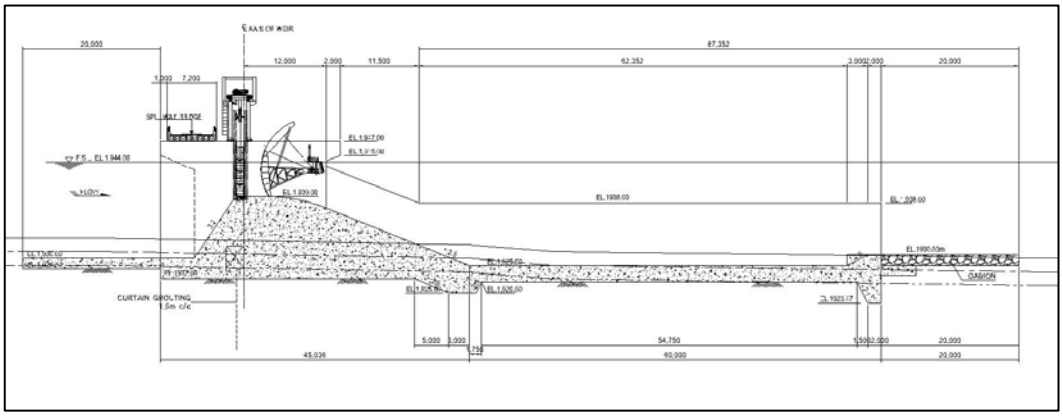


Figure 11 : Profile of Spillway Section

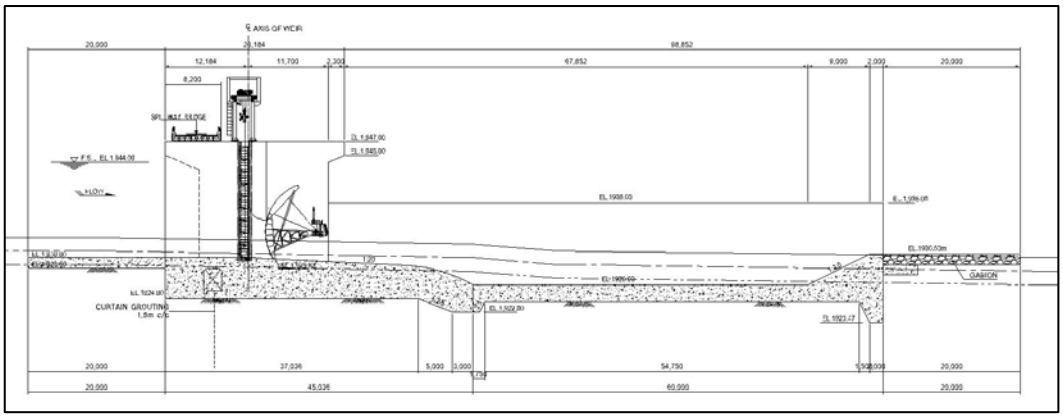


Figure 12 : Profile of Sluiceway Section

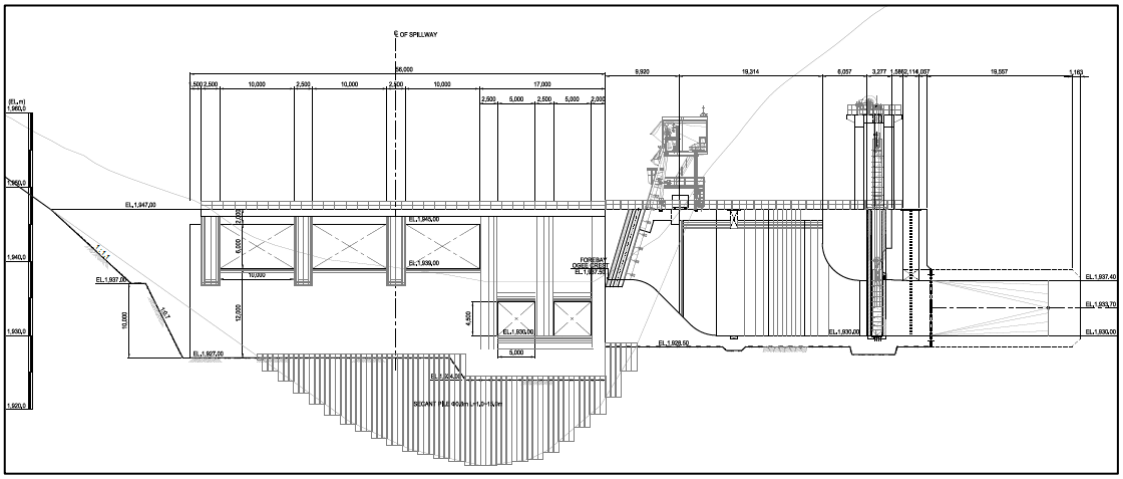


Figure 13 : Elevation of Weir Upstream

Natural Desander

The Hydropower Project like Kalam-Asrit HPP where amount of sedimentation is a little high, however it is very vital to ensure duration of power generation as well as to save maintenance and replacement cost due to damages on turbines through preventing amount of sediment flowing into the power intake. To reduce concentration of sediment, various sediment management measure such conventional sandtrap constructed by the concrete has already been constructed for other projects. However, its trap efficiency is somewhat doubtful. The expert of sedimentation at Patrind HPP suggested that using natural pool between the upstream cofferdam and the weir as function of desander would be more efficient and economically feasible. Also, The expert of sedimentation mentioned that by constructing a bypass tunnel, flood discharge would be diverted through the bypass tunnel which would facilitate trapping function of natural

pool as function of desander. Similar cases can be found in Upper Karnail project in India as well as in Lhuri project in Nepal, which the expert of sedimentation has been involve with.

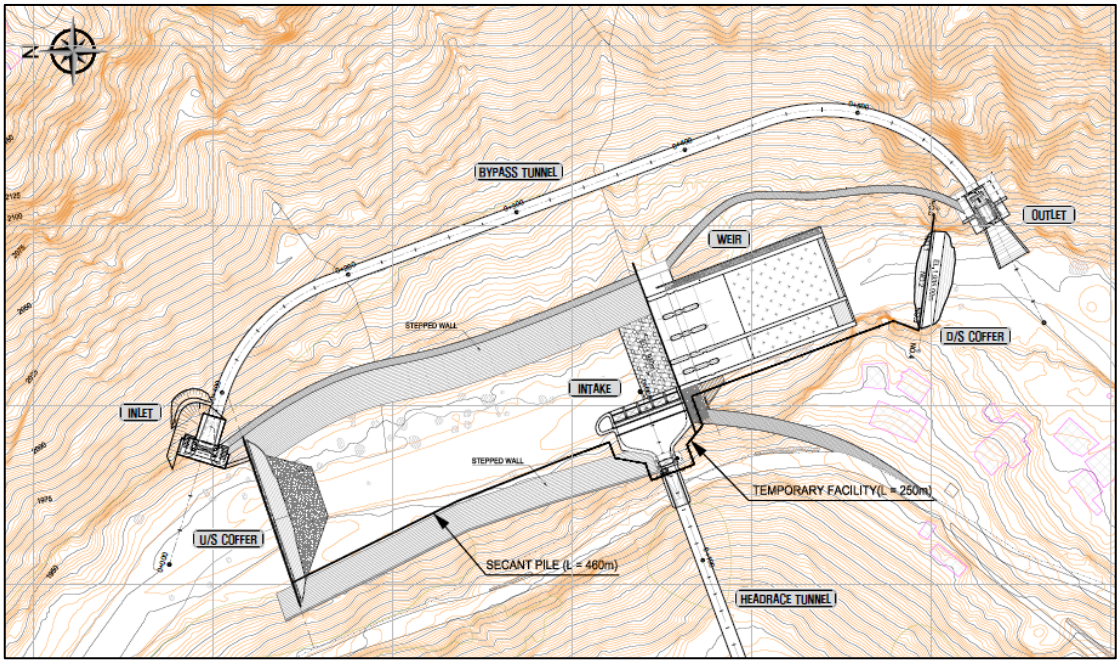


Figure 14 : Layout of weir site for Kalam-Asrit HPP

Accordingly, an attempt to improve trap efficiency has been made by applying concept of “Natural Desander which consists of ;

- A bypass tunnel, under normal operation diverting flow in excess of 130 m^3/s and also acting as a flushing device for accumulation of sediments upstream of the concrete cofferdam in the reservoir.
- A Natural Desander between the upstream concrete cofferdam and the Weir

The upstream coffer dam will be a permanent structure and will be used as a barrier for trapping large size boulders. The coffer dam will trap the sand, gravels & boulders and will flush through bypass tunnel. This scheme will also protect the intake structure and associated mechanical installation in weir structure from rolling stones which may get damage in conventional sandtrap scheme.

The basic concept of Natural Desander applied is to allow only the plant discharge to flow into the natural settlement pond in order to let the sediment be settled in the pond, during normal operation. The dimensions of natural desander are adjusted in a way

that the velocity will be kept minimum i.e. 0.2 m/sec, enabling sediments to settle properly.

The inlet level of intake structure and under sluice gates of weir will be adjusted in a way that all the trapped sediments in the natural desander will be flushed without entering the headrace tunnel. In general, the level of under sluice gates of weir will be kept lower than the intake invert level."

Intake

Through the intake, water flows into the waterway. Any entrainment of sediment or debris has to be prevented by trash racks to avoid possible damages to the equipment in the powerhouse. The maintenance works of the intake should be easy to ensure better economic operation of the power plant, for instance, access to the structure and trash rack maintenance. The intake size and its configuration should be designed to secure the inflow of the design discharge as well as to be satisfied with important hydraulic requirements for the intake such as equal distribution of the inflow velocities and prevention of vortex formation.

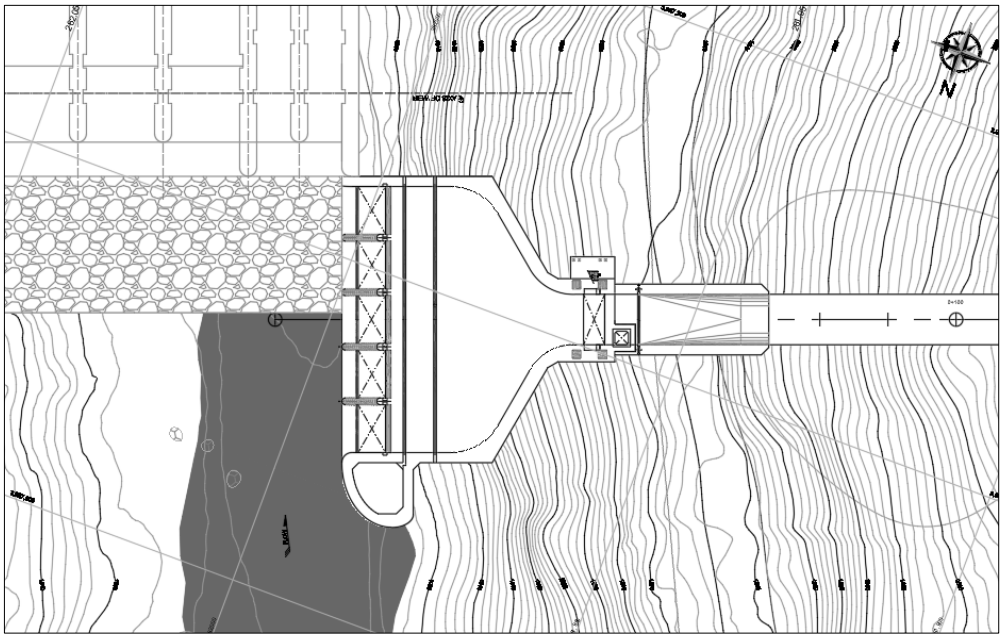


Figure 15 : Plan of Intake

1) Intake

- Type : Horizontal bell mouth type
- Sill Elevation : EL. 1,930.0 m
- Inlet Size : W7.0 m × H6.8 m × 5 Nos. (A = 238 m^2)

2) Gates

- Type : Roller gate
- Size : W7.4 m × H7.4 m × 1 Nos.

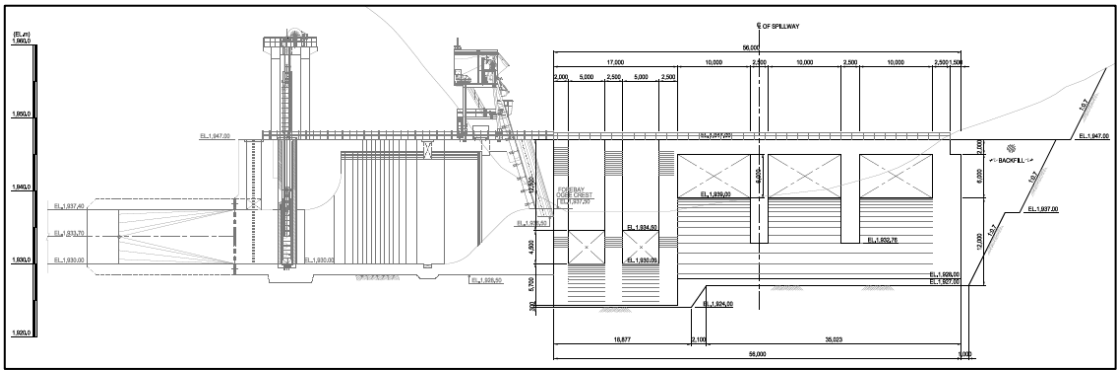


Figure 16 : Elevation of Weir Downstream

Intakes are generally divided into two types, i.e., vertical morning glory and horizontal bell mouth type. The project area is situated between steep gullies so that the vertical morning glory type is not appropriate for this terrain. Therefore, the horizontal bell mouth type is preferred given the operation and maintenance issues.

Vortex formation in the intake could cause many problems such as reduction of power generation due to reduced inflow amount with entrained air, pressure pulsation phenomena due to discharge fluctuation, possible damages to the waterway structure and increase of head loss.

The invert elevation of the power intake was possible to be set from the elevation of EL.1,930.8 m. However, considering safety issues and making the invert elevation deeper to discharge the inflow towards powerhouse without any voids, the elevation of EL.1,930.0 m was carefully set as the invert elevation of the power intake.

In general, if the plant discharge is large, the approach velocity toward power intake is allowed up to around 1.0m/s, and the approach velocity of an intake with trash rack is around 0.6 ~ 1.5 m/s. Design approach velocity of power intake for Kalam-Asrit HPP is conservatively planned about 0.6 m/s to improve efficiency of natural settlement pool

and to prevent inlet loss and vibrations to the trash racks. Its cross section has been designed in order to induce smoothly the discharge of 130.0 m^3/s and to make the allowable velocity less than 0.6 m/s.

The calculation results brought the intake width of 7.0 m. The sill elevation is set at EL.1,937.5 m, and the average velocity is below 0.6 m/s so that water is fluently flown into power intake.

Waterway Tunnel

The layout of waterway tunnel, connecting from the Power Intake at the reservoir to the powerhouse, should be first determined considering the location of the surge chamber and the powerhouse. The optimum design of the waterway tunnel was performed throughout review of the topographical and geometrical conditions, the powerhouse direction and the hydraulic conditions such as water hammer and surging phenomenon.

Table 13 : Waterway Tunnel Specification

Items		Length (m)	Cross Section (m)	Slope	Remark
Headrace Tunnel		11,589.6 m	D 7.4 m	0.47%	Modified Horse Shoe (Inner Circular)
Surge chamber	Chamber	L50 m × B20.0 m	H10.0 m	-	
	Shaft	67 m	D 18.0 m	-	Circular
	Orifice	14 m	D 5.0m	-	Circular
Pressure Tunnel	Vertical	188 m	D 7.4m	-	Circular Incl. curvature lengths
	Horizontal	118 m	D 7.4m	-	Modified Horse Shoe (Inner Circular)
Steel Penstock	1 Line	296.9 m	D 5.6m	-	Steel Lined
	4 Line	106 m 19 m	D 3.0m D 2.3m	-	Steel Lined

The waterway tunnel is connected from the power intake at the reservoir to the powerhouse. It consists of power intake, headrace tunnel, vertical and horizontal pressure tunnel, and steel penstock and its total length is 12.1 km. The surge chamber is located between headrace tunnel and vertical pressure tunnel in order to reduce the hydraulic transient in the pressure tunnel. The steel penstock divides in front of the powerhouse to supply the plant discharge for 4 turbines.

The longitudinal alignment of waterway tunnel is satisfied with natural drainage, therefore, the maximum longitudinal slope will be below 1.5%. The steel penstock slope is level for workability.

The economical cross section of the waterway tunnel should minimize the sum of construction costs, maintenance cost and generation loss cost per unit length. The basic concept is that the wider cross section is, the less generation loss cost by friction loss of the headrace tunnel is, whereas the more expensive the construction cost is. Therefore, the optimum cross section is adopted as the cross section that can minimize the sum of the generation loss cost and the construction cost above mentioned. The diameter of the headrace tunnel and the steel penstock is determined by cost optimization design.

Table 14 : Optimum Cross Section of Waterway Tunnel

Items	Plant discharge (m^3/s)	Diameter (m)	Velocity (m/s)	Remark
Headrace	130	7.4	3.0	Concrete Lined
Pressure Tunnel		7.4	3.0	Concrete Lined
Steel Penstock (1 Line)		5.6	5.3	Steel Lined
Steel Penstock (4 Line)		3.0	5.3	Steel Lined
		2.3	4.3	

Headrace Tunnel excavation methods should be selected considering workability and economic analysis. Analysis results are decided according to size and shape of the tunnel section, length, geological conditions, work adit conditions, construction period and costs as well as surroundings (access roads, social complaint, environmental issues). There are 2 types of tunneling methods. One is Drill & Blast (NATM) and another is Tunnel Boring Machine (TBM). Their advantages and disadvantages are below. TBM tunneling is reviewed with “Classification of Excavation Equipment as per Ground Condition, AFTES, 2000”. As a result of review, TBM is recommended. TBM method is chosen specially to Open-face gripper TBM.

Table 15 : Selection of Headrace Tunnel Alignment

Classification	Route 1 (on the right side)	Route 2 (on the left side)
Ground Properties	・The depth of the headrace tunnel is about 100 m deep, so the tunnel is located on the rock under the colluvium ・Good conditions because the Headrace tunnel passes through the rock	・The bedrock is partially exposed, and colluvium at the beginning of the tunnel and colluvium and alluvial at the end of the tunnel are relatively broad and deep
Characteristic	・No temporary bridges and roads are required for Headrace tunnel ・Extension of Headrace tunnel is shorter on the right bank than on the left bank.	・Construction of temporary bridges and temporary roads is needed to enter equipment for tunnel construction at the start and end of tunnel ・Extension of Headrace tunnel is longer on the left bank than on the right bank.
Applied	◎	

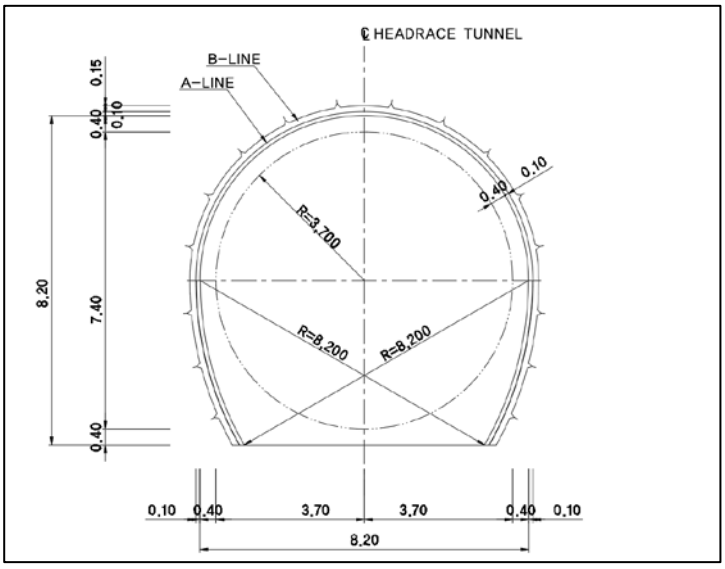


Figure 17 : Section of Drill & Blasting Application of Headrace Tunnel

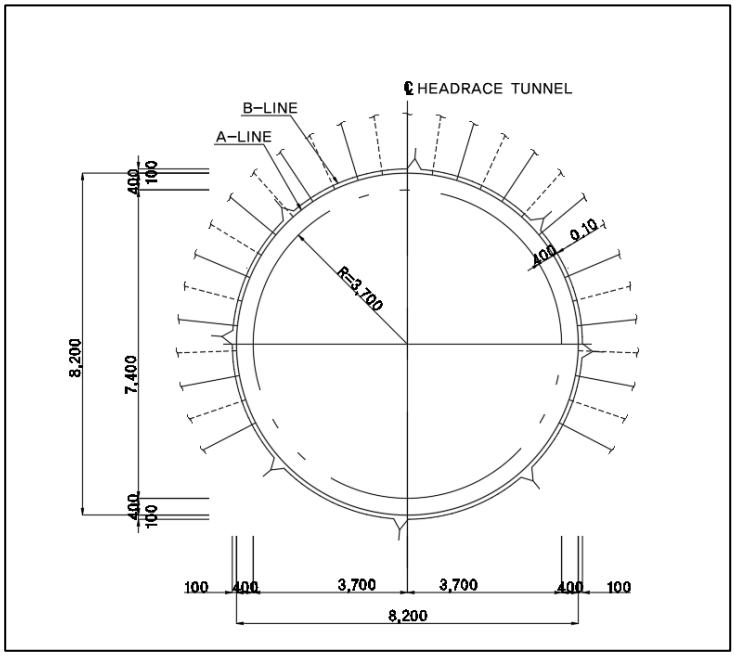


Figure 18 : Section of TBM Application of Headrace Tunnel

In the case of TBM method, the construction period was reviewed with the concept of monthly excavated length according to the ground conditions. The critical path of this project is the headrace tunnel, so the construction period was reviewed for preparation work, adit excavation, and TBM assembling and construction. The review condition of 1 month applies to 25 days for the total construction period of 5 years (60 months). In the TBM construction phase, equipment ordering, fabrication and on-site delivery are prepared with the start of the project, which is not considered as a separate construction period. When excavating the headrace tunnel, 5% of the total headrace tunnel extension was considered in consideration of risks such as jamming.

The pressure tunnel starting at the end of the headrace tunnel connects to the steel penstock tunnel.

The vertical pressure tunnel was planned as a circular type considering economic efficiency and workability. For ease of construction by means of the raise boring method the 7.4 m diameter pressure tunnel is designed vertical.

The longitudinal slope of the horizontal pressure tunnel was designed as no slope for construction vehicles movement and tunnel drainage during construction and tunnel maintenance during operation. In view of expected internal tunnel pressure and rock mass characteristics in the pressure tunnel, concrete lining is required.

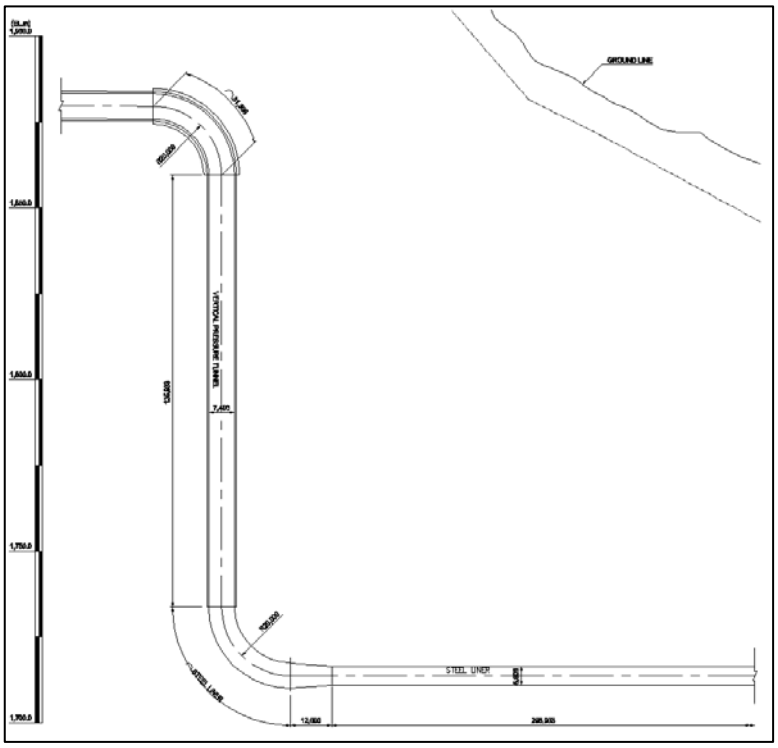


Figure 19 : Pressure Tunnel Profile

In the pressure tunnel, the surrounding rock of the pressure tunnel is in charge of cut-off role. However, in case that the minimum principle stress of the surrounding rock is smaller than the internal water pressure, seepage water to the rock causes Hydraulic Jacking at the surrounding rock. In order to assure the hydraulic and structural stability of the surrounding rock against Hydraulic Jacking, watertight liner that can prevent water from leakage to the surrounding rock, should be considered. Reinforced concrete liner or steel liner can be applied according to the surrounding rock conditions.

In the section that the internal water pressure is high and the deformation modulus of the surrounding rock is small, tension crack could occur along the reinforced concrete liner. Therefore, steel liner backfilled with concrete should be adopted. Application of reinforced concrete liner or steel liner depends on the internal water pressure at the installed location and the deformation modulus of the surrounding rock. Especially, in case that the surrounding rock is permeable in pressure tunnel, steel liner should be considered.

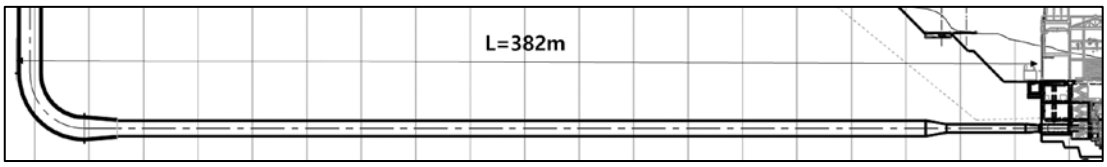


Figure 20 : Penstock Length

Though the calculation results in much smaller value, the length of Steel Penstock has adopted conservatively the length of **382** m reaching to the lower bend of the vertical shaft.

Surge Shaft

Water hammer is caused by flow disturbances in a waterway tunnel from a steady state to another. To ensure the structural stability of the headrace tunnel against the water hammer due to pressure change, a surge tank is installed. It induces pressure rise or drop in the hydraulic systems, rotational speed variation in the turbines as well as level fluctuation in surge tanks and air chambers.

Transmission of pressure waves along waterway leads to high dynamics of loads on the power plant components during transient operation events such as rapid load acceptance and reduction or unit shutdown. The fluctuation of load changes on the surface within the surge tank decreases gradually by the friction of headrace and then damped to the water level corresponding to the load after change. This exchange of water surface is a U-tube type of fluctuation forms between a surge tank and pressure tunnel.

Controlling water hammer can be achieved by designing of flow-passage system layout, and diameter, length of the waterway tunnel and operation characteristics of generating units have effects on the attenuation in surge tanks for example, closing and opening laws and limitation of operating conditions.

The project applied Francis turbines, and guide vane positions have direct effects on inlet velocities. Figure 20 shows the profile of surge shaft.

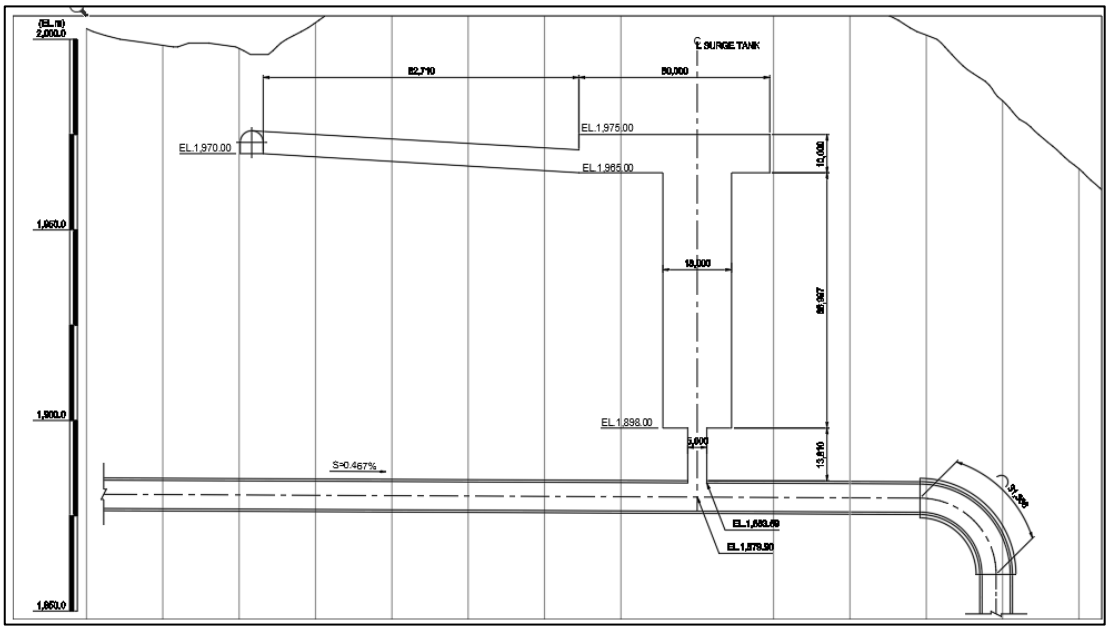


Figure 21 : Surge Shaft Profile

The scheme with the long headrace tunnel requires surge tank for stability of the power generation system, and its stability is evaluated from the ratio between mechanical start-up time and water column start-up time.

The calculation result using the formula above was T_m / T_w = 3.704, which is larger than the safety value of 3. The value needs cross checks once a turbine manufacturer defines WR^2 value of the turbine.

The analysis used Wanda 4.5 to simulate the water level fluctuation within surge tank. The simulation applied 13 seconds of Closing time, and the load acceptance case applied 10 seconds of opening time for simulation of Francis turbines using the geometry developed for F/S. The dimension of surge tank with chamber and the guide vane operation conditions are summarized as follows.

- Boundary condition
  1) Type : Restricted orifice type
  2) Flow : 130 m^3/s
  3) Analysis Method : Wanda 4.5 (Deltares)
  4) Dimension of Surge Shaft : D 18.0 m, L 67.0 m
  5) Orifice Size : D 5.0 m, L 14.4 m
  6) Chamber Size : W 20.0 m, H 10.0 m, L 50.0 m
- Operation condition
  1) Full load rejection within 13 seconds

2) Full load acceptance within 10 seconds

Accordingly, adjustment of chamber size and the diameter of the surge tank brought a development of several cases, and the final results of surge analysis in an effort of reducing the excavation amount and easy access of equipment into the chamber. For securing the downsurging level, the design performed adjusting slope of HRT reducing the vertical shaft. The results show that the maximum upsurging water level is occurring at EL. 1,969.61 m, and the maximum downsurging water level is occurring at EL. 1,903.83 m in the surge tank.

Powerhouse

Hydropower is the generated electricity using the potential energy of water. Powerhouse has turbines, and those are designed considering some conditions such as, heads, flow duration curves, topography, geology, conveyance, construction materials, drainage area, estimated electricity load and transmission facilities to make it as economic as possible. The surface type powerhouse has been adopted in this project.

Hydro-mechanical equipment was designed under the conditions as follows.

a) Reservoir water level
   - Max Water Level (M.W.L) : EL. 1,946.0 m
   - Normal High Water Level (N.H.W.L) : EL. 1,944.0 m

b) Tailwater level
   - Return period of 100 years Flood : EL. 1,724.52 m
   - Return period of 1,000 years Flood : EL. 1,725.35 m
   - Tailwater Level (T.W.L) : EL. 1,719.7 m at small unit
     EL. 1,721.9 m at full units

The surface-type powerhouse is adopted in the feasibility study. Also, the size of the powerhouse was planned with 41.7 m width and 100.65 m length in the feasibility study. The powerhouse is a permanent structure so that it must be safe against the flood discharge from Swat River. Considering the 1,000 years frequency flood water level, the powerhouse shall be on EL. 1,730.90 m with clearance.

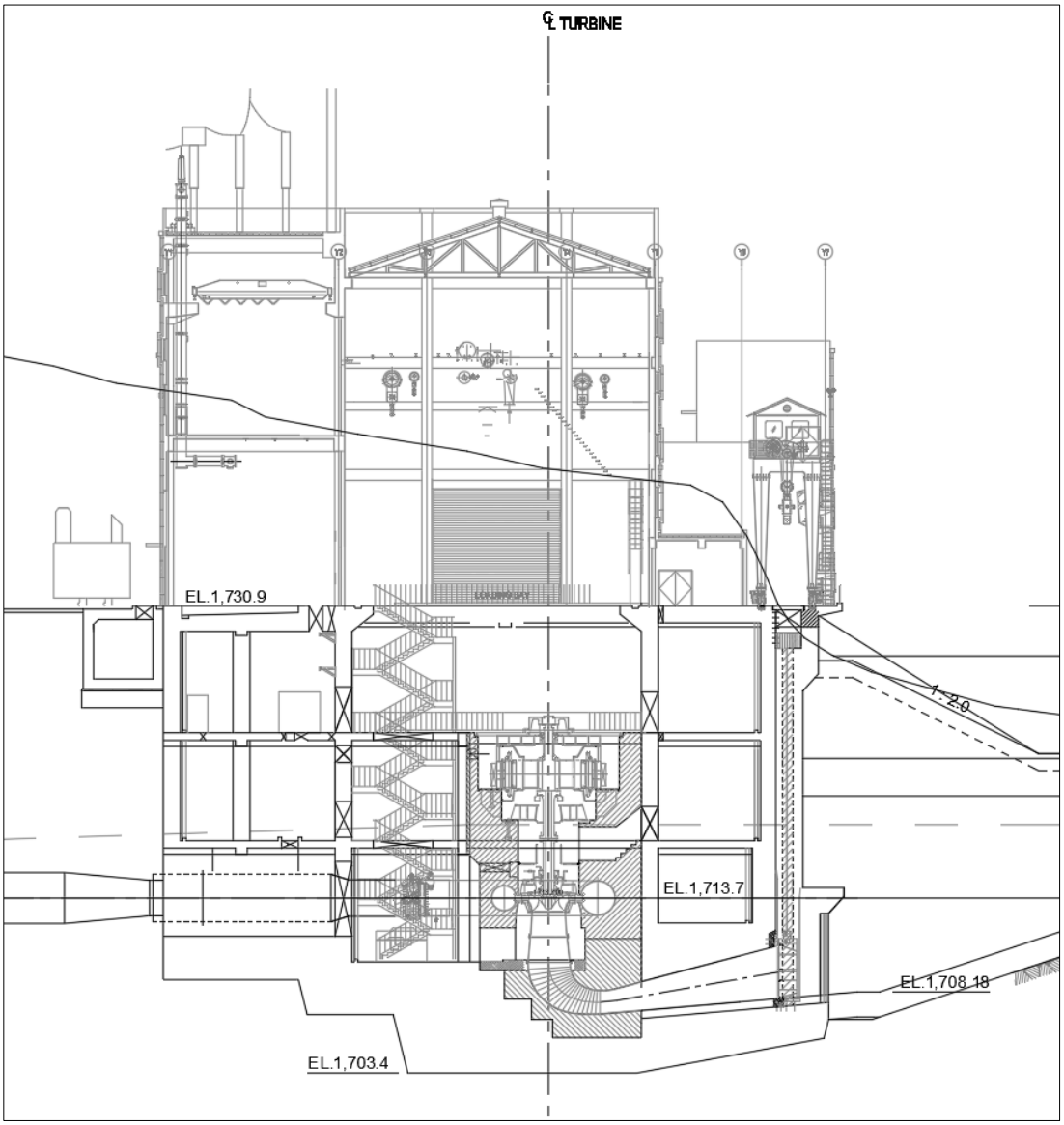


Figure 22 : Profile of Powerhouse

Electro-Mechanical Equipment

The mechanical equipment and main mechanical auxiliaries in the powerhouse consists of following items:

- Turbine I : three(3) vertical shaft single-stage Francis-turbines including hydraulic/electronic turbine governors
- Turbine II : one(1) vertical shaft single-stage Francis-turbines including hydraulic/electronic turbine governors

butterfly valve in front of each turbine with auxiliaries

Following table is the basic characteristics of the turbines selected.

Table 16 : Specification of Turbine

Division	Turbine I	Turbine II
Turbine output (MW, unit)	70.05	33.77
Number of units	3	1
Type of turbine	Vertical Francis	Vertical Francis
Design discharge (m^3/sec, unit)	37.33	18.0
Plant discharge (m^3/sec, all unit)	112	18
Rated net head (m)	204.0	204.0
Efficiency (%)	94.0	94.0
Selected Specific speed (m-kW)	114.2	102.0
Rotational speed (min-1)	333.3	428.6
Turbine setting elevation(EL.m)	1,713.7	1,713.7
Tail water level (small Unit operation, EL.m)	1,719.7	1,719.7

As shown in below figure, Francis type turbines were selected as the most appropriate type of the turbine.

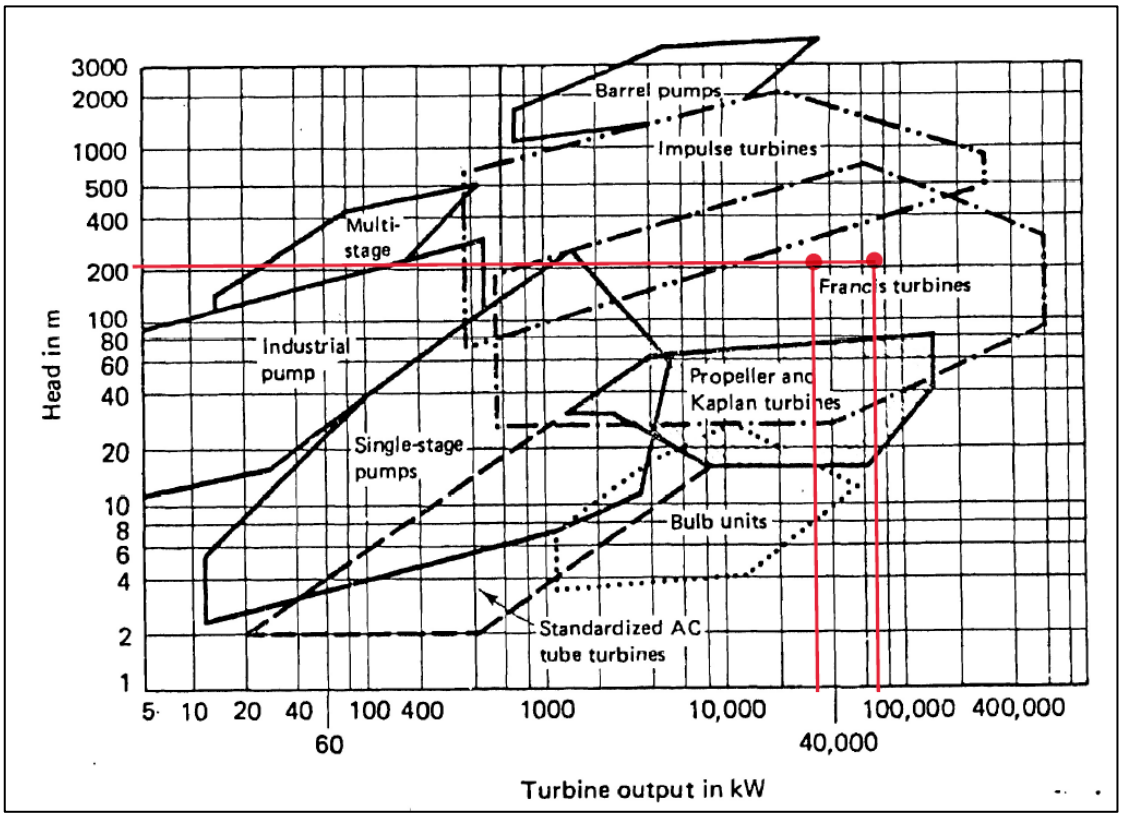


Figure 23 : Application ranges for conventional hydraulic turbines (Hydro Power Engineering, USA)

The upstream side of each turbine, one Flow-through valve (Biplane type butterfly valve) is installed as emergency and repair shutdown valve of the turbine. The flow-through valve was selected since the alternative spherical valve type results according to common experience in significantly higher equipment costs and requires larger dimensions for access facilities and capacity of lifting equipment.

Table 17 : Specification of Main Inlet Valve

Division	Turbine I	Turbine II
Number of units	3	1
Type of valve	Flow-through valve (Biplane type butterfly valve)	Flow-through valve (Biplane type butterfly valve)
Nominal diameter (m)	app. 2.3	app. 1.6
Static head (m)	229	229

Electrical Equipment

The power and speed of the generators are dictated by the turbine, with its calculated output at the shaft coupling at design heads and design flow. Considering the

respective turbine power output, a typical generator efficiency of approx. 98.2% and a power factor of 0.8 lagging to 0.9 leading (which allows the generation of the necessary reactive power for voltage regulation at the 220 kV grid), the respective generator design data result as follows:

Table 18 : Design Parameter for Generator Design

Division	Specification
Capacity(Unit1,2,3 / 4)	68.8MW (86 MVA) / 33.2MW (41.5 MVA)
Power factor(PF)	0.8 lagging to 0.9 leading
Rated speed(Unit1,2,3 / 4)	333.3RPM / 428.6 RPM
Frequency	50Hz
Terminal voltage	11 ±10% kV
Stator coil connection	Y connection
Neutral point ground method	High resistance grounding method using Single-phase transformer for grounding and secondary resistor.

Step-up transformer characteristics are as following.

Table 19 : Design Parameter of Single Phase Transformers

Division	Specification
Number of 3 phase transformer	3 / 1
Type	3-phase, two windings
Rated bank output of 3 phase transformer	86MVA / 41.5 MVA
Frequency	50Hz
Type of cooling	OFWF
Primary voltage rating	11kV
Secondary voltage rating	220kV

Each generator and line bay will be equipped with a SF_6 circuit-breaker, combined isolating/earthing switches and required current transformers. Voltage transformers will be installed on both bus bars as well as in the line bays. The technical characteristics of the GIS will be as follows:

Table 20 : Design Parameter of 220 kV GIS Switchgear

Division	Specification
Insulation medium	SF_6
Maximum operation voltage	245 kV
Rated power frequency withstand voltage (rms value), across open switching device and/or isolating distance, at minimum operating gas-pressure	460 kV
Rated power frequency withstand voltage (rms value), phase to phase and phase to earth, at minimum operating gas-pressure	530 kV
Rated lighting impulse withstand voltage (peak), phase to phase and phase to earth, at minimum operating gas-pressure	1050 kV

Hydro-Mechanical Equipment

The hydro-mechanical equipment for operation of Kalam-Asrit HPP is as following

Table 21 : Hydro-Mechanical equipment for Kalam-Asrit HPP

Item	Description	Specifications
Spillway	Radial Gate	W10.0 m x H 6.0 m x 3 EA
Sluiceway	Under Sluice Radial Gate	W 5.0 m x H 4.5 m x 2 EA
Gantry Crane for Spillway & Sluiceway	Electrical operated gantry crane	20 ton x 1 EA
Bypass Tunnel	Inlet Fixed Wheel Gate (Roller Gate)	W 7.5 m x H 8.0 m x 1 EA
	Outlet Radial Gate	W 7.5 x H 7.5 m x 1 EA
Intake	Roller Gate	W 7.4 m x H 7.4 m x 1 EA
	Trashrack	W 1.0 m x H 10.0 m x 5 set
	Trashrack Cleaner	Moveable, Rake, Knuckle crane with gripper
Steel Penstock	Penstock and Manifold	D 5.6 m
Powerhouse	Draft Tube Gate (Slide Gate)	W 6.0 (4.7) m x H 3.3 m x 2 EA

Transmission & Interconnection Study

238 MW Hydro Power Project' is modeled in the NTDC grid system by Power Planner International Consultants. Power Planner International is analyzing multiple options for

power evacuation of '238 MW Hydro Power Project' and the most appropriate interconnection proposal is presented in view of following system studies:

Data gathering and modeling

This processed plant data has been modeled in NTDC network as per proposed connection scheme. If required, Power Planner International will assume the missing or incorrect data based on prudent industry practices. NTDC network model will then be updated and tested. Updated NTDC network base case will be tested for any error using standard checks like convergence, number of iterations, voltage and thermal limits, and drift test for dynamics run.

Load flow analysis

Load flow studies for power evacuation of '238 MW Hydro Power Project' would determine Confirmation that no voltage and thermal limits are exceeded as per NERPA Grid Code Planning criteria, Voltage profile of NTDC system, Transmission line loadings in terms of Active (MW) and Reactive Power (MVAR) flows, Active Power (MW) loss in the network, Transmission network and transformation reactive losses (MVAR) and Proposal of remedial solutions to the bottlenecks, if found any.

Short circuit analysis

Short circuit studies would determine the following;

- Total fault currents and contribution from the associated network.
- Maximum short circuit levels for selection of switchgear ratings at Power Plant switchyard.
- Minimum short circuit levels for relay coordination in protection schemes.
- To ensure that if short circuit ratings of the existing network equipment are adequate for the evaluated fault levels, otherwise proposal of corrective measures to the identified problems, if any.

Dynamic stability analysis

The studies involve choice of equipment and optimum regulation through control strategies which allows the system to remain in stable conditions under potential risks. Dynamic stability studies would provide the basis of power management system for the

subject power plant as it would determine the following;

- Qualification and quantification of the disturbances which may appear.
- Evaluation of the stability margins and stability of power plant in dynamic conditions.
- Dynamic stability of the power plant after any fault occurs in the system by damping of oscillations in the voltage, angle and frequency etc.
- Risk of dynamic instability (loss of synchronization among the generators).
- The capability of system to damp the oscillations timely.
- Operating limits of frequency and voltage for power plant as imposed by the NEPRA Grid Code standards.
- Proposal of remedial solutions in the event of a problem.

Recommendations

Re-enforcements (such as new transmission lines or replacement of conductor and augmentation or extension at existing grid stations etc.) in case of any congestion or severe contingencies in the linked network. In case of high short circuit levels after the subject power plant come in to the system, following remedies may be suggested at associated NTDC grid stations;

- Replacement of old switchgear having low short circuit capacity with new ones with higher strength ratings.
- Split bus arrangement for the associated grid stations.
- Series reactors at bus bars of the associated grid stations.

Stability limitations if found will be complex process to fix and suggestions of changes in related parameters will be proposed such as, reducing breaker opening time, impedance reduction of the connected lines and/or transformers, generator control parameters of other nearby machines etc

Environmental & Social Impact Assessment

The Environmental & Social Impact Assessment (ESIA) study has been conducted in line with the requirements of Pakistan Environmental Protection Act 1997, KPK – Environmental Protection Act, 2014 and EIA/IEE Regulations, 2021.

The report includes Public Consultation with the affected communities in the project

area in order to apprise them of the project activities and to obtain their views and concerns.

The major conclusion of the ESIA are;

- During the project implementation, environmental and social impacts would be experienced primarily during construction and operation phases. The potentially significant impacts on the social, physical and biological environment of construction and operation phases will be reduced / mitigated to acceptable levels provided that the EMSP is implemented in a true spirit. This has been confirmed during field surveys.
- The possible impacts have been duly considered during design phase. Such impacts which would occur during construction/operation phases include the following:
    - Land Acquisition
    - Loss of Houses
    - Business Enterprises
    - Economic Trees
    - Disposal of Excavated Material
    - Soil Erosion
    - Water Pollution
    - Effect on ambient air quality
    - Dust
    - Noise pollution
    - Safety hazards
    - Workers and public health concerns for the nearby community
    - Habitat loss, tree cutting, displacement would occur during construction phase of the project
- The key environmental issues during design, construction and operation phases of the project include bank stability of the river, dam safety and safety hazards for the staff requiring site specific SSMP.
- All the recommended mitigation measures are contained in the Environmental

Management Plan (EMP), which will need to be made part of the Contract. The plan provides for the requisite setup during the project implementation, defining roles and responsibilities of key players.

- The contractor will be required to prepare an SSMP including temporary traffic management, materials management master plan, waste management plan, blasting management plan, oil spill management plan and HSE plan. The SSMP should be deliverable by the contractors and approved by EPA- KPK. before construction commences.
- A stand-alone Land & Resettlement Action Plan (LARP) has been developed and made part of the EIA study to provide framework to address the involuntary resettlement issues and to guide through the compensation assessment and disbursement process. The relevant provisions of LARP will also be made part of the Contract.
- The proposed mitigation measures address potentially significant impacts and concerns raised by all stakeholders.
- The overall findings of the environmental and social impact assessment show that the project is environmentally and socially viable provided that the mitigation measures are completely and effectively implemented.

Transportation & Infrastructure Survey

Kalam valley is located about 270 km from Islamabad, the capital of Pakistan and 99 Kilometres from Mingora in the northern upper reaches of Swat valley along the bank of Swat River in Khyber Pakhtunkhwa province of Pakistan. The main accessibility to Kalam valley from Swat valley is through the N-95 Swat Kalam Road.

The distance from Karachi port to kalam is approximately 1754 Km having metaled road except from Behrain to Kalam, the road (N-95) rehabilitation work has been completed in 2020. Following is the recommended route for transportation of TBM from Karachi port to Kalam;

Table 22 : Transportation Route for TBM

Route	Road Designation	Distance (Km)
Karachi to Hyderabad	M-9	165
Hyderabad to Nawabshah	N-55	121
Nawabshah to Khairpur	N-5	163
Khairpur to Rahim Yar khan	N-5	207
Rahim Yar Khan to Bahawalpur	N-5	162
Bahawalpur to Khanewal	E-5	106
Khanewal to Faisalabad	E-5/M-4	205
Faisalabad to Islamabad	M-2	301
Islamabad to Swat	M-1~Swat expressway	230
Swat to Behrain	N-95	56
Behrain to Kalam	N-95	38
Total		1754

For construction materials (cement, slag, steel etc.) all the sources are enlisted with the distances from the project site. Most viable option can be opted during construction phase on the basis of availability and cost factors etc.

Construction Schedule

Based on the project scope, bill of quantities, sequence of activities and their dependence on the expected hydrological conditions at the site, a construction period of approximately 5 years has been planned. The implementation schedule assumes that the contract will be awarded to an experienced and qualified contractor with international experience in similar projects and local conditions.

The construction sections for completing the Kalam Asrit Hydropower Project within the construction period of 5 years are largely classified into the upstream weir section, power waterway section and the lower powerhouse section to be planned for parallel construction.

EPC Cost Estimates

The cost estimates presented herein form the basis of the Economic and Financial Analysis presented in Chapter 20. The project construction cost summary is presented

in Table 22. The project construction cost excluding Interest During Construction and Financing Charges is estimated at USD 366.0 Million. IDC and other financing charges are added to this cost to arrive at total capital cost figure which is used in financial evaluation of the power project

Table 23 : EPC Cost Estimate

CODE	DESCRIPTION	UNIT	Kalam-Asrit HPP POE Approved (15% reduction in Unit Rate by POE)				
			Quantity	Unit Price (US$)	Total (US$)	Total (Rps)	Remark
	TOTAL EPC COST				**365,958,331**	**65,323,562,135**	**100%**
A	**Civil Works**				**228,911,461**	**40,860,695,876**	**63%**
1	ROADS				5,740,000	1,024,590,000	2%
2	BYPASS TUNNEL & COFFERDAM				18,469,380	3,296,784,374	5%
3	SPILLWAY				22,397,132	3,997,888,070	6%
4	POWER INTAKE				4,559,242	813,824,664	1%
5	WATERWAY				129,750,347	23,160,436,867	35%
6	SURGE SHAFT				5,602,083	999,971,809	2%
7	POWERHOUSE CIVIL				21,347,191	3,810,473,600	6%
8	O&M STAFF COLONY				2,550,000	455,175,000	1%
9	CONSTRUCTION MACHINERY & EQUIPMENT				7,595,541	1,355,804,069	2%
10	CONTINGENCY FOR CIVIL WORKS	%	5%	218,010,916	10,900,546	1,945,747,423	3%
B	**ELECTRICAL & MECHNICAL EQUIPMENT**				**105,398,764**	**18,813,679,338**	**29%**
1	ELECTRICAL WORK				26,720,646	4,769,635,247	7%
2	HYDRAULIC STEEL STRUCTURE EQUIPMENT				36,104,187	6,444,597,431	10%
3	ELECTRO-MECHNICAL EQUIPMENT				42,573,931	7,599,446,660	12%
C	**PRELIMINARY WORKS & EPC CAMP ESTABLISHMENT COST**				**31,648,106**	**5,649,186,921**	**8%**
1	BUILDINGS (2.0 % of Civil)		2%	218,010,916	4,162,026	742,921,641	1%
2	ESTABLISHMENT (6.0 % of Civil)		6%	218,010,916	12,486,080	2,228,765,280	4%
3	ENGINEERING	LS	1	15,000,000	15,000,000	2,677,500,000	4%
TOTAL EPC COST					**365,958,331**	**65,323,562,135**	**100%**

D. On Shore and Off Shore Work		(US$)	(Rps)	TOTAL USD
1	Civil Work + Others (On shore)		36,044,374,576	201,929,269
2	Mechanical & Eletrical Costs (On Shore)		1,505,094,347	8,431,901
Sub-Total (On Shore)			**37,549,468,923**	**210,361,170**
1	Civil Work + TBM (Off shore) + Engineering	58,630,298		58,630,298
2	Mechanical & Electrical Costs (Off Shore)	96,966,863		96,966,863
Sub-Total (Off Shore)		**155,597,161**		**155,597,161**
TOTAL EPC COST		**155,597,161**	**37,549,468,923**	**365,958,331**

Risk Considerations

Design Risks

Well-developed design is essential, taking into account of the factors such as geology, hydrology, installed capacity, shape and position of the weir and power plant, appurtenant structures, etc.

Hydrological Risk

The ability to deliver power once Kalam-Asrit hydropower project is constructed, will be contingent on the projected hydrological conditions for the output of power based on available hydrological data. This is important as unanticipated hydrological conditions may result in reduced power output, which in turn will reduce the project revenues.

Geological and Geotechnical Risks

The geological and geotechnical risks are in a very important category as they have an immediate influence on the construction costs as well as the safety of the scheme.

Cost of civil works, for the weir, power plant and appurtenant structures, are directly related to the quality of geology. The cost of excavation, or the need to consolidate foundations, can vary largely, if the rock quality differs from what has been originally expected. Numerous schemes include a lot of underground works (Power tunnel, etc), where geological and geotechnical problems are a critical factor. Geological and geotechnical information with good quality are therefore essential.

Another critical element is the availability of construction material. The distance between the construction site and the quarry site are also a critical factor, as transport of construction material is an important cost element. The quality of the construction materials is also critical. Carefully planned site installations can help decreasing construction costs and duration.

Seismic risks must be studied carefully, and the structures dimensioned to resist potential earthquakes (OBE & MCE values). Further consideration regarding the ground movement lies on liquefaction as of possibility in excessive installation of secant pile cutoff wall.

Construction Risk

The construction of the power plants involves substantial technical, commercial and financial commitments. The ability of the project to be finished on time is important in achieving the forecast return. A number of factors could cause delay in construction.

E&M Equipment and Suppliers Risks

Equipment with good quality is essential. It must be well adapted to O&M. Price, quality and ease of operation and maintenance has to be carefully studied during equipment selection. The design of components must be carefully selected to avoid problems such as cavitation. The expected production regime is also important to select the equipment, as well as parameters such as the regulation possibilities. Interface between civil works and electromechanical equipment are critical, and poor coordination can lead to serious problems and delays.

Energy Delivery Risks

Adequate evacuation of energy from sub-stations and transmission lines are mandatory.

Operation Risks

Risks particularly may occur during unplanned or emergency operation: opening of closure of gates due to unforeseen circumstances, either natural (flood, electrical problems, mechanical problems, etc.)

Legal, Political and Institutional Risks

Most of the legal risks are related to the frequently complicated structure of the financing, and the number of contracts involved (PPA, Concession, EPC, O&M, water rights, land property, etc.). Political issues can intervene during construction and operation delaying or stopping operation, also influencing electricity prices, imports, etc.

Economic and Financial Analysis

Project Tariff & Financial Statistics

Project tariff is calculated using two-tier structure as provided in the Policy and previous determinations of the NEPRA for similar projects.

Table 24 : Summary Financial Statistics of the Project

Project IRR	8.62%
Project NPV (US$ M)	41.21
Project Payback (years)	7.42
Project WACC	7.21%
Equity IRR	17.00%
Equity NPV (US$ M)	97.03
Equity Payback (years)	4.31
Levelized Tariff (PKR/KWh)	12.7350
Levelized Tariff (US¢/KWh)	7.1344

Conclusions and Recommendations

The feasibility study for Kalam Asrit hydropower projects summarizes and emphasizes major findings and recommendations as following. Those are the results of extensive field works including geological/geotechnical investigations, topographic survey, hydrological studies, project optimization, energy modeling, electro mechanical studies, accessibility studies, cost evaluation and construction method and schedule. The recommendations include further works to advance the project.

Study Conclusions

The feasibility study has planned the power tunnel route in the right bank of Swat River as it is advantageous to workability and economy. The weir position will be at Kalam village about 2 km downstream from the confluence of Gabral and Ushu Rivers where the beginning point of Swat River. The HRT route is parallel to Swat River's flow direction, straight down to Asrit village. The powerhouse will be at near Asrit village before reaching the confluence of Asrit Khwar and Swat River, about 12 km downstream from the intake.

The project has the following major components:

a) Gated weir structure near Kalam village

b) Natural desander between Debris dam (U/S Coffer dam) and Weir

c) Bypass Tunnel (Diversion Tunnel)

d) Power Intake in the right bank adjacent to Headrace tunnel

e) Headrace tunnel with a length of around 12 km

f) Surge shaft

g) Vertical pressure shaft

h) Horizontal pressure tunnel

i) Steel penstock & branches

j) Surface type powerhouse

k) Tailrace channel

- The recommended installed capacity is 238 MW as of the expected role from the project in Pakistan's power system.
- The project is expected to deliver average annual generation of 945.8 GWh with the plant factor of 45.37%.
- The mean annual flow is about 88.4 m^3/s. The estimated flow is using the local gauging station data. While there is some uncertainties due to the available information.
- Francis turbine with vertical shaft has been selected as the most appropriate turbine type for this project. Due to suspended sediments in the water, the turbine parts such as runner, guide vanes, etc. shall be considered an abrasion resistance coating.
- Main power supply scheme at powerhouse is that the applied connection scheme between the generators and four respective step-up transformers will be of conventional arrangement, with generator circuit-breaker and with tap-off to the excitation transformers and to the station service transformer.

- The main environmental issues will be related with the construction period concerns and the effect of the reservoir on the existing terrestrial habitat. The reservoir area will be affected by deforest from human activities.
- Social impacts will include effects on local population due to economic activities while the construction is ongoing. Some resettlement will take place for people currently living in the reservoir area and for people affected by some construction sites. The project will bring some significant change of lifestyle for all inhabitants of the area. A possible positive impact will be improved access to health, education and other public services.
- The key environmental issues during design, construction and operation phases of the project include bank stability of the river, dam safety and safety hazards for the staff requiring site specific ESMP.
- The overall findings of the environmental and social impact assessment show that the project is environmentally and socially viable provided that the mitigation measures are completely and effectively implemented.
- Construction is expected to require 5 years.
- The construction cost is USD 365,958,331 with a levelized tariff of 7.13 Cent/KWh.
- The ROE and ROEDC guaranteed by NEPRA is 17.0%.
- Annual operating and maintenance costs (O&M costs) of USD 7.34 mn are conservatively calculated to be worth 1.5% of Total Project Cost.
- Funding structure for the Project's construction comprises 20% of equity and 80% of debt.
- This project expects stable generation of positive net cash flow throughout the project period, which indicates that principal repayment seems promising under the base case scenario.
- According to the project review, it meets the financial institution's requirement of a stable cash flow necessary to generate for the debt repayment.

Recommendations

The project technically, environmentally and financially viable. Some additional development activities will enable the project for the next stage. The following recommendations and studies are proposed.

- Further geotechnical and geological investigations focus on ground investigations and in-situ test are recommendable for subsequent design phases. Additional lab test should also be carried out to extend the data on material properties for design and construction.
- Further analysis on climate change impact on the project hydrology including sediment will be beneficial.
- The applied efficiency of the units needs guarantee by future manufacturer.
- The minimum operating discharge for turbine will be dependent on turbine manufacturer's proposal. The study applies combination of one small unit (18 m^3/s) and three large units (37.3 m^3/s) to boost the power generation in which future turbine manufacturer should guarantee.
- The study recommends numerical analysis and physical modeling for the natural desander, spillway and flushing gate.
- Numerical analysis on Y-branch trifurcation is recommended to confirm the discharge distribution.
- Structural dynamic analysis is also recommended for major structures such as weir.
- The contractor will be required to prepare an SSEMP including temporary traffic management, materials management master plan, waste management plan, blasting management plan, oil spill management plan and HSE plan. The SSEMP should be deliverable by the contractors and approved by EPA- KPK. before construction commences.
- In this analysis, KPMG assumes that the term for repayment of debt is bi-annual repayment of debt spread over 12 years plus 5 years of construction period.

Environmental Impact Assessment for 238 MW Kalam-Asrit Hydropower Project in Swat District, Khyber Pakhtunkhwa

Volume I: Environmental Impact Assessment (EIA)

Final Report

SEES Ref: KA POWER LTD.-V01-001

Date: June 30, 2022

238 MW Kalam Asrit Hydropower Project

Environmental Impact Assessment (EIA)

Final

SEES REF: KA POWER LTD.-V01-001

June 30, 2022

KA Power Ltd.
Islamabad

Contents

LIST OF ABBREVIATIONS

amsl	Above Mean Sea Level
APs	Affected Persons
BAP	Biodiversity Action Plan
BDL	Below Detection Limits
BHU	Basic Health Unit
BOD	Biochemical Oxygen Demand
BOQ	Bill of Quantity
CBO	Community Based Organization
CDS	Comprehensive Development Strategy
CLO	Community Liaison Officer
CMC	Conservation of Migratory Species
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
dB	Decibel
DC	Deputy Commissioner
DOR	District Officer Revenue
DPR	Detailed Project Reports
DWSS	Drinking Water Supply Strategy
ECM	Entitlement and Compensation Matrix
ED	Environment Department
EIA	Environmental Impact Assessment
EIA	Environmental Impact Assessment
EMC	Environmental Monitoring Cell
EMMP	Environment Management and Monitoring Plan
EMP	Environmental Management Plan
EPA	Environment Protection Act\Agency
EPD_s	Environmental Protection Departments
ERC	Environmental and Resettlement Cell
ESDC	Environmental and Social Development Cell
GIS	Geographical Information System
GFP	Grievance Focal Points
GOKP	Government of Khyber Pakhtunkhwa
GOP	Government of Pakistan
GRC	Grievance Redressal Committee

GRM	Grievance Redress Mechanism
GWh	Gigawatt/hour
H_2S	Hydrogen Sulfide
HPP	Hydropower Project
IEA	International Energy Agency
IEE	Initial Environmental Examination
IUCN	International Union for Conservation of Nature
KAHPP	Kalam-Asrit Hydropower Project
KESC	Karachi Electric Supply Company
KM	Kilometer
KPK	Khyber Pakhtunkhwa
KV	Kilo Voltage
LAA	Land Acquisition Act
LARP	Land Acquisition & Resettlement Plan
LAC	Land Acquisition Collector
LAR	Land Acquisition Resettlement
LVC	Land Valuation Committee
masl	Meters above Sea Level
MBT	Main Boundary Thrust
MCM	Million Cubic Meter
MECE	Mutually Exclusive, Collectively Exhaustive
MW	Mega Watt
NCS	National Conservation Strategy
NEQS	National Environment Quality Standards
NGO	Non-Government Organization
NO_x	Nitrogen Oxides
NSDWQ	National Standards of Drinking Water Quality
NTU	Nephelometric Turbidity Units
NWFP	North-West Frontier Province
PADP	Provincial Annual Development Programme
PAPs	Project Affected Persons
PC	Planning Commission
PEPA	Pakistan Environmental Protection Act
PEPC	Pakistan Environment Protection Council
PEPO	Pakistan Environmental Protection Ordinance
PEDO	Pakhtunkhwa Energy Development Organization
PPIB	Private Power Infrastructure Board

PKR	Pakistan Rupee
PM	Particulate Matter
PMD	Pakistan Meteorological Department
PMF	Probable Maximum Flood
PMU	Program Management Unit
PNCS	Pakistan National Conservation Strategy
PPM	Parts per Million
PS	Performing Standards
PSA	Project Study Area
RAP	Resettlement Action Plan
RPM	Resolution per Minute
RS	Remote Sensing
SO_2	Sulphur Dioxides
SOP	Survey of Pakistan
SQ.km	Square Kilometer
TCU	True Color Units
TOR	Terms of Reference
UC	Union Council
WAPDA	Water and Power Development Authority
WB	World Bank
WHO	World Health Organization
WWF	World Wildlife Fund

Revision History

Revision	***Date***	***Details***	***Prepared***
Draft	20 Jan 2022	The initial draft for circulation and commenting	AZMEC
Final	26 April 2022	Final	AZMEC

Approvals

Prepared by:	***Reviewed: by***	***Approved by***
AZMEC	KA Private Limited	

Executive Summary

ES.1 Introduction

This report presents the findings of the Environmental Impact Assessment (EIA) for the 238 MW Kalam-Asrit Hydropower Project proposed by Korea South-East Power Co. (KOEN) through its subsidiary KA Power Ltd (The Proponent). The studies are carried out by AZMEC Consulting Engineers (AZMEC). The proposed project will be developed on the purchase from private owners and the Government of Khyber Pakhtunkhwa in Kalam and Asrit villages of tehsil Behrain, district Swat of Khyber Pakhtunkhwa province (KPK). A key map of the project area showing the exact location for the establishment of the proposed Hydropower Project is presented as **Figure ES-1.**

This report presents the existing Environmental and Social (E&S) baseline conditions and evaluation of the EIA concerning the following parameters of the Hydropower plant:

- Design and construction phase.
- Operational and maintenance phase; and
- Post-operational and Decommissioning phase.

The EIA study process for the proposed 238 MW Kalam-Asrit Hydropower Project uses major international (IFC, ADB etc.) and national guidelines related to Hydropower plant project design, construction, operation, and decommissioning.

Commonly applied international lenders' regulatory frameworks are provided by the IFC Performance Standards, Asian Development Bank Safeguards and Regional regulatory framework is published by the Khyber Pakhtunkhwa Environmental Protection Agency (KPK EPA). Currently, there are no specific guidelines published by the Government of Pakistan/KPK in relation to the design, construction, operation and decommissioning phases for Hydropower projects. Similarly, Equator Principles (EP) have also been applied towards the environmental and social assessment of this project.

The proposed project weir (35°27'52.65"N 72°35'52.42"E) will be located at Kalam at approximately 2 km downstream from the confluence of Gabral and Ushu Rivers. The powerhouse (35°21'45.62"N 72°36'6.20") is located upstream of Asrit Khwar, which is about 600m downstream from the intake. The site is about 97 km away from Saidu Sharif Airport, Swat and is upstream of the 229 MW Asrit Kedam Hydropower Project. Project area maps for the proposed Kalam-Asrit Hydropower project is presented in Figures ES-2 & ES-3.

The Project is being implemented by KOEN under the KPK Hydropower Policy of 2016 and Federal Government Power Generation Policy of 2015 on a BOOT (Build, Own,

Operator, Transfer) basis. A Tripartite letter of support shall be asked by the Private Power Infrastructure Board (PPIB) and Pakhtunkhwa Energy Development Organization (PEDO).

Original feasibility study of the project was carried out by a Korean Consultant Saman Corporation in collaboration with local and international consultants.

The Environmental & Social (E&S) impacts were assessed in compliance with the relevant national and international environmental legislation and guidelines related to Hydropower plant projects development and operations.

The Hydropower project is being developed in an area, which is mountainous, having agricultural areas, with sparse forest, barren and range land. No sensitive ecological habitats with high ecological value were found during the field surveys of the EIA. Similarly, Involuntary Resettlement Category, the proposed project falls in Category-B. The construction of the 238 MW Kalam Asrit project has an impact on 73 DPs (less than 200), who will experience impacts in terms of losing, their housing and 10% or more of their productive assets project vicinity is expected to be adversely impacted by the proposed project activities.

The approach for identification of Environmental and Social Impact Assessment was based on MECE (Mutually Exclusive, Collectively Exhaustive) methodology which guides to include a broad range of aspects concerning financing arrangements, regulatory requirements and environmental controls of lender, details of technology and plant layout etc.

ES.2 The EIA Methodology

Various steps undertaken for the EIA preparation include understanding of the proposed project; review of provincial, national and international legislation and guidelines; EIA scope and methodology; a collection of secondary data including physical, biological & socioeconomic environment and, cultural and heritage aspects; primary field data collection; potential environmental impacts identification; recommendations for mitigation and monitoring measures; development of Environmental Management Plan (EMP) and reporting.

Field surveys for the EIA study were carried out by a team of environmental specialists, fisheries experts, sociologists/gender experts, wildlife experts, botanists and archaeologists along with representatives from KPK Wildlife, forest and revenue departments during September 2021. Field data collection included ground trusting of available secondary information. Secondary information was obtained from KA Power Limited, other sources like previous environmental studies in the region, published data and schedule rates from the forest, revenue, agriculture, fisheries and wildlife departments and respective District Census Reports (DCRs).

ES.3 Objectives of the EIA

The objectives of this EIA are to:

- Assess the existing E&S conditions in the proposed project area including the identification of environmentally sensitive area(s) to develop a baseline of its prevalent environmental and socioeconomic conditions;
- Identify and investigate all potential environmental and social impacts of the proposed Hydropower plant's construction, commissioning, operational and decommissioning activities on the physical, biological, socio-economic and cultural environment of the project area;
- To propose mitigation measures that would help the Proponent. in carrying out the project related activities in an environmental and socially sustainable manner;
- To uncover the planning, development and operational phase impacts up to microenvironment levels in which project is being sited;
- Assess the proposed activities and determine whether they comply with the relevant environmental regulations in Pakistan and KPK, as well as with requirements of the project lenders; and
- Prepare an EIA report supplemented by Environmental Management Plan (EMP) for effective implementation of the recommendations of the EIA and submittal to the project lenders.

ES.4 International Finance Corporation's (IFC) Performance Standards (PS) on Environmental Sustainability

The IFC's PS(s) are applied to manage E&S risks and impacts. Together, the eight PS(s) are required to comply by the proponent throughout the project life. The proponent will follow the IFC's PS(s) on E&S sustainability as well.

ES.5 Requirement of EIA

This EIA study of the project has been done as per requirements Pakistan Environmental Protection Act 1997 as well as KPK- Environmental Protection Act 2014.

Land acquisition and resettlement aspects have been studied concerning WB/IFC Involuntary Resettlement guidelines, Land Acquisition Act (Act I of 1894), The Land Acquisition (KPK Amendment) Act 2020 and National Resettlement Policy (March 2002).

a) Pakistan Environmental Protection Legislation IEE/EIA

The Pakistan Environmental Protection Act 1997 (PEPA-1997) Section 12 lays down basic requirements and procedures for the Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA). The Act provides that "No proponent of a development project shall commence construction or operation unless he has filed an IEE or EIA with the Government Agency designated by the Federal Environmental

Protection Agency or Provincial Environmental Protection Agencies, as the case may be, or, where the project is likely to cause a significant adverse environmental effect, an Environmental Impact Assessment (EIA), for approval from Government Agency in respect thereof".

b) Pakistan Environmental Protection Act 1997 (PEPA - 1997)

Pakistan Environmental Protection Act, 1997, has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects.

c) Pakistan Environmental Protection Agency (PAK. EPA)

Under Section 5 of PEPA-1997, Pakistan Environmental Protection Agency has been established with a Director-General as its head. Sections 6 and 7 of PEPA 1997 describe the functions and powers of the Agency. Similarly provincial EPA‟s is functional in each province as provided in PEPA-1997. The province (Khyber Pakhtunkhwa) has its own EPA.

d) Khyber Pakhtunkhwa Environmental Protection Act, 2014

Khyber Pakhtunkhwa Environmental Protection Agency, already established under the Pakistan Environmental Protection Act, 1997 to exercise the powers and perform the functions assigned to it under the provisions of this Act and the rules made. The Agency, headed by a Director-General who shall be appointed by Government in the manner as it may determine and have such administrative, technical, legal and enforcement staff, as Government may appoint. The Director General may, by general or special order, delegate any of the powers and functions to staff appointed. For assisting the Agency in the discharge of its functions, Government may establish Advisory Committees for various sectors and appoint their members from amongst eminent position of the relevant sector, educational institutions, research institutes and non-governmental organizations.

Subject to the provisions of this Act, rules, notifications, and guidelines made thereunder.

1. No person shall discharge or emit or allow the discharge or emission of any effluent or wastes or air pollutant or noise, load, concentration or level which is more than the Environmental Quality Standards or, where applicable, the standards established; and
2. No person shall discharge effluents, emissions or wastes in excess of load permitted in the conditions of environmental permit or environmental approval or license.

e) Environmental Tribunals

Under Section 21 of the "The Khyber Pakhtunkhwa Environmental Protection Act 2014", Tribunals have been established to trial cases of contravention or failure to comply with designated provisions of KP Environmental Protection Act 2014. According to Environmental Tribunals rules, the tribunal shall make every effort to dispose of a complaint or an appeal or other proceeding within 60 days of its filing.

f) Land Acquisition Act 1894

The Land Acquisition Act (LAA) 1894 is a "law for the acquisition of land needed for public purposes and companies and for determining the amount of compensation to be paid on account of such acquisition". The Land Acquisition Act 1894 provides a comprehensive mechanism of land acquisition for public purposes or companies based on the market value by an independent pricing committee.

g) National Resettlement Policy and Ordinance

The LAA is limited to a cash compensation policy for the acquisition of land and built-up property, and damage to other assets, such as crops, trees, and infrastructure based on market prices. The LAA does not consider the rehabilitation and resettlement of disrupted populations and the restoration of their livelihoods. There are some other context-specific provincial regulations and policies, which are incorporated to complement the process of Land Acquisition and Resettlement. For instance, the Affected Persons Ordinance 2001, WAPDA Act 1958 and EPA's National Resettlement Policy, 2002 Despite having a comprehensive land acquisition law in place, Pakistan does not have any law regarding involuntary resettlement caused by development projects. Pakistan, therefore, follows the resettlement policy of donors where applicable, therefore, Land Acquisition and Involuntary Resettlement as spelt out in IFC PS5 will form the basis for managing the resettlement needs arising from the project.

h) Legislation on Environmental Management Plan (EMP)

Under the Good International Industry Practice (standards), "Policy and Procedures for the filing, review and approval of environmental assessments", the EMP is generally defined as a "document designed to ensure that the commitments in the" Environmental Report, subsequent review reports, and Environmental Approval conditions are fully implemented".

i) National Environmental Quality Standards (NEQS)

The National Environmental Quality Standards (NEQs) specify the standards apply to gaseous emissions and liquid effluents discharged by batching plants, asphalt plants, camp sites, construction machinery, and vehicles. The standards for a vehicle, noise wastewater and drinking water will apply during the construction as well as operational phase of the project

ES.6 Study Zone

Consultant teams explored the spatial boundaries of the environmental impact assessment area and attempted to cover all the areas prone to any changes either directly or indirectly with Kalam-Asrit HPP. The experts considered various stages of the project specifically the construction and operation phases. Additionally, the cumulative level of various Hydropower projects in the Basin was considered keeping in view the developmental plans of Pakhtunkhwa Energy Development Organization (PEDO). The permanent footprint of the proposed project includes the area that will be acquired for the weir, reservoir, powerhouse, roads and some other facilities. The temporary footprints include the land that will be required or disturbed due to the facilities that will be developed during the construction phase in the weir, powerhouse and other infrastructure components.

Aquatic Study Zone

Swat River stretches starting from Kalam (Swat River) which is considered the upstream section of proposed HPP to the downstream (Asrit) is taken as an aquatic study zone. The length of the river is approx. 12 km, which include the tributaries in the stretch.

Terrestrial Study Zone:

500m buffer is taken on each side of the river where Project-related facilities are to be located as well as the reservoir.

Socio-economic Study Zone:

During the socio-economic studies, 500m buffer on each side of the river including the settlements are considered. In over to cover the communities around the permanent project facilities or the temporary, a 1km cover as buffer radius is taken to identify a range of communities around the project facilities.

ES.7 Physical Baseline

Topography

The project area is mountainous, with an altitude generally between 6500 to 5700 feet above mean sea level (amsl).

Land Use and Cover

The mountain ranges generally run from north to south. The reservoir area of the project is under barren and rangeland. A moderate number of forest trees, fruit trees, mixed shrubs and grassy patches also exist.

Climatic Conditions

The project area falls in the sub-humid and sub-tropical zone of district swat with moderate summer and extremely cold winter. The hottest month is June with mean maximum and minimum temperature of 33°C and 16°C respectively, and the coldest month is January with mean maximum and minimum temperature of 6.9°C and -7.6°C, while the annual precipitation averages 866 mm (34.1 in).

Water Resources

Surface water is a major water resource in the project area, Nullah water is consumed as drinking water, which is supplied through a pipeline network. Nullah surface water is also used for cultivation.

There are no significant deviations observed based on sampling conducted by specialists concluded; for water analysis in project area more than 10 water samples, near weir site and others near powerhouse site were collected by an EPA-KPK certified Environmental lab. The sampling also included streams and minor water channels along the river.

All the water quality parameters (Sixteen parameters) are within NEQS and WHO Drinking water standards.

Ambient Air Quality

The ambient air quality was measured for respirable particulate matter (PM), sulfur dioxide (SO2) and oxides of nitrogen (NOX). Air quality sampling was carried out at two different locations in the Study Area.

Key observations of the basis of the sampling conducted by the Sustainable Environmental Services are

- The 24-hour PM10 and PM2.5 concentrations comply with both the NEQS and IFC-EHS limits at all sampling locations (Powerhouse Site and Weir Site).
- The 24-hour concentrations of SO2, CO, NO2 and NO comply with both the NEQS and IF-EHS limits.
- The air quality in the area is also good, revealed from instrumental analysis on air quality monitoring results are discussed in Chapter 4, while the Environment Monitoring report is Appendix-C

Noise Quality

During the site study baseline, ambient noise levels in the study area of Kalam-Asrit were assessed. Noise measurements were taken at 2 locations (Weir and Powerhouse) which are considered the possible sources of noise pollution from project activities. The sampling duration was extended to 24hours at each the sites

There are no major industries in and around the project area; therefore, noise pollution was observed to be generally below 65 dB (A).

Most of the noise around the project area corresponds to river flow and surrounding traffic movements.

ES.8 Ecological Resources

The project area falls in the sub-humid and sub-tropical zone of district swat with moderate summer and extremely cold winter. However, for all the habitats in the project, area doesn't fall under the protected wildlife category. However, some of the project area around the powerhouse classified as a protect forest area by the KPK Forest Department. Further details on the ecological resources are provided below

Terrestrial Fauna

A total of 7 mammals were recorded/observed from the project area. The Red Fox, Rhesus monkey, Asiatic Jackal, and Leopard Cat. Among these species, none are listed as vulnerable by IUCN.

The common small mammals are Indian Gerbil, House Mouse, Woolly Flying Squirrel, Asian Palm Civet, Indian Bush Rat, Himalayan Marmot and Stoat. A total of 3 reptiles were recorded/observed from the project area and the common species are Bengal Monitor Lizard, (*Varanus bengalensis*), Indian Spiny-tailed Lizard (*Saara hardwickii*), and Common Leopard Gecko (*Eublepharis macularius*) along with species of frogs and snakes. None of these species are listed in IUCN Red List as endangered or near threatened.

Terrestrial Flora

Similarly, regarding floral attributes, a total of 40 vegetation species belonging to various plant families were found on the project site. None of the rare, endemic or threatened floral species was identified during the EIA site visit and is widely distributed in the Swat district. Furthermore, the ecological specialist conducted a detailed measurement of trees volume in the project area based on diameter, basal area, average height etc.

Aquatic Fauna

During the aquatic sampling and survey, two fish of commercial importance i.e. the exotic Brown Trout (*Salmo trutta*) and the indigenous Snow Carp (*Schizothorax plagiostomus*) were found near Kalam, i-e upstream of the weir site. During population abundance trials total catch of the brown trout was 90% and that of snow carp was 10% only. Field reconnaissance presents that none of the aquatic species is endangered or critically endangered.

Avifauna

A total of 12 birds' species were recorded from the project area. House Sparrow, House Crow, Raven, Chukar Partridge and other commonly observed bird species such as Collared Dove, Little Brown Dove, House Crow, House Sparrow, Red-vented Bulbul, Common & Bank Myna, Little Green bee-eater, Crested Lark and White-cheeked Bulbul. Among the raptors, Black Kite, Brahminy Kite, Common Buzzard, Common Kestrel, Marsh Harrier, Steppe Eagle, Tawny Eagle and a White-eyed Buzzard were also recorded can be seen. Prevailing dry alpine and moist temperate forests and cold temperatures during the ecological assessment of the area. The area is a transitional zone between plains and foothills of the Himalayas. It provides a diverse habitat to the birds' species such as winter migrants from higher altitudes and summer migrants from lower altitudes. This renders higher bird diversity and species richness. The diversity of species in a particular area depends not only on the number of species found but also on their individuals' counts. Most of the species belong to the status of least concerned in terms of the IUCN Red list, however, Parakeet and Black Patridge are considered to be in a vulnerable state due to hunting. These two species were not found specifically in the project area during surveys but are commonly reported in secondary data (literature).

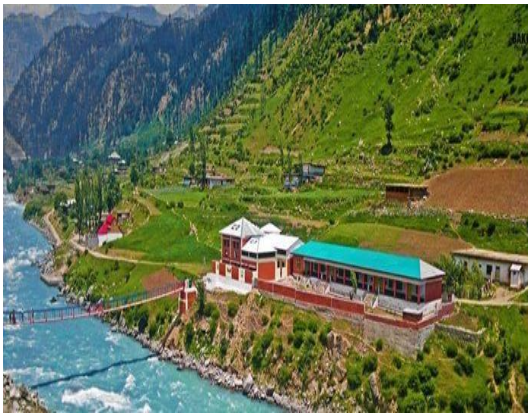
ES.9 Socioeconomic Environment

The proposed 238 MW Kalam-Asrit hydropower project start from Kalam (adjacent to Boyun) and leads towards Asrit village by passing through Dadul Karandoki, Pushmal, Ariyan Bagla and Asrit villages of Tehsil Bahrain district Swat. To find out the social status of the residents, social surveys in the study area villages was carried out at the different locations shown below

Exhibit I: Physical and Socioeconomic Features of the Study Area

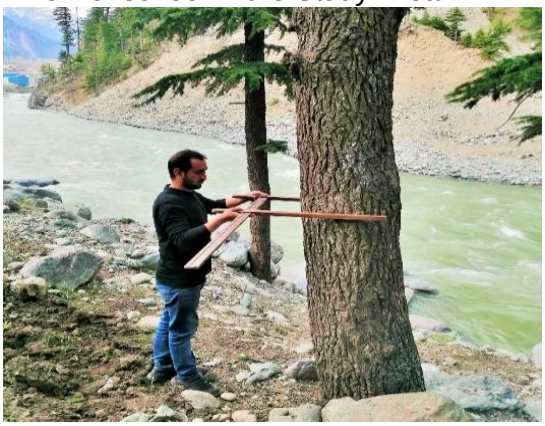
View of Sand Deposits in Kalam

Transportation in the study area



View of school in the Study Area

Housing Pattern in the Study Area



View of Ecological assets measurements

View of Social Consultations

View of River from weir area

Markets in the upstream area away from weir

There are 04 villages in the project area, from which there are specifically 13 settlements from the weir site (Pushmal Village) and 5 from the powerhouse sites (Asrit Village) are being affected due to the project. Other villages are not to be affected

significantly directly by the land resettlement issues. The following table shows the villages name that are linked with project areas.

Sr. No.	Name Village	Population	Number of houses
1.	Dadul Karandoki Village	1350	140
2.	Pushmal Village	105	17
3.	Ariyan Bagla Village	700	100
4.	Asrit Village	350	60

Socio-economic surveys were conducted to obtain a detailed understanding of the socio- economic conditions of the APs. This information will provide baseline data for the monitoring of the implementation of the LARP and the impacts of the project. The key variables covered in the surveys and qualitative interviews include

(i) demography

(ii) social organization;

(iii) main occupations;

(iv) income and expenditure levels;

(v)access to public services

(vi) personal property.

All data collections and presentations were disaggregated by gender and other relevant social characteristics, depending on the social group of concern. The socio-economic survey of the project area covered all the available affected households. The survey results show that most of the women are housewives and men are majorly related to the occupational side and act as an earning hand of the house. Out of which, 39% of the male workforce is linked with farming, whereas 20% with livestock which includes poultry, cows, goat, sheep and even horses, 11% in the private sector and 16% in their own business activities. The average annual income of the affected population per household is approximately Rs. 480,000/- at the reservoir area and almost Rs. 160,400/- at the powerhouse side. The higher income rate of households at the reservoir site is mainly because of different business activities along with farming.

In addition to that, educational facilities are not appropriate in the area, females are not encouraged much for getting the education. Only 02 schools and 02 madrassah are situated in the project area, which lacks proper infrastructure, clean drinking water facilities, lack of play grounds etc. There are no hospitals only one dispensary is working on the project and for the surrounding area. The community of the project area strongly demand the medical facility during the conduction socioeconomic

questionnaire. For medical treatment, people have to visit a dispensary/medical clinic in Bahrain, Madyan or Kalam.

Sediment mining is carried out to a small extent around the powerhouse and weir areas that are accessible. The mineable sediment resource is being extracted to meet small-scale construction demand, involving construction and maintenance of local residential and commercial buildings. The mining techniques are crude, involving use of labour for dredging and use of local livestock and tractors for the movement of sediment.

None of the settlements surveyed in the Socioeconomic study area are connected to a municipal sewage system like in cities. Human waste in some parts of the Mankial and Balakot is disposed of in septic tanks in properly constructed houses, however, in the majority of areas all wastewater eventually runs off into the River Swat. Most settlements surveyed reported access to pit latrines of some type.

During the socio-economic survey, the respondents of the community observe tourism as a major influx of capital into the local area economy. Due to various tourism spots around Kalam, Atror, Ushu and surrounding tourism and recreational activities.

ES.10 Environmental Flows

The ecological study presented in the report provides details for the changes expected on the population of fish and the expected barriers created by other weirs including Kalam-Asrit HPP.

Minimum Environmental Flow (EFlow) will be released from the weir to meet the requirements of the aquatic ecosystem as the powerhouse is located at a distance of approx. 12 km. However the Proponent. has devised a scheme for river diversion (Cofferdam and Diversion Tunnel) and plans to allow a minimum of approx~2.8 Cumec flow to maintain the river ecology during low flow seasons. The E Flow study adopts 2.8 Cumec using CHEMGRAPH method for calculation of E-Flow which is much advanced level as compared to conventional methods of using 10% of monthly average river flows.

Moreover, there are approximate 5 major tributaries that fed water in this stretch, Details are given in the following Table. Tinka & Boh Nullahs are just 700 & 800 m downstream of the weir site, respectively. These tributaries flow an additional volume of water into the channel which will be the additional volume of water present in the river to maintain the ecological integrity of the river.

S. No	Name	Location	Bank	GPS Coordinates
Stream 1	Ghail Nullah	Upstream of Weir	Right	35.466007,

				72.585871
Stream 2	Bilyo Nullah	Downstream of Weir	Left	35.460660 72.598990
Stream 3	Hernaai Khwar (Nullah)	Downstream of Weir	Left	35.439342, 72.616888
Stream 4	Markiyal Khwar	Downstream of Weir	Left	35.427007, 72.631951
Stream 5	Not Named yet	Downstream of Weir	Left	35.412290, 72.609644
Stream 6	Laikot Ghat Khwar (Nullah)	Downstream of Weir	Right	35.404083, 72.598620
Stream 7	Mashkoon Nullah	Downstream of Weir	Right	35.398040, 72.602429
Stream 7	Khankai Nullah	Downstream of Powerhouse	Left	35.381448, 72.609220

ES.11 Project Benefits

Hydropower provides renewable, sustainable and indigenous energy with wide-ranging benefits including:

Climate change – The release of toxic gases into the atmosphere, such as carbon dioxide, methane and nitrous oxide does not only contribute to air pollution but also enhances the greenhouse effect. Generating electricity from Hydropower plants produce no greenhouse gases whatsoever, while only minimal harmful and toxic emissions are released which are not directly related to the power production process, rather from supporting activities i.e. use of vehicles and heavy machinery, backup generators etc. The same also reduces the carbon footprint and so can reduce the negative effects of climate change.

Independent research has shown that the use of hydropower instead of fossil fuel for electricity generation has helped to avoid 100 billion tons of carbon dioxide in the past 50 years alone.

Reducing reliance on fossil fuels – Reducing reliance on these finite resources and taking advantage of an abundant, free source of energy means lower energy prices, reduction of greenhouse gas emissions and a stronger more stable energy future.

Social advantages – The Project will improve the socioeconomic dynamics of the area through generation of employment opportunities, sustenance of income, development of infrastructure including education, health facilities and means of access etc. Additionally, creation of business opportunities and locals' engagement for socio-economic benefits will increase overtime.

Improved Tourism- The Project is expected to enhance the tourism sector of the area and plans to provide additional spots to enhance the tourism sector or the area. The project will involve directly affected population once the weir is operationalized several hot spot safe areas around the project will be improved for better tourism and employment generation activities.

Using less water – Generating energy through Hydropower does not use all the water diverted through diversion tunnel and will be released back in River Swat through powerhouse tailrace. Traditional energy production methodologe.g. coal and thermal power generation uses large quantities of water for their power production process in the amounts of 2.15768 $m^3$0F[1] per minute for processing and cleaning.

ES.12 Public Consultation

The Environmental Protection Act (PEPA 1997) makes the participation of the local communities mandatory in the planning and design of a development project. Scoping session is a process that ensures participation of the Project affected persons (PAPs), communities, notables, elite and other stakeholders of the project area. The Pak-EPA, under Regulation 6 of the IEE-EIA Regulations 2000, has issued a set of guidelines of general applicability and sectoral guidelines indicating specific assessment requirements. The consultation process was designed to be consistent with the relevant national legislation and the IFC PS on social and environmental sustainability.

Following points were discussed during the public and institutional consultations:

- Project components, activities and impacts on public.
- Needs, priorities and reactions of the affected people regarding the proposed project.

[1] https://www.gem.wiki/Water_consumption_from_coal_plants

- Water requirements.
- Effect on Environment and Health.
- Reservoir inundation Impact on Flora and Fauna.
- Impact on local culture and privacy.
- Ensuring the participation of the PAPs in the resettlement planning.
- Grievances redressal procedures.
- Entitlement Matrix development for affectees of the project.
- Evaluation criteria of the buildings.
- Basis for determining the rates of the land, houses, and other infrastructure.
- Compensation framework for the project affectees.
- Role of affectees in implementation of the project.
- Early Flood Warning systems.
- Social Issues, lack of safe water supply and employment, etc.

These consultations were held in a participatory way with the following primary and secondary stakeholders comprising of locals including females, farmers, businessmen, labour, representatives of concerned departments, and Affected Persons (APs).

ES.13 Impacts and Mitigations

The EIA covers potential E&S impacts of the proposed project activities in the project area. Potential impacts on the physical, biological, socioeconomic, and cultural environment that may arise from the proposed project activities and the related mitigation measures that will be adopted to reduce or minimize the identified impacts have been assessed and are summarized in **Table ES-6.**

Permanent Land Requirement

The total land acquisition area is 571.15 Kanal. The only major adverse impact of the project is acquisition of 256.7 Kanal of land out of which approx. 231.25 Kanal (to be used for construction of labour camps and disposal areas) is privately owned land and the remaining 25.45 Kanal is government-owned land. A comprehensive Land Acquisition and Resettlement Action plan (LARP) is prepared to mitigate and monitor the mitigation of this impact timely.

Temporary Land Requirement

314.45 Kanal is the temporary acquisition of land which is owned by the government and consist of cultivable and wasteland for the construction of labor camp and waste disposal area.

Components of the Kalam Asrit-Hydropower Project will exploit the water resources of the Swat River for power generation which will require the Land as per the following details:

ES Table-1: Details of Impact on Land

Project Components	Permanent (Kanal)		Temporary (Kanal)	Total (Kanal)
	Private	Government	Government	
Reservoir Area	47.60	-	-	47.60
Weir/Intake	29.85	0.35	-	30.20
Disposal Site-I	8.85	-	-	8.85
Disposal Site-II	1.80	0.10	-	1.90
Disposal Site-III	25.55	-	8.95	34.50
Disposal Site-IV	-	-	111.65	111.65
Disposal Site-V	-	-	37.90	37.90
Disposal Site-VI	-	-	60.95	60.95
Power House	117.60	25.00	45.00	187.6
Worker Camp	-	-	50.00	50.00
Total	**231.25**	**25.45**	**314.45**	**571.15**

The Land Acquisition and Resettlement Plan is prepared and annexed with this EIA on the basis of all sorts of impacts on physical aspects such as land, various types of structures, trees along with the necessary compensation and allowances. The study has been carried out based on the socio-economic and impacts assessment surveys and on-going consultations through meetings, interviews, focus group discussions with APs and other stakeholders as well. The project in brief will have the following impacts

- Total 04 Villages, Dadul Karandoki, Pushmal, Ariyana bagla Pushmal and Asrit will be impacted directly and/or indirectly by the project.
- Total land to be acquired is 571.15 Kanal out of which 339.90 Kanal is government owned land and rest 231.25 Kanal is privately-owned land.
- Out of the 571.15 Kanal, permanent acquisition would be 256.70 Kanal and temporary acquisition would be 314.45 Kanal.
- A total number of 11 households, 7 at weir site (Shaid bagh, Pushmal) and 4 at powerhouse (Asrit) will be physically displaced.
- 1 commercial buildings which are under construction will be displaced.
- 8 electric poles at the powerhouse site will be relocated.
- Moreover approximately 218 trees will be cut down due to construction of weir, powerhouse, access road and associated facilities for the project details is given below;

E S Table-2: Details of Affected Trees

Project Site	Wild trees	Fruit Trees	Firewood / Timbre Trees	Total
Weir / Reservoir Side (Right Bank)	61	10	39	110
Weir / Reservoir Side (Left Bank)	44	4	-	48
Powerhouse	35	18	7	60
			Total	**218**

The loss of trees will also be compensated by successful plantation of native species. The lost trees will be replaced at a ratio of 1:10 with consultation of forest department. A tree plantation plan is established for plantation of 2,180 trees, in this regard to ensure growth of plantation till maturity.

Apart from the above impacts of land acquisition, inundation of reservoir and tree cutting, all other impacts of the project are temporary, reversible and can be mitigated easily with the implementation of EMP (Volume II) and Good International Industry Practice (GIIP). A summary of the impacts assessed before and after mitigation measures are shown in **ES Tables 3 and 4**.

ES Table-3 Summary of Construction Phase Impacts

A. Impacts on Physical Environment												
Nature of Impact	**Initial Impacts**						**Residual Impacts**					
	Nature	Duration	Geo Scale	Severity	Likelihood	Significance	Nature	Duration	Geo Scale	Severity	Likelihood	Significance
Land Acquisition	Direct	Short-Term	Local	Medium	Low	Medium	Direct	Short-term	Local	Low	Low	Low
Submergence of Road	Direct	Short-Term	Local	Medium	Low	Medium	Direct	Short-term	Local	Low	Low	Low
Air Quality	Indirect	Medium-Term	Local	Low	Medium	Low	Indirect	Medium-Term	Local	Low	Low	Low
Noise Levels	Direct	Short-Term	Local	High	Medium	High	Direct	Short-term	Local	Medium	Low	Low
Vibration from Blasting	Direct	Short-Term	Local	Medium	Medium	High	Direct	Short-Term	Local	Low	Low	Low
Flying Debris from Blasting	Direct	Short-Term	Local	Medium	Medium	High	Direct	Short-Term	Local	Low	Low	Low
Visual Impacts	Direct	Medium-Term	Local	Low	Low	Low	Direct	Short-Term	Local	Low	Low	Low
Water Resource Depletion	Direct	Medium-Term	Local	High	Medium	High	Direct	Short-Term	Local	Low	Low	Low
Water Pollution	Direct	Medium-Term	Local	High	Medium	High	Direct	Short-Term	Local	Low	Low	Low
Municipal Solid Waste	Direct	Medium-Term	Local	Medium	Medium	High	Direct	Short-Term	Local	Low	Low	Low
GHG Emission	Indirect	Medium-Term	Regional	Low	Medium	Medium	Indirect	Short	Regional	Low	Medium	Medium
Road Accessibility	Indirect	Medium-Term	Local	Low	Medium	Medium	Indirect	Short-Term	Local	Low	Low	Low
Traffic Congestion	Indirect	Medium-Term	Local	Low	Medium	Medium	Indirect	Short-Term	Local	Low	Low	Low
Health & Safety	Direct	Medium-Term	National	Medium	Medium	Medium	Direct	Short-Term	Local	Medium	Low	Low
COVID-19 Epidemic	Direct	Medium-Term	Local	Medium	Low	Medium	Direct	Short-Term	Local	Low	Low	Low
B. Impacts on Biological Environment												

Nature of Impact	Initial Impacts						Residual Impacts					
	Nature	Duration	Geo Scale	Severity	Likelihood	Significance	Nature	Duration	Geo Scale	Severity	Likelihood	Significance
Flora	Direct	Medium-Term	Local	Low	Low	Low	Indirect	Short-Term	Local	Low	Low	Low
Terrestrial Fauna	Direct	Medium-Term	Local	Low	Low	Low	Indirect	Short-Term	Local	Low	Low	Low
Habitat Loss	Indirect	Short-Term	Local	Low	Low	Low	Indirect	Short-Term	Local	Low	Low	Low
Aquatic Fauna	Direct	Long-Term	Local	Low	Low	Low	Direct	Short Term	Local	Low	Low	Low
Fisheries	Direct	Long-Term	Local	Low	Low	Low	Direct	Short Term	Local	Low	Low	Low
Avi-Fauna	Direct	Short-Term	Local	Medium	Medium	Medium	Direct	Short Term	Local	Low	Low	Low
Wildlife	Direct	Long-Term	Local	Low	Medium	Medium	Direct	Short Term	Local	Low	Low	Low
Protected Areas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

C. Impacts on Socioeconomic Environment

Nature of Impact	Initial Impacts						Residual Impacts					
	Nature	Duration	Geo Scale	Severity	Likelihood	Significance	Nature	Duration	Geo Scale	Severity	Likelihood	Significance
Community Health & safety	Direct	Short Term	Local	Medium	Medium	Medium	Direct	Short Term	Local	Low	Low	Low
Commute	Direct	Long Term	Local	High	High	High	Direct	Long Term	Local	High*	High*	High*
Employment Opportunities	Direct	Long Term	National	Medium	Medium	Medium	Direct	Long	Local	High*	High*	High*
Labor Influx	Indirect	Long Term	Local	Medium	Medium	Medium	Indirect	Long Term	Local	Medium	Low	Medium
gender and cultural issues	Direct	Long Term	Local	Medium	Medium	Medium	Direct	Medium	Local	Low	Low	Low
Sustenance of income	Direct	Long Term	Local	High	Medium	High	Direct	Short Term	Local	Low	Low	Low
Indigenous People	Indirect	Short Term	Local	Low	Low	Low	Indirect	Short Term	Local	Low	Low	Low
Grievances	Direct	Long Term	Local	Medium	Medium	Medium	Direct	Medium	Local	Low	Low	Low

The * impact present enhanced positive impact

ES Table-4 Summary of Operational Phase Impacts

Nature of Impact	Initial Impacts						Residual Impacts					
	Magnitude	Duration	Scale	Consequence	Probability	Significance	Magnitude	Duration	Scale	Consequence	Probability	Significance
Reduced Flows	Direct	Long Term	Local	Medium	Medium	Medium	Direct	Short Term	Local	Low	Low	Low
Inundation of Terrestrial Habitat	Direct	Long Term	Local	Medium	Medium	Medium	Direct	Short Term	Local	Low	Low	Low
Weir Integrity	Direct	Long Term	Local	High	Medium	High	Direct	Short Term	Local	Low	Low	Low
Aquatic Habitat	Indirect	Long Term	Local	High	Medium	High	Indirect	Long Term	Local	Low	Low	Low
Fish Migration	Direct	Long Term	Local	High	Medium	High	Direct	Short Term	Local	Low	Low	Low
Birds Collision	Direct	Long Term	National	Medium	Medium	Medium	Direct	Short Term	National	Low	Low	Low

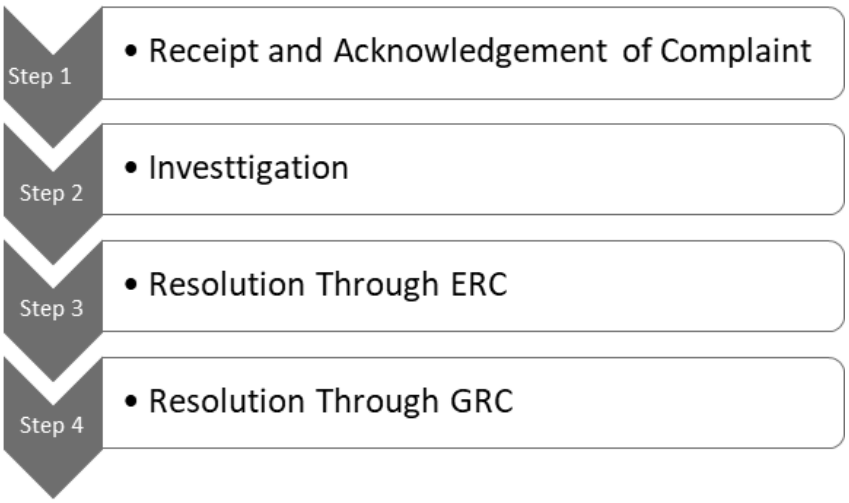
ES.14 Grievances Redress Mechanism

A Grievances Redress Mechanism has been put into place where all the project stakeholders are provided an avenue to file complaints regarding any aspect of the environmental / ecological disturbance, construction impacts, land acquisition and resettlement requirements and other project-related issues. The complaints can be made verbally or in written form.

Under the Project the following has been established and appointed to ensure timely and effective handling of grievances:

- An Environmental and Resettlement Cell (ERC), which is responsible to receive, log, and resolve complaints
- A Grievance Redress Committee (GRC), responsible to oversee the functioning of the ERC as well as the final non-judicial authority on resolving grievances that cannot be resolved by ERC
- Grievance Focal Points (GFPs), who are educated people from each community who can be approached by community members to express their grievances against the Project. The GFPs are provided training by the Project in facilitating grievance handling and redress.

Grievances will be logged through the following process



ES.15 Environmental Management Plan (EMP)

For the effective implementation of mitigation measures and management of residual impacts an EMP has been developed.

The EMP provides a delivery mechanism to address potential environmental impacts of the proposed hydropower project activities, to enhance project benefits and to introduce standards of good practice in all project related activities. The EMP has been prepared with the prime objective of:

- Defining legislative requirements, guidelines and best industry practices that apply to the project;

- Defining mitigation measures required for avoiding or minimizing potential impacts assessed by the EIA;
- Defining roles and responsibilities of the Proponent and the execution contractors; and
- Defining requirements for monitoring and reporting.

Proponent will be responsible for the overall implementation of environmental mitigation measures through their construction contractor and O & M operator in collaboration with government departments.

The project indicative EMP cost amounts to 356,900,000 PKR (see below table).

ES-5: EMP Cost Estimation

S No.	Description	PKR
1	Environmental Studies	19,102,500
2	Environmental Monitoring and Testing Cost	5,000,000
3	Tree Plantation Cost	7,500,000
4	Construction and upgradation of fish hatchery	13,677,500
5	Biodiversity Action Plan	13,570,000
6	Human Resourcing & Strengthening Cost	21,000,000
7	Institutional Capacity Building	3,000,000
8	Hiring of Monitoring and Evaluation (M&E)	4,785,000
9	Community Investment Programs	171,000,000
10	EIA Fees and Public Hearing Arrangements	1,500,000
11	Tourism Management Plan	35,000,000
12	Stakeholders Engagement Plan Implementation	7,000,000
13	Development of Site-Specific Management Plans (SSMP's)	5,677,500
14	Lenders Monitoring cost	49,087,500
	Total PKR	**356,900,000**

ES.16 Corporate Social Responsibility

Under the Corporate Social Responsibility (CSR), the project implementation is expected to raise hopes of the project area population for their general welfare. It is

therefore necessary that the project sponsor may provide facilities in the form of education, health, and development of tourism sites to the people of the project area..

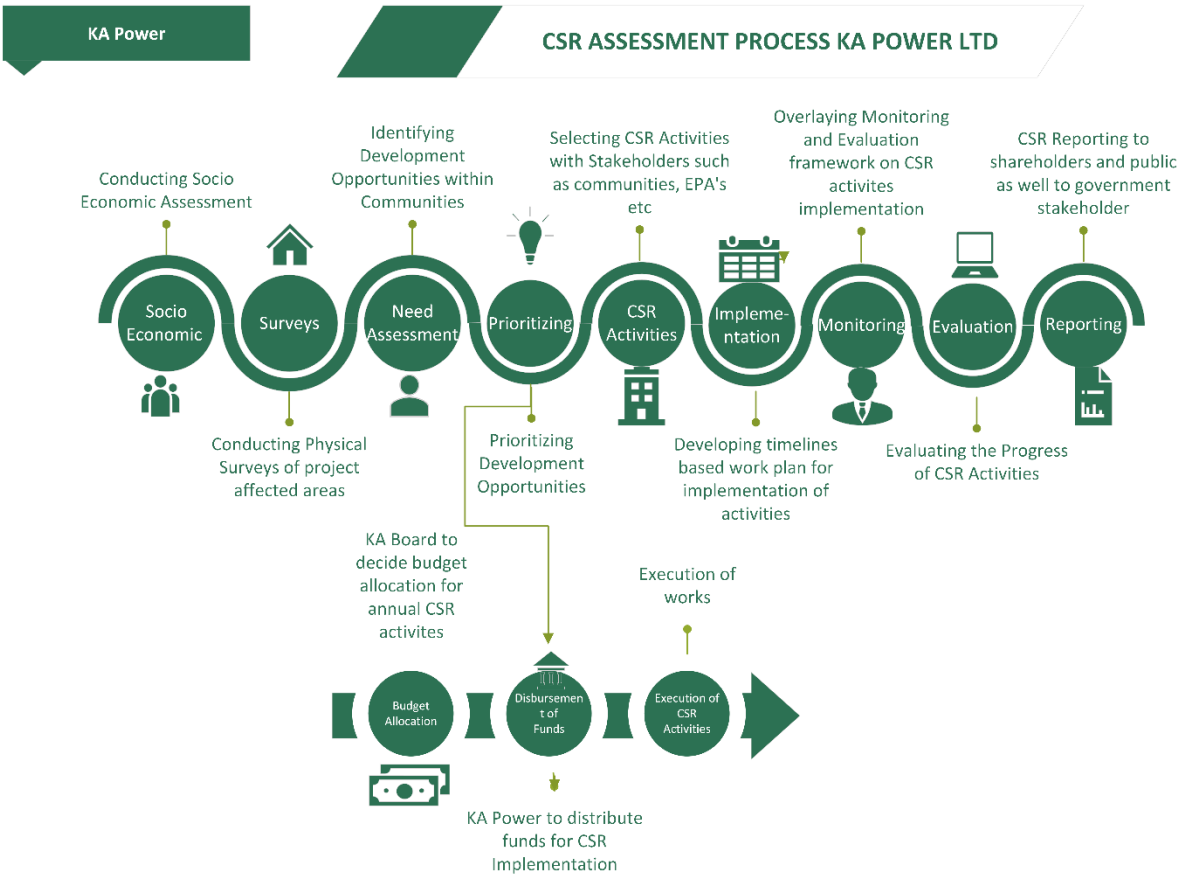
Considering the betterment of the local community and based on the consultations carried out with the local community and local administration, following socio-environmental development plans have been proposed.

- Tree Plantation
- Construction of new hatchery at project site or upgradation of existing Trout hatchery in Kalam, consultation with Fisheries Department, may be considered as project CSR activity to raise more relevant fish seed required
- Improvement of the sites used for various construction activities for parks and playgrounds.
- Development scheme like medical treatment, school support, drinking water supply and treatment plants.
- Job opportunities and capacity building of locals

For the purpose of project cost the budget will be divided in two parts i.e., Community Investment Program (CIP) & Corporate Social Responsibility (CSR). Most IPPs in the country divide total budget in these two heads. However, the Proponent will finalize CSR programs before start of construction activities based on consultation with affected community and line departments and will share with stakeholders before finalization.

CSR IMPLEMENTATION STRATEGY

- To implement the CSR in transparent & effective manner, a CSR management committee will be constituted with representation from all relevant stakeholders.
- Proposed members of CSR committee are team members of KOAK Power (admin, finance, PD, technical representatives), EPC Contractor (if it agrees to share the expense) and minor representation from community.
- Selection of projects for CSR, budget approval, procurement and monitoring will be done through CSR Management Committee.
- Collaboration with counter department of the provincial government will be made by the CSR Management Committee ensure effective implementation and acknowledgement



Proposed CSR Assessment Process by KA Power Ltd

ES.17 Conclusion

The EIA has examined the proposed project activities in detail, the baseline E&S conditions of the project area and assessed the project's potential E&S impacts. Mitigation measures to help minimize the identified potential impacts have been recommended and an EMP has been developed for effective implementation of these mitigation measures.

The prime objective of the proposed hydropower plant is to provide green, sustainable and environment friendly energy in comparison to already available traditional sources of energy based on non-renewable fossil fuels.

The proposed Hydropower plant will contribute in meeting national renewable energy and climate change targets. Based on the same, the EIA concludes that if mitigation measures for all identified impacts in the EIA are implemented as per the

recommendations, no significant or adverse change in the baseline environmental or social conditions will occur.

The releases from the weir are approx. 2.8 cumec, which will be provided in the project to meet the environmental, ecological, aesthetic requirements of the downstream villages up to the powerhouse. Drinking water (generally spring, stream and nullah water is used), other human needs and environmental requirements will remain the priority for the downstream releases.

Operation of the powerhouse and maintenance of the weir structure will result in the creation of job opportunities, better opportunity of business and transport and tourism development.

The project will change the visual landscape. For mitigation of this impact, proper landscaping will be done, and an overall Landscape Plan be prepared. Tree planting will be well organized and where possible vegetation and natural habitats will be restored.

The contractor will ensure to prepare Site Specific Management Plan (SSMP) including temporary traffic management, waste management plan, blasting management plan, oil spill management plan and HSE plan. The Company will ensure adherence to the environmental legislation and regulations. The Company/contractor(s) will employ local labour as much as possible

Therefore, it is concluded that the proposed construction, installation, operation and decommissioning of Kalam-Asrit Hydropower Plant has low intensity of adverse impacts, likely to be of short term duration, moderate and of local consequences and are insignificant. A vigilant implementation of mitigation measures, along with CSR Plan and EMP will ensure that environmental impacts are managed, minimized and are within acceptable limits.

Table 6: Summary of Potential Impacts and Mitigations

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
Design & Pre-Construction Phase		
Air Quality	- Dust from land clearing	- Ensure proper management of the movement/removal of material to minimize dust emissions including vehicles that carry dusty materials. - Ensure sprinkling of stockpiles and areas of activity.
Surface Water Quality	- Increased turbidity of surface water due to runoff from stock piles of excavated material	- Ensure that excavated/cleared materials are stacked properly to reduce turbidity effect on surface runoffs.
Noise Emissions	- Elevated ambient noise levels from machinery and vehicular traffic	- Ensure contractors' equipment is in good working condition and fitted with noise-reducing devices where necessary. - Conduct noise monitoring in compliance with local legislation. - Equip workforce with adequate PPE's.
Vegetation and Wildlife	- Loss of vegetation and grazing area	- Ensure minimal vegetation losses and re-plant the economic vegetation species at appropriate locations within the area of influence. - Ensure that land clearing and site grading are well planned to avoid excessive land clearance beyond requirements. - Consultation with Forest, Wildlife and fisheries department

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		proactively and obtain required NOC's and approvals prior to any activity.
Soil and Land Use	- Erosion of topsoil that will be exposed during site clearing - Soil compaction - Change of land use in the project area	- Ensure proper storage of excavated material to reduce runoff. - Ensure that site clearing is limited to acquired boundaries and excessive land clearance should be avoided. - Ensure filling and compaction to minimize the mobilization of eroded silt and clay particles.
Socioeconomic Resources	- Source of income/employment as a result of land acquisition - Stress on existing infrastructure and resources - Incidental destruction or alteration of significant cultural, historical or archaeological sites	- Ensure adequate compensation to land owners - Ensure adequate recruitment of Labor from surrounding communities as appropriate - Ensure trainings of workers on health, safety and environmental protection measures
Ecological Impacts	- Changes in ecological flows in river swat	- Assessment of ecological flow during design of project. - Maintaining minimum 2.8 cumec as e-flow. - Shorter diversion tunnels within designing process to maintain migration of fish during construction phases.

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
Construction & O&M Phase		
Land Impact	-The project will permanently occupy 271.70 kanal of land due to construction of weir and diversion, and impoundment of the reservoir and construction of powerhouse and associated facilities. -Resettlement of 11 houses, 1 commercial units and 8 electric pole.	-Re-alignment of roads and reconstruction prior to disturbance. -Preparation of comprehensive Land Acquisition and Resettlement Plan. - Livelihood Allowances for affected people/families - Transition Period Allowances for affected people/families Crop compensation and Tree Compensation apart from replanting with the ratio of 1:10. - Establishment of Grievances Redress Mechanism
Surface Water Quality	- Water pollution from surface runoff and improper disposal of sewage - Potential spills of lubricants and oil due to poor handling - Increased turbidity of water body from runoff of stock piles	- Preparation of spill response plan, construction of bunds, assigning designated areas for hydropower equipment and vehicle maintenance. - Ensure containment of surface runoffs and storm water through appropriate grading of land - Provide spill containment facilities on site for storage of hazardous materials, if required - Disposal of waste as per waste management procedures on regular and strict basis

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		- To avoid leakages adequate drainage facilities, temporary storage of identified materials/waste in paved and impervious segregated areas to be ensured
Water Resources	Depletion of Kalam-Asrit community water wells	- Capping the amount of water abstraction. -Using KPK government approved water sources for extraction. - Avoiding community water wells abstraction. - Implementing water conservation strategies.
Groundwater/ Surface water contamination	- Accidental discharge of hazardous materials (oils, wastewater) to soil - Leaching pollution from solid waste disposal - Reduction from Use and overuse	-Preparation and implementation of Water Quality Management Plan, Hazardous Material Management Plan, Waste Management Plan. - Ensure that the contractor handles, stores and disposes off the materials and wastes in accordance with the waste management plan and the environmental management plan developed for this project - Ensure provision of temporary storage of hazardous materials in adequately designed and segregated areas and handling wastes according to their Material Safety Data Sheets (MSDS) in compatible and safe containers

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		- Ensure that contractor personnel are trained to handle hazardous wastes as per safe practices - Ensure the water conservation measures suggestion are adopted,
Air Quality	- Air emissions from construction equipment and vehicles - Dust and gaseous emissions from vehicles movement (VOCs, CO, NOx, SOx, O3, particulates and greenhouse gases)	- Preparation and Implementation of Site Specific Management Plan (SSMP). - Ensure proper sprinkling/watering on dusty sites to reduce dust emissions - Ensure contractor personnel are trained in adequate environmental management - Undertake routine maintenance of engines, vehicles, equipment to minimize air emissions, avoid idling, cover vehicles transporting dusty material - Implement appropriate operational controls/procedures to ensure compliance
Project Wastes	- Improper management of waste effluents - Improper management of solid wastes including hazardous & non-hazardous wastes	- A waste management plan should be developed before the start of the project activities and implemented accordingly. - Implementation of the waste management Plan.

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		- Ensure provision of septic tank for management of domestic effluents - All types of solid waste disposal should be through KPK EPA's approved waste contractor - Ensure segregation and storage for different types of wastes for appropriate safe disposal
Noise Emissions	- Increased noise levels from generators, heavy equipment and machinery, and vehicular traffic - Nuisance to nearby communities due to increased noise level - Night time activity and generators will increase noise levels in the nearby settlements - Hearing impairment of project workers and neighbors	- Ensure contractor manages construction & installation activities with minimal disturbance to community - Ensure regular servicing and routine maintenance of all construction and installation equipment - Signal the noise areas and ensure provision of ear protective devices to workers at the project site during the land preparation/construction stage and installation of mufflers on heavy equipment - Conduct regular noise monitoring as per applicable laws and regulations
Vibration	- Vibration from blasting during the construction phase may disturb local communities	- Developing a Blasting and Explosives Management Plan - Conducting informed scheduled blasting activities.

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		- Monitoring of blasting activities and recording of grievances of Kalam-Asrit communities.
Fly Rock	- Safety hazard due to flying debris	- Providing a minimum buffer of 100 m, using covers over blast surfaces, use of siren and alarms, and designing the blast activity to reduce fly rocks.
Wildlife	- Wildlife migration due to blasting and noise activities	- Implementation of Security Management Plan to avoid external disturbances. - Training of staff on illegal poaching - Enforcing speed limits.
Tourism and Scenic impacts	- Change in existing natural landscape and topography	- Ensure site is adequately fenced off - Ensuring proper landscaping during implementation of works. - Retaining natural vegetation as much as possible - Ensure waste generated is transported offsite by an approved waste contractor. - Ensure replantation of economic vegetation, if required. - Use of colors that better integrate with the landscape.

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
Soil	- Accidental spill of oil and lubricants during equipment refueling operation	- Ensure that the contractor handles hazardous materials in accordance with site waste management plan and the project environmental management plan. - Provide spill containment facilities on site for storage of hazardous materials, if required. - Contaminated soil to be collected and disposed of as per applicable procedures and in compliance with local legislation.
Socioeconomic Resources	- Strain on infrastructure, social and cultural conditions, access to goods and services and means of livelihood due to influx of construction workers - Disruption of community activities - Loss of assets and livelihood	- Ensure adequate recruitment of Labor from surrounding communities as appropriate. - Ensure counselling and training of workforce on social and cultural aspects, ethics and advising minimal interaction with communities. - Appoint a Community Liaison Officer as focal contact point regarding locals' grievances, if any - Ensure maintenance of closed construction camp and restriction of access to camp and work locations to authorized personnel only. - Minimize disruption to road traffic, farming and other community activities by the project workers and project activities .

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		- Ensure that the qualified Labor from within the project's host communities are given preference in employment opportunities by the Proponent. - Implement appropriate operational controls/procedures for labors management and human resource management
Archaeological	- Archaeological/historical sites in the reservoir area as well as the powerhouse area, do not exist	- In case of identification of any relics or historical thing, chance find procedure will be implemented.
Health & Safety	Spread of contagious diseases among construction workers and community people	- Ensure implementation of health-related awareness programs for the project workers and the community. - Respect local cultural norms. - Training and awareness of communities.
Traffic	- Increased level of traffic due to heavy equipment and machinery transport - Risk of increased road accidents - Occupational accidents around the construction areas - Reduced road quality due to increased traffic	- Conduct risk assessment for identification of potential hazards associated with traffic and to take appropriate mitigation measure thereafter. - Ensure strict compliance to driving policy, transportation operating procedures, training of drivers, delivery of different materials according to a plan, speed limits, licensed and maintained vehicles.

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		- Train project workers in use of protective equipment. - Prepare and ensure the placement of warning and caution signs within and around the project work site as appropriate for hazard recognition. - Ensure the development of site emergency response plan.
Community Grievance	- Community related grievances, worker related complaints	- A grievance handling system must be established. - Appoint a Community Liaison Officer (CLO). - Ensure a social complaint register is maintained on site by the Proponent. - Ensure community complaints are duly addressed and appropriately resolved. - Encourage local communities to use the grievance procedure to address their project related concerns
Climate Change	- Occurrence of an increase in extreme events (e.g. increase of PMP or extreme events is likely, with medium confidence, under future climate scenarios;	- Climatic extremes events themselves are very unlikely, and design-oriented measures shall be ensured to withstand any unforeseeable situation. - Generic offsetting measures for reduction of emissions from construction works include:

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		- Making sure vehicles are maintained - Regular inspection of vehicle exhaust emissions to meet required NEQS standard for exhaust emissions - Plantation of lost trees in ratio of 1:10. - Preparing strategy to manage flooding and flows - Installing flood warning systems.
Ecological Flow	- Changes in ecological flows in river swat. - Loss of riverine ecosystem.	- Construction of fish hatchery. - Integration of in river diversion within designing process to maintain migration of fish during construction phases. - Appropriate methods than conventional methods of 10% mean will be adopted to calculate E-Flows to ensure minimum flow to maintain ecological integrity in river.
River Habitat	- Pollutants from human and chemical wastes might be deposited in the river	- Provision of awareness training to staff and contractors on disposal of waste in River - Minimize the inflow of sediments and other contaminants in the water. - All possible measures will be adopted to avoid contamination of water and unauthorized catching of fish by the Labor.

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		- Solid waste will only be disposed of at designated sites;
Vegetation	- Loss of vegetation can occur due to proposed establishment of Hydropower project related activities	- Trees cutting will be compensated by planting 10 trees against one cut tree - Periodic trainings of the project staff - Clearing of vegetation and the cutting of trees will be minimized - Off-road travel will be strictly prohibited
Avifauna	- There will be no impact to the birds and fowl communities.	- Project will create a suitable habitat for this community with the creation of reservoir
Operational & Maintenance Phase		
Air Quality	- Minimal air emissions during operation	- Routine visual monitoring of the exhaust emission.
Soil	- Soil contamination from accidental spills of oil and lubricants during plant maintenance	- Ensure that any equipment having hazardous substance is installed on paved floor - Ensure that adequate areas are provided to contain possible oil/lubricant spills

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		- Induct project workers through adequate training on proper environmental hygiene. The training will also include proper handling and disposal of liquid wastes to avoid accidental spills - Prepare and ensure display of appropriate warning and caution signs to reduce hazards from oil, lubricants and related hazardous chemicals and materials
Surface Water and Ground water	Accidental leakage of transformer oils into nearby surface water bodies Reduction from Use and overuse	- Containment basins can be installed to avoid deterioration of surface water quality - Oil and lubricants to be stored in designated areas only. - Ensure the water conservation measures suggestion are adopted in case of Government Approved Contractor - Water supply contractors to provide water to project construction works.
Ecology & Wildlife	Permanent displacement of birds and other existing wildlife Biological confusion due to "lake effect"	- Adequate arrangements to restrict gathering of avifauna during operations using non-lethal measures e.g. mylar tape, scare balloons, & minimum vegetation around the plant site Ensuring E&S Monitoring on the aspect.

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
Socioeconomic Resources	Use of existing local resources around the project area Loss of livelihood	- Improve existing infrastructure during to the extent as provided under the project's corporate social responsibility plan. - Allocating resources to project affected persons for revenue generation and tourism e.g. land allocation near reservoir and scenic dedicated areas. - Appoint a Community Liaison Officer as focal contact point regarding locals' grievances if any - Ensure that qualified Labor from within the project's host communities are given preference in employment opportunities by the Proponent.
Traffic	Increased traffic during substation and transmission line maintenance	- Implement transport management procedures developed for this project Ensure that project drivers are well trained in defensive driving procedures
Health & Safety	Public and occupational health and safety risks	- Train staff in HSE, social and security management - Maintain and ensure appropriate medical arrangements

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		- Subscribe to the services of appropriate medical facility in nearby town/city with adequate transportation arrangements to handle health issues that are beyond first aid attention - Ensure the provision of fire extinguishers at site - Maintain a dedicated telephone line/channel for emergency - Create an Emergency Collection point and ensure that it is clearly identified at site - Provide a gate to the project site manned by trained personnel to check unauthorized entries
Community Grievance	Community related grievances, worker related complaints	- A grievance handling system must be established - Appoint a Community Liaison Officer (CLO) - Ensure a social complaint register is maintained on site by Proponent - Ensure Community complaints are duly addressed and appropriately resolved. - Encourage local communities to use the grievance procedure for concerns related to project related activities

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
Terrestial Habitat Inundation	11.9km stretch of River Swat to be occupied	- Identification of species, prevention of fauna injuries, trainings to project staff, avoiding flood lights and disposal of solid waste through appropriate waste contractor.
Avifauna	Impact on birds due to transmission line construction	- Client of transmission lines to conduct ESIA and relevant mitigation measures for safeguarding avifauna of project area and surroundings.
Aquatic Fauna	Increased pollution (human waste, sedimentation, refuse, fuels and other contaminants) may have negative impact on the fish population	- Provision of awareness training to staff and contractors on Disposal of waste in River - Monitoring of fish protection measures.
Post-operational and Decommissioning Phase		
Air Quality	Air and dust emissions from equipment and vehicles	- Ensure proper sprinkling/watering on dusty sites to reduce dust emissions - Routine maintenance of engines, vehicles, equipment to minimize air emissions, avoid idling, cover vehicles transporting dusty material

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
Noise Emissions	Increased noise levels from generators, heavy equipment and machinery, and vehicular traffic Nuisance to nearby communities due to increased noise level Hearing impairment of project workers and neighbors	- Ensure contractor manages decommissioning activities with minimal disturbance to communities. - Ensure provision of ear protective devices to workers at the decommissioning project site - Ensure activities are restricted to daytime only
Water Quality	Water pollution from surface runoff and improper disposal of sewage Potential spills of lubricants and oil due to poor handling Increased turbidity of water body from runoff of waste piles Leaching pollution from solid waste disposal	- Ensure containment of surface runoffs and storm water through grading of land and adequate storage of surface runoffs and storm water for proper drainage - Provide spill containment facilities on site for hazardous materials, if required - Disposal of waste as per waste management procedures on regular and strict basis - To avoid leakages, adequate drainage facilities, temporary storage of identified materials/waste in paved and impervious segregated areas to be ensured. Ensure that contractor personnel are trained to handle hazardous wastes as per safe practices

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
Project Wastes	Improper management of waste effluents Improper management of solid wastes including hazardous & non-hazardous wastes	- Follow the golden waste management rule i.e. remove, reduce, reuse, recycle, recover, treat and dispose - All types of solid waste disposal should be through KPK EPA's approved waste contractor - Ensure segregation and storage for different types of wastes for appropriate safe disposal
Soil	Accidental spill of oil and lubricant during equipment refueling operation	- Ensure that contractor handles hazardous materials in accordance with site waste management plan and the project environmental management plan - Provide spill containment facilities on site of hazardous materials, if required - Contaminated soil to be collected and disposed of as per applicable procedures and in compliance with local legislation
Socioeconomic Resources	Strain on infrastructure, social and cultural conditions, access to goods and services and means of livelihood due to influx of workers Disruption of community activities	- Counselling of staff to respect local communities their culture and norms. - Appoint a Community Liaison Officer as focal contact point regarding locals' grievances, if any - Minimize disruption to road traffic and other community activities by the project workers and project activities

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
		- Ensure the qualified Labor from within the project's host communities are given preference in employment opportunities by the Proponent.
Health & Safety	Spread of contagious diseases among workers and community people	Ensure implementation of health-related awareness programs for the project workers and the community
	Effects on local's life style and cultural setting as the local community is not accustomed to a multicultural environment and their perceptions about people of different culture	Respect local cultural norms Training and awareness of communities.
Traffic	Increased level of traffic due to heavy equipment and machinery transport Risk of increased road accidents Occupational accidents around the construction areas Reduced road quality due to enhanced traffic	- Ensure strict compliance to driving policy, vehicle operating procedures, training of drivers, delivery of different materials according to a plan, speed limits, licensed and maintained vehicles - Train project workers in use of protective equipment - Prepare and ensure the placement of warning and caution signs within and around the project work site as appropriate and for hazard recognition - Identification of potential hazards associated with traffic and to take appropriate mitigation measure thereafter

Environmental Medium	Potential Source and Impact	Recommended Mitigation Measures
Restoration	Project waste Ecological concerns	- Project wastes (hazardous and non-hazardous) will be removed and disposed of according to best industrial guidelines and in compliance with local regulations
Security	Project Security related risks	- Implementation of Security Management Plan. - Coordination with Pakistan Army and Policy to implement comprehensive security management plan. - Special consideration shall be given to expat movements and security.

Figure ES-1: Key Map

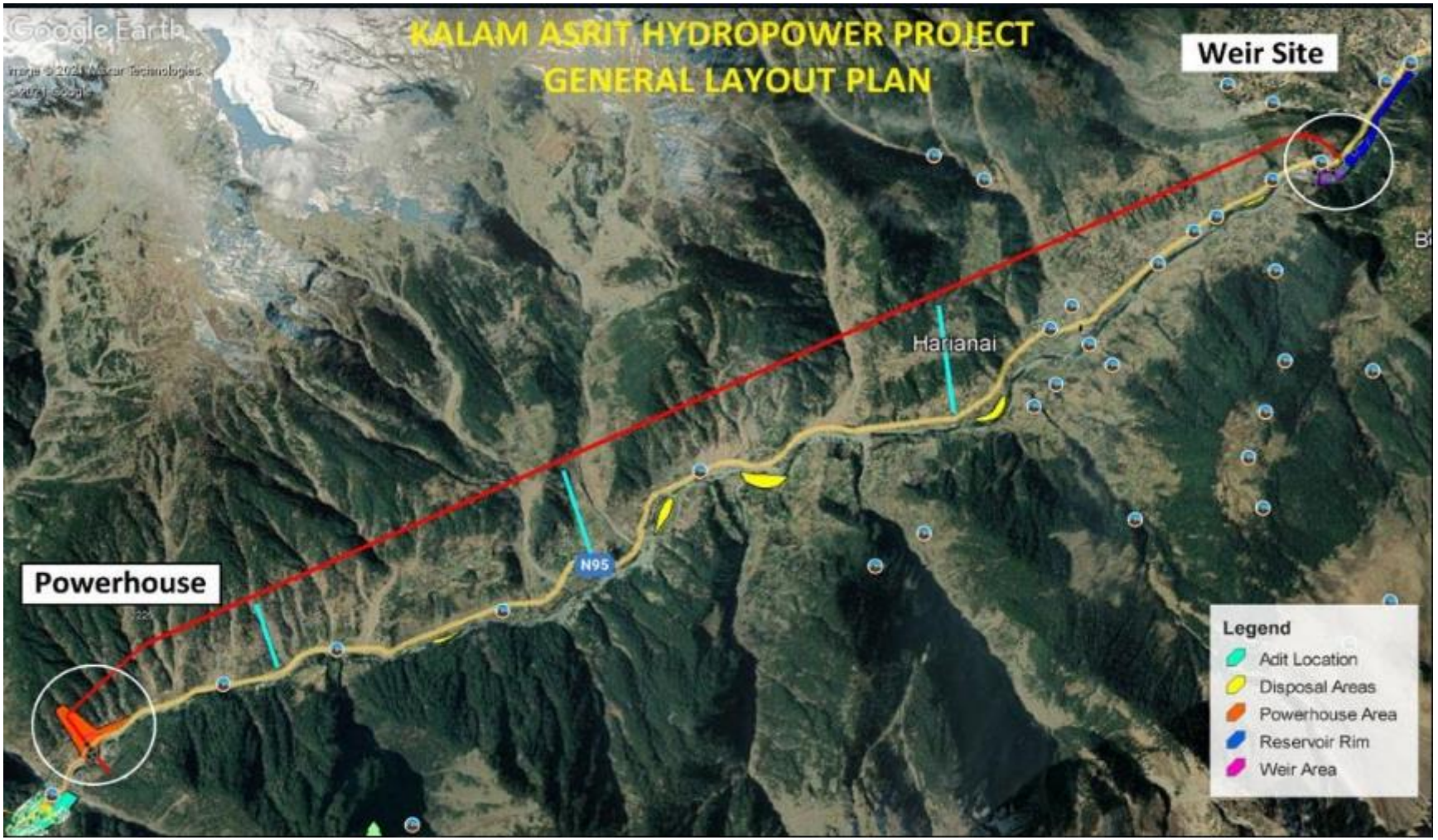


Figure ES-2: Project Area Map (Weir)

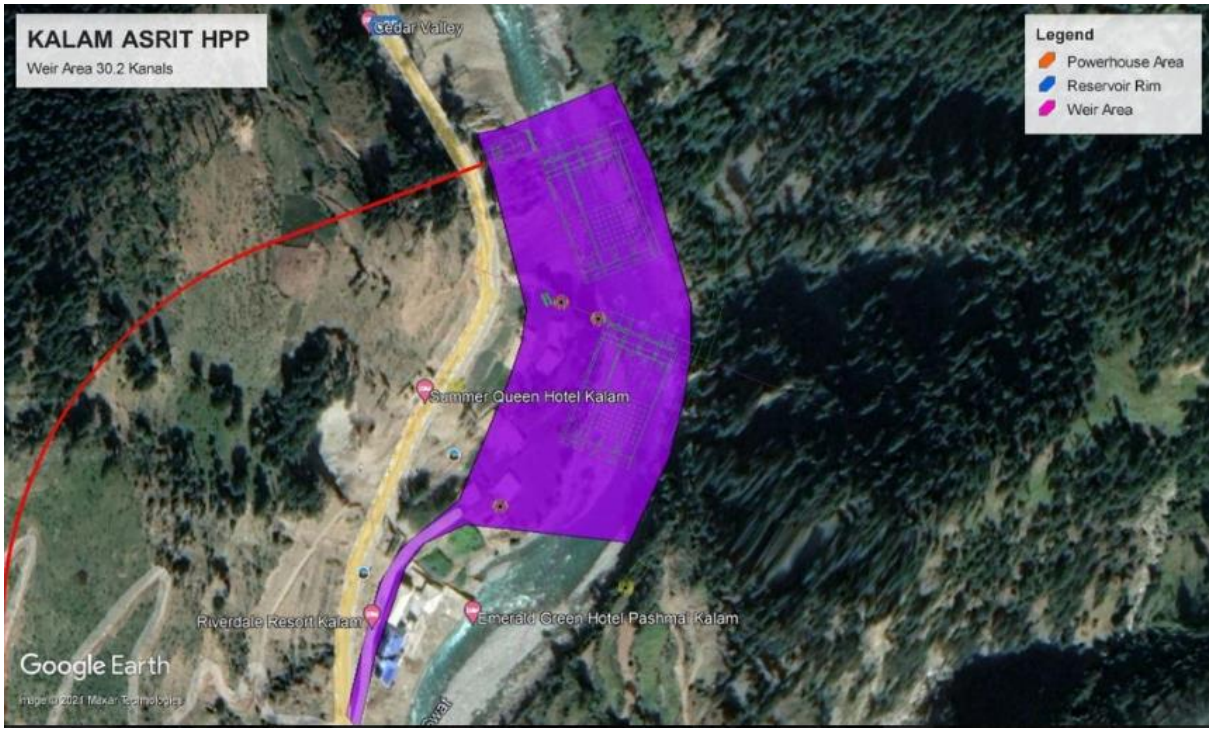
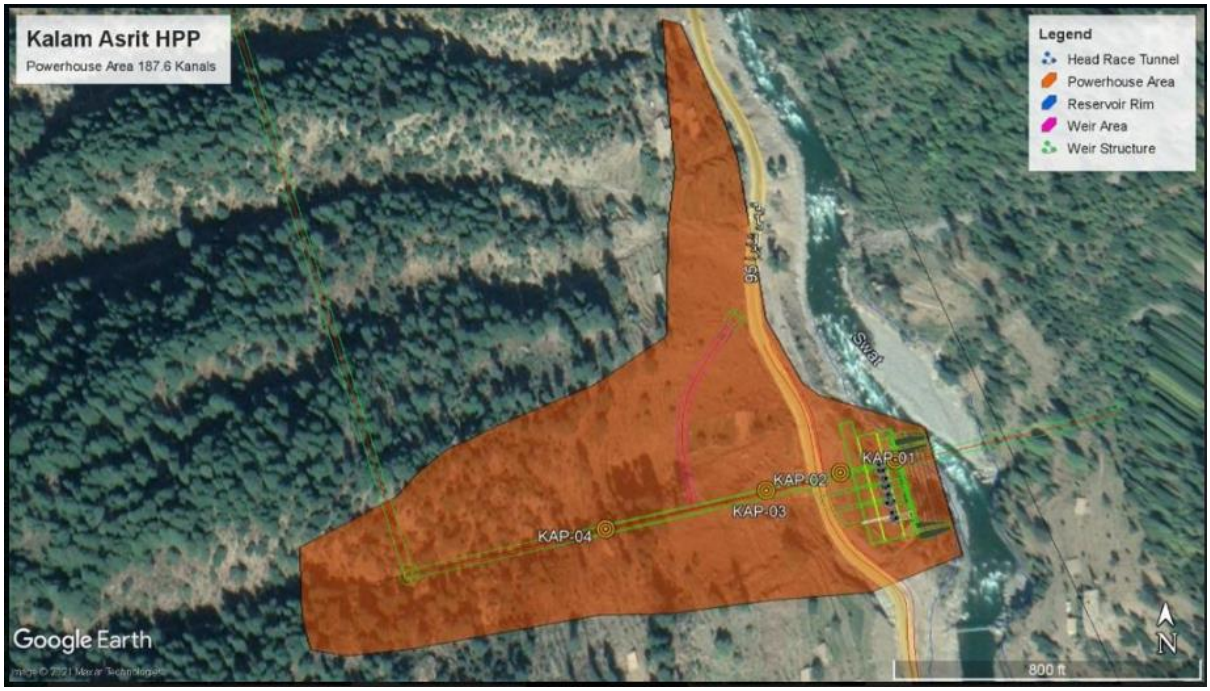


Figure ES-3: Project Area Map (Reservoir)

Figure ES-4: Project Area Map (Powerhouse)



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List of Acronyms

ADB	Asian Development Bank
AMSL	Above Mean Sea Level
ASTM	American Society for Testing of Materials
BHU	Basic Health Unit
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLO	Community Liaison Officer
CMS	Convention on Migratory Species
CSP	Concentrated Hydropower
DC	Direct Current
DCR	District Census Report
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EP	Equator Principals
EMP	Environmental Management Plan
GHG	Greenhouse Gases
GoP	Government of Pakistan
GPS	Global Positioning System
KPL	KA POWER LTD.
HSE	Health, Safety and Environment
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ISO	International Organization of Standardization
IUCN	International Union for Conservation of Nature
kV	Kilovolt
kW	Kilowatt
LAA	Land Acquisition Act
LV	Low Voltage
MSDS	Material Safety Data Sheet
MV	Medium Voltage
MW	Megawatt Peak
NCS	National Conservation Strategy
NEP	National Environmental Policy
NEPRA	National Electric Power Regulatory Authority
NGO	Nongovernmental Organization
O&M	Operation and Maintenance
OPIC	Overseas Private Investment Corporation
PPA	Power Purchase Agreement
PS	Performance Standards
RHC	Rural Health Centre
SEE Solutions	Sustainable Environment & Energy Solutions
SEP	Stakeholders Engagement Plan
KPK EPA	KPK Environmental Protection Agency

NEQS	National Environmental Quality Standards
SOP	Survey of Pakistan
SPS	Safeguard Policy Statement
SWD	KPK Wildlife Department
SWPO	KPK Wildlife Protection Ordinance
TDS	Total Dissolved Solids
THQ	Tehsil Headquarter
TSF	Temporary Site Facility
TSS	Total Suspended Solids
UC	Union Council
VOC	Volatile Organic Content
WHO	World Health Organization
WWF	Worldwide Fund for Nature

1 Environmental and Social Impact Assessment

This report presents the findings of the Environmental Impact Assessment (EIA) for the 238 MW Kalam-Asrit Hydropower Project proposed by Korea South-East Power Co. (KOEN) through its subsidiary KA Power Ltd (Hereby referred as the Proponent). The proposed project will be develop on the land purchased from the private owners and Government of Khyber Pakhtunkhwa in Asrit, District Swat of Khyber Pakhtunkhwa province (KPK). A key map of the project area showing the exact location for establishment of various components of the proposed Hydropower generation plant is presented as **Figure 1 and 2**.

This report presents the existing baseline conditions and environment & social impact assessment with respect to the following parameters of the Hydropower plant:

- Design, and Construction phase;
- Operational and maintenance phase; and
- Post-operational and decommissioning phase.

The EIA study process for proposed Hydropower project use, major international (IFC, ADB, Standards etc.) and national guidelines related to design, construction, operation and decommissioning.

Most common International lenders' regulatory framework are from IFC/World Bank, ADB Guidelines and National regulatory framework is published by the Khyber Pakhtunkhwa Environmental Protection Agency (KPK EPA). There is no specific guidance document published by Government of Pakistan/KPK in relation to the design, construction, operation and decommissioning phases for the Hydropower projects. Similarly, performance standard one (1) is focused during the E&S assessment of this project, as PS-1 is being used as a tool by the international lenders for risk assessment only.

The land for the proposed hydropower project is located in district Swat of KPK province. The total land area is 271.70 kanal, which will be used for Diversion Channel, Upstream Cofferdam, Downstream Cofferdam, Weir & Spillway, Desander Basin, Intake, Headrace Tunnel, Vertical, Pressure Shaft, Horizontal Pressure Tunnel, Penstock, Penstock (Manifold), Surge Shaft, Powerhouse, Transformer , GIS Cavern and tailrace tunnel.

Project area map for the proposed 238 MW Kalam-Asrit Hydropower Project is presented in **Figure 2**.

Currently, KA Power Ltd 215 MW Asrit-Kedam Hydropower project is in construction adjacent to proposed project location on main Swat-Kalam highway.

Following the approval of the EIA and feasibility study, the Project Company shall apply for the generation license and feasibility stage tariff to NEPRA. Once the generation license and feasibility stage tariff is approved the Project Company shall approach PPIB for the issuance of the Tripartite letter of Support. After the issuance of LOS, the concession document including PPA shall be executed and following arrangements shall be done, EPC Contract shall be finalized already to financial close and construction stage. Topographic survey, hydrological study, geotechnical study has been conducted for the proposed project, and flood assessment has been evaluated for the proposed site under the feasibility studies.

The E&S impacts were assessed in compliance with the relevant national and international environmental legislations and guidelines related to hydropower projects development and operations.

The hydropower plant will be developed in an area which is temperate ecoregion with coniferous forest ecosystem, which is integrated by monsoon disturbances (July-September) as well. No sensitive ecological habitats with high ecological value were found during the field survey of the EIA. Similarly, marginal human settlement in the project is expected to be impacted by the proposed project activities, including minor resettlement of 11 residential structures and 1 commercial building for which a standalone Land Acquisition & Resettlement Plan has been prepared with this EIA. The Project Proponent conducted due diligence on the CSR possibilities via social assessments scheme of this study and plan to improve areas such as “tourism, waste management, medical treatment, education, drinking water etc.” in future.

1.1 Objectives of the Kalam-Asrit EIA

The objectives of this EIA are to:

- Assess the existing E&S conditions in the proposed project area including the identification of environmental sensitive area(s) to develop a baseline of its prevalent environmental and socioeconomic conditions;
- Identify and investigate all potential environmental and social impacts of the proposed Hydropower plant’s construction, commissioning, operational and decommissioning activities on the physical, biological and socioeconomic environment of the project area;
- To propose mitigation measures that would help the Proponent in carrying out the project related activities in an environmental and socially sustainable manner;
- To uncover the planning, development and operational phase impacts up to microenvironment levels in which project is being sited;

- Assess the proposed activities and determine whether they comply with the relevant environmental regulations in Pakistan and KPK, as well as with requirements of the future project lenders; and
- Prepare an EIA report supplemented by Environmental and Management Plan (EMP) for effective implementation of the recommendations of the EIA and submittal to the project lenders.

The IFC's PS(s) are applied to manage E&S risks and impacts and further, to enhance development opportunities. Together, the eight PS(s) that the proponent is required to meet throughout the project life by IFC along with the ADB's safeguard requirements. Proponent will follow the PS(s) of the IFC for their proposed project and will ensure that the contractors/subcontractors appointed by Proponent will follow the IFC's PS(s) on E&S sustainability.

Project Benefits

Hydropower provides green, renewable, and sustainable energy which has wide-ranging benefits including:

Climate change – The release of toxic gases into the atmosphere, such as carbon dioxide, methane and nitrous oxide does not only contribute to air pollution, but also enhances greenhouse effect. Generating electricity from Hydropower plants produce no greenhouse gases whatsoever, while only minimal harmful and toxic emissions are released which are not directly related to the power production process, rather from supporting activities i.e., use of vehicles and heavy machinery, backup generators etc. The same also reduces the carbon footprint and so can reduce the negative effects of climate change.

Independent research has shown that use of hydropower instead of fossil fuel for electricity generation has helped to avoid 100 billion tons of carbon dioxide in past 50 years alone.

Reducing reliance on fossil fuels – Reducing reliance on these finite resources and taking advantage of an abundant, free source of energy means lower energy prices, reduction of greenhouse gas emissions and a stronger more stable energy future; and

Social advantages – The Project will improve the socioeconomic dynamics of the area through generation of employment opportunities, sustenance of income, development of infrastructure including education, health facilities and means of access etc. Additionally, creation of business opportunities and locals' engagement for socio-economic benefits will increase overtime.

Promoting Tourism and Improving Aesthetics; - The Project is expected to enhance the tourism sector of the area and plans to provide additional spots to enhance the tourism sector or the area. The project will involve directly affected population in these opportunities. Once the weir is operationalized several hot spot safe areas around the project will be improved for better tourism and employment generation activities.

1.2 Ecological Resources

The proposed project area for the 238 MW Kalam Asrit Hydropower Project lies in the Indus delta of Swat district which has a mosaic of micro habitats which includes a wide range of birds, mammals, and reptiles. However, all the mentioned habitats do not fall under the protected wildlife category, nor the project area is constituted as a forest area by the KPK Forest Department. Various bird species, mammals and were reported in the project area and immediate periphery. None of the wildlife species are listed on IUCN Red List as endangered or near threatened. Similarly, regarding floral attributes, a total of 44 vegetation species belonging to different plant families were found on the project site and close vicinities. None of the rare, endemic, or threatened floral species were identified during the EIA site visit and are widely distributed in KPK and particularly in Swat district.

1.3 Environmental Disfiguration

Since the project site is in an area which is historically reported as a major tourism route. The environmental impacts related to temporary disruption of tourism activities on temporary basis due to temporary construction activities of hydropower have been evaluated with respect to visual losses. As, this is an assessment observation and actual monitoring data will reflect the impacts of temporary disruption of tourism.

Since the project land is in a vicinity where food and forage for mammals and reptiles is abundantly available, therefore the establishment of the of the project shall not impact the feeding grounds available for the mammals and reptiles, which usually have a long home range and can settle in nearby areas where food and forage is available.

Similarly, there are fewer community members residing within the immediate vicinity of the project site, no adverse social impacts are envisaged. Overall, the social impacts will be positive with the implementation of Land Acquisition and Resettlement Plan.

1.4 Proposed Approval and Management System

Preparation and approval of subject EIA covers the complete project cycle that includes construction, operation & maintenance and post operational/decommissioning and assessment of impacts to cover all E&S sensitivities.

Proponent is cognizant of the essential EIA related issues and have addressed them in the EIA by undertaking or proposing the following:

- The EIA is based on primary as well as secondary data. Primary data is collected on all physical, biological, and socioeconomic aspects.
- Assessment of all potentially significant impacts on the physical, biological and socioeconomic receptors due to the proposed development activities. Relevant mitigation measures have also been discussed in detail; and
- To ensure that KPK EPA and other stakeholders continues to regulate and oversee the E&S performance of activities within the area of operation, the

EIA has recommended the following environmental approval, monitoring and management protocols:

- Once the activity is initiated, the Proponent will undertake E&S monitoring according to the requirements of the project specific EMP and any additional requirements specified by the KPK EPA and lenders and
- Proponent will accommodate any visits by KPK EPA, and other concerned regulators' officials for the purpose of external audits or onsite inspections.

1.5 Study Zone

Consultants explored the spatial boundaries of the environmental impact assessment and attempted to cover all the areas prone to any changes either directly or indirectly within the Kalam Asrit HPP. The experts considered various stages of the project specifically construction and operation phases. Additionally, the cumulative level of various hydropower HPP's in Basin were considered keeping in view the developmental plans of PEDO and PPIB. The permanent footprint of the proposed Project includes the area that will be acquired for the weir, reservoir, powerhouse, roads, and some other facilities. The temporary footprint includes the land that will be required or disturbed due to the facilities that will be developed during the construction phase in the weir, powerhouse, and other infrastructure components (transmission line). With reference to the Project connectivity with the National Grid. The Peshawar Electric Supply Company and Communication and Works Department will be responsible for the services/utilities. Whereas the National Transmission & Dispatch Company (NTDC) is the responsible agency for developing transmission line networks in the country. The exact T&D route of the transmission network as well as the location of the grid stations through which the Kalam Asrit Project will be connected is going to be finalized after the approval of the integrated project study by NTDC and Grid Interconnection Studies by the consultant.

Aquatic Study Zone

Swat River stretches starting from Kalam (Swat River) which is considered the upstream section of proposed HPP to the downstream (Asrit) is taken as aquatic study zone. The length of the river is approx. 12km which include the tributaries in the stretch.

Terrestrial Study Zone:

500m buffer is taken on each side of the river where Project-related facilities are to be located as well as the reservoir.

Socio-economic Study Zone:

During the socio-economic studies 500m buffer on each side of the river including the settlements are considered. In over to cover the communities around the permanent

project facilities or the temporary, a 1km cover as buffer radius is taken to identify range of communities around the project facilities.

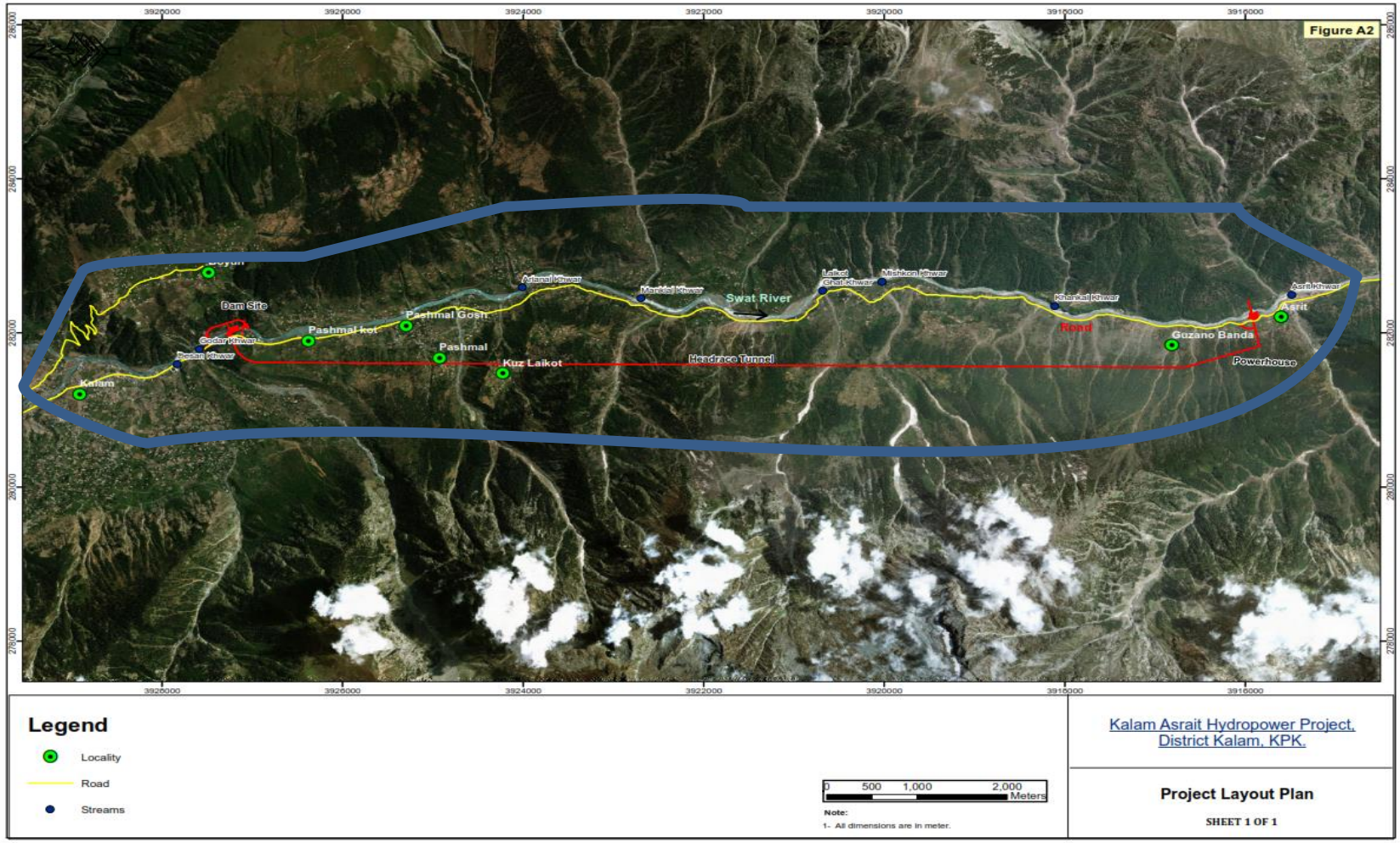
1.6 EIA Consultants

This EIA study is carried out by AZMEC , Nasir Absar Consulting (Pvt.) Ltd. and Sustainable Environmental and Energy Solutions (SEES) comprising of Environmental Specialists, Social Experts, Wildlife Experts, Botanist, Archaeologist and Water Resources Experts having sound technical expertise to perform various environmental assessment assignments of different sectors. The details of the project team members appointed on this study are provided below:

No.	Name	Expertise
1.	Ms. Mehwish Rehman	Director – Team Lead
2.	Mr. Waqar Saleem	Social/Gender Expert/Archaeologist
3.	Mr. Zeeshan Qadeer Abbasi	AZMEC Director/ technical Inputs/ QA/QC for EIA
4.	Dr. Anila Nisar Syed	Environmentalist (NAS)
5.	Mr. Wazir Ali	Resettlement Expert (NAS)
6.	Mr. Jahangir	Monitoring Expert (NAS)
7.	Mr. Ahsan Toor	CEO- SEE Solutions (Review Consultant)
8.	Mr. Sahibzada Ahmed	International E&S Consultant
9.	Prof Dr. Muhammad Ali	Ecological Expert
10.	Dr. Khurshid Roghani	Environmental Expert
11.	Prof. Dr. Naveed	Ecologist and Botanist
12.	Muhammad Iftikhar	Terrestrial Fauna
13.	Mohsin Ullah Mohsin	Zoologist/Invertebrates
14.	Ahmar Hassan	Zoologist
15.	Mr. Naeem Khan	Ecologist
16.	Mr. Abid Hussain	GIS Expert
17.	Mr. Muhammad Asim	GIS Expert
18.	Mr. Abid Hussain	Technical and Hydropower Expert (CEO AZMEC)/ QA/QC for EIA

Figure 1: Key Map

Figure 2: Area of Influence (Study Area Map)



2 Legislative, Regulatory and Institutional Frameworks

2.1 Introduction

The following is the review of the relevant national legislation, regulatory and policy instrument, and some international ones. The Proponent of the project will conduct its infrastructural and operational activities in compliance with applicable Pakistan, international legislation, and agreements.

A comprehensive review of the legal and institutional frameworks within which the environmental and social assessment is to be carried out is conducted. At the initial stage of the EIA process, preliminary information was provided to aid in the determination of legal and other requirements that apply to the proposed 238 MW Kalam Asrit Hydropower Project. This step was conducted utilizing a high-level description of the project and its facilities. The screening process involved the following:

a. Reviewing of applicable regulatory framework for the proposed hydropower project.
b. Reviewing of applicable financial requirements for the proposed hydropower project.
c. Reviewing of hydropower project related construction and operation activities and their impacts on various components of the environment.
d. Collection and compilation of available secondary baseline data from various environmental and social receptors.
e. Conducting site visits to collect qualitative data for scoping purpose; and
f. Categorization of project as per IFC Guidelines and ADB requirements.

Proponent will be required to adhere to the relevant requirements of the policies, legislations, and recommendations of the guidelines, which have also been incorporated in the mitigation measures and the EMP (Volume-II) provided in this EIA.

2.2 Project Category

There are two levels of regulatory provisions applicable to the proposed hydropower project.

1. The first is the KPK Environmental Protection Agency (KPK EPA) assessment and approvals process which need to be followed to achieve regulatory environmental approval.

- The Provincial law categories have provision for three types of environmental assessment, the environmental impact assessment (EIA), the initial environmental examination (IEE) and the General Environmental Assessment (GEA).

2. Secondly, as 238 MW Kalam Asrit Hydropower Project is seeking adherence to meeting international standards i.e., the IFC Performance Standards (IFC PS) 1-8, and the IFC EHS General Guidelines,
    - Similarly, IFC environmental performance standards uses three categories–A, B, and C for the purpose of the environmental assessments of development projects which are mostly adhered by Asian Development Bank Safeguards Policy as well.
3. Other international financing institutions such ADB applies Safeguard Policy Statement to all ADB-financed sovereign and non-sovereign projects, and project components that are associated with ADB-supported projects, regardless of whether these components are financed by ADB, the borrower/client, or co-financiers. The Safeguard Policy Statement were published in July 2009, with the aim of providing an approach to the determination, assessment, and management of environmental and social risk in project financing. The intention of the environment and social safeguards was to ensure projects receiving finance were developed, operated and closed in a socially responsible manner and reflected sound environmental management practices.

The primary means of integrating the Safeguard Policy Statement, IFC PS, IFC EHS Guidelines expectations into the construction and operational phase of the project is through the preparation of this EIA and EMP.

2.3 Institutional Backgrounds

The national as well as provincial institutional framework for decision making and policy formulation for environmental and conservation aspects were accessed to determine the applicable scope of activities.

2.4 Pakistan Environmental Protection Council

The apex body, Pakistan Environment Protection Council (PEPC), was first constituted in 1984 under Section 3 of the Pakistan Environmental Protection Ordinance (PEPO), 1983, with President of Pakistan as its Chairman. In 1994, an amendment was made in the Ordinance to provide for the Prime Minister or his nominee to be the head of the Council. The Council was reconstituted after enactment of the new law, i.e., Pakistan Environmental Protection Act, 1997 (PEPA).

It is headed by the Prime Minister (Chief Executive) of Pakistan. The council is represented by trade and industry, leading non-governmental organization (NGOs), educational intuitions, experts, journalists and concerned ministries.

The Council is responsible to

(a) coordinate and supervise enforcement of the provisions of Environmental Protection Act (discussed later in the Chapter).

(b) approve comprehensive National Environmental Policies (NEPs) and ensure their implementation within the framework of a National Conservation Strategy (NCS) as may be approved by the Federal Government from time to time.

(c) approve the National Environmental Quality Standards (NEQS).

(d) provide guidelines for the protection and conservation of species, habitats, and biodiversity in general, and for the conservation of renewable and non-renewable resources; and

(e) coordinate integration of the principles and concerns of sustainable development into national development plans and policies.

2.4.1 Pakistan Environmental Protection Agency

The Pakistan Environmental Protection Agency (Pak-EPA) headed by a Director General has wide ranging functions given under the PEPA including preparation and co-ordination of NEP for approval by the PEPC, administering and implementing the PEPA and preparation, establishment or revision of the National Environment Quality Standards (NEQS). The Pak-EPA also has the responsibility for reviewing and approving IEE and EIA reports for the following projects:

- Projects on federal land
- Military projects
- Projects involving trans-country or trans-province impacts

The responsibility for the review and approval of all other IEEs and EIAs was delegated to the relevant Provincial EPA's. Vide notification dated 29 June 2011 the Pak-EPA was assigned to the Capital Administration and Development Division under National Disaster Management Division.

2.4.2 Khyber Pakhtunkhwa Environment Protection Agency (KP EPA)

The KPK Environmental Protection Agency (KPK EPA) was established under PEPA 1997. It is headed by a Director General who exercises powers delegated previously to him by the Pak-EPA and now by the Environmental Department, GoKPK. For the proponent, KP EPA is the relevant regulatory agency for the review and approval of IEE and EIA reports which is already acquired.

Statutory functions of the provincial EPAs are to:

- Administer and implement the Environmental Protection Act, its rules and regulations
- Review IEE/EIA, preparation of procedures and guidelines
- Prepare, revise and enforce Environmental Quality Standards (industries, municipalities, vehicular emission)

- Establish and maintain laboratories, certification of laboratories for conducting tests and analysis
- Assist local Councils, Authorities and / or Government Agencies in the execution of projects
- Establish a system of surveys, monitoring, examination, and inspection to combat pollution
- Conduct training for Government functionaries and industrial management
- Provide information and education to the public on environmental issues
- Publish the Annual State of the Environment report
- Undertake surveys and qualitative and quantitative analysis of data on air, soil and water
- quality, and industrial, municipal and traffic emissions
- Take measures to promote environment-related Research and Development (R&D) activities.

After the 18th Amendment in the Constitution of Pakistan, the Environment Ministry was devolved to the provinces. EPA, Khyber Pakhtunkhwa was established in 1989 under the administrative control of PP&H Department. Later, in 1992, it was transferred to PE&D Department. In year 2001 it was placed under the newly created Environment Department. EPA is working with a total staff strength of 100 regular employees. The KPK renamed the EPA KPK to deal with the threats posed by global warming and environmental protection.

The Proponent is responsible for preparing the complete environmental documentation required by the EPA and remain committed for getting clearance from it.

2.4.3 KP Forestry Wildlife Department

Khyber Pakhtunkhwa Wildlife Department, which was notified as an attached Department in August 1994, started as wing of Forest Department in 1975. The Wildlife Organization in Khyber Pakhtunkhwa Province emerged in 1974 as an ex-cadre wing of the Forest Department under the administrative control of Chief Conservator of Forests. This wing functioned for 4 years as a non-significant and low priority organization and was ultimately abolished in 1978 under an economy drive. Conservation of wildlife again became a priority, and the wildlife wing was re-established in 1981. Conservation awareness and priority reached a high mark in 1995 when the wildlife wing was given the status of an "Attached Department" within Forest, Fisheries and Wildlife Department and Conservator Wildlife was declared as Head of the Department.

The project is expected to involve clearing of vegetation and trees within the proposed project area. The project proponent will be responsible for acquiring a "No-Objection Certificate" (NOC) from the respective Forest Departments and Local Administration.

2.4.4 KPK Irrigation Department

KPK Irrigation Department Khyber Pakhtunkhwa1F[2] is a government organization with a mandate to plan, develop, manage, operate and maintain different modes of environmentally and socially acceptable Irrigation and Drainage Systems in the province. The province of Khyber Pakhtunkhwa is endowed with hydraulic civilization, natured by rich irrigation heritage.

The Project is only required to consult with irrigation department regarding project activities. No NoC from respective Irrigation department is required.

2.4.5 Revenue Department

Under the national law, matters relating to land use and ownership are provincial subjects, and for the purposes of this project, the respective Revenue Departments of KP are empowered to carry out the acquisition of private land or built-up property for public purposes. To depute land acquisition collectors (LACs) and other revenue staff who will be responsible for handling matters related to acquisition of land and the disbursement of compensation, the proponent must lodge applications with the KP government.

The proponent will provide logistical support and assist in preparing the documents necessary for notification. It will also need to liaise with the Agriculture Department, and forestry to evaluate affected vegetation resources, such as trees and crops etc., for compensation purposes. Where public buildings/infrastructures are involved, the proponent will approach the relevant departments for valuation of the affected building or infrastructure before removing the facilities.

Likewise, the proponent will liaise with other relevant departments/agencies for relocation of public facilities such as electricity and telephone poles, public water supply schemes, public buildings, etc.

2.4.6 Pakhtunkhwa Energy Development Organization (PEDO)

In 1993, it was an autonomous body under the 1993 Act and renamed as "Sarhad Hydel Development Organization (SHYDO) " In 2013, the name of organization was changed to "Pakhtunkhwa Hydel Development Organization (PHYDO)" In 2014 PHYDO was renamed as "Pakhtunkhwa Energy Development Organization (PEDO)" through passage of PEDO Act 2014. The objectives of the PEDO to:

- Encourage private sector investment through full cost recovery and attractive rates of return
- Provide least cost power generation

[2] https://irrigation.kp.gov.pk/#:~:text=Muhammad%20Tahir%20Orakzai-,Irrigation%20Department%2C%20Khyber%C2%A0Pakhtunkhwa%C2%A0is%20a%20government%20organization%20with%20a,is%20endowed%20with%20hydraulic%20civilization%2C%20natured%20by%20rich%20irrigation%20heritage.,-The%20Irrigation%20Department

- Ensure fast track and transparent development of power projects
- Encourage and ensure participation of investors in the development and implementation of Hydropower projects
- Ensure participation, development, and welfare of all stakeholders
- Provide green energy.

2.4.7 National Highway Authority and Provincial Departments

The National Highway Authority (NHA) is a federal department dealing with express ways, motorways and main trunk roads of Pakistan. At provincial levels there is a separate "Provincial Highways Department" under the provincial Ministry for Communication and Works. All roads leading to the project sites from the Motorway are owned by the "Provincial Highways Department" of the KP province. The "District Officer Roads" in the Swat is the officer in charge to maintain these roads. The Provincial Highways Department of the province and the District Officer Roads are to be approached by the Proponent and the EPC contractor for any reconstruction and relocation of the project access routes of the project site and in the weir area and in the upper reservoir reach.

2.4.8 National Electric Power Regulatory Authority (NEPRA)

The National Electric Power Regulatory Authority (NEPRA) was established under an act of the Parliament (Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997, also known as the 'NEPRA Act') to function as an Independent Regulator and ensure a transparent, competitive and commercially oriented power market in Pakistan.

The Authority's main functions include, *inter alia*, issuing licenses for generation, transmission and distribution of electric power, establishing and enforcing standards to ensure quality, safety and proper accounting of operation and supply of electric power to consumers, approving investment and power acquisition programs of the utility companies and determining tariffs for bulk generation and transmission and retail distribution of electric power.

2.4.9 Local Government and Municipalities

The proponent and its contractors must ensure that the project meets the criteria of the government of KP for the establishment of construction camps and plants, use of the water resources and the safe disposal of wastewater, and toxic materials. These matters lie in the jurisdiction of Local Government. Therefore, the Contractor should liaise closely with the concerned body. The Proponent. will coordinate and monitor environment-related issues.

The Proponent. will liaise with local government/administration and municipalities on the matters related to resettlement of squatters and removal of encroachments or sources of congestion. In specific cases, the Proponent. will enter into agreements with the municipality, local government, or other service provider on the resettlement of displaced squatters.

2.5 Relevant National Legislation, Regulatory and Policy Instrument and International

2.5.1 Constitutional Provisions

The subject of 'Environmental Pollution and Ecology' was included in the concurrent list of the Constitution of Pakistan before the 18th constitutional amendment. Thus, allowing the Provincial Governments to enact laws on the subject. Previously, only the Federal Government had enacted laws on environment and the provincial environmental institutions/departments derived their powers from Federal law. However, after the passage of 18th constitutional amendment, the said ministry has been devolved into provinces and Pakistan Environmental Protection Agency is now working under the umbrella of Climate Change Division.

2.5.2 National Environmental Policy, Legislation and Guidelines

The enactment of comprehensive legislation on the environment, covering multiple areas of concern is a relatively new and ongoing process in Pakistan. Whereas a basic policy and legislative framework for the protection of the environment and overall biodiversity in the country is now in place, detailed rules, regulations and guidelines required for the implementation of the policies and enforcement of legislations are still in various stages of formulation and discussion. The following section presents a brief overview of the existing national policies, legislations and guidelines.

National Environmental Policy

The National Environmental Policy (NEP) was approved by the Pakistan Environmental Protection Council (PEPC) in its 10th meeting on 27th December 2004 under the chairmanship of the Prime Minister of Pakistan and thereafter, approved by the Cabinet on 29th June 2005. NEP is the primary policy of Government of Pakistan that addresses the environmental issues of the country. The broad goal of NEP is, "To protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development". The NEP identifies the following set of sectoral and cross-sectoral guidelines to achieve its goal of sustainable development.

The NEP suggests the following policy instruments to overcome the environmental problems throughout the country:

- Integration of environment into development planning.
- Legislation and regulatory framework.
- Capacity development.
- Economic and market-based instrument.
- Public awareness and education; and
- Public private civil society partnership.

NEP is a policy document and does not apply to proposed hydropower project. However, Proponent shall ensure that the project activities should not add to the aggravation of the environmental issues identified in NEP and mitigation measures shall be adopted to minimize or avoid any contribution of the project impacts in operation.

National Conservation Strategy

Before the approval of National Environmental Policy (NEP) the National Conservation Strategy (NCS) was considered as the Government's primary policy document on national environmental issues. Now this strategy just exists as a national conservation program. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation, preservation of cultural heritage and recommends immediate attention to these core areas to preserve the country's environment.

NCS does not directly apply to renewable energy projects however, Proponent shall ensure that the project should not add to the aggravation of the 14 core environmental issues identified in the NCS and mitigation measures should be adopted to minimize or avoid any contribution of the project impacts in operation.

The Biodiversity Action Plan, 2000

The Biodiversity Action Plan (BAP), which was designed to complement the NCS and the proposed provincial conservation strategies, identifies the causes of biodiversity loss in Pakistan and suggests a series of proposals for action to conserve biodiversity in the country.

The BAP recognizes that an environmental assessment is used as a tool at a project level to identify environmental effects of a proposed project and to plan for reducing adverse effects. The BAP further stipulates that an environmental assessment needs to be initiated at an early stage of project development and that public participation in the review of potential effects is important.

The Pakistan Environmental Assessment Procedures, 1997

The Pakistan Environmental Protection Agency (Pak EPA) prepared the Pakistan Environmental Assessment Procedures in 1997. The guidelines pertaining to the review process of EIAs and IEEs was given regulatory status in the Review of IEE and EIA Regulations, 2000. They are based on much of the existing work done by international donor agencies and Non-Governmental Organizations (NGOs). The package of regulations prepared by Pak EPA includes:

- Policy and procedures for filing, review and approval of environmental assessments.
- Guidelines for the preparation and review of environmental reports.
- Guidelines for public consultation; and
- Guidelines for sensitive and critical areas.

The guidelines on policy and procedures define the policy context and the administrative procedures that will govern the environmental assessment process, from the project pre-feasibility stage to the approval of the environmental report. According to the procedures laid out in the policy guidelines, IEEs or EIAs are to be filed with the respective Provincial EPA where the project is to be implemented. The Federal EPA has, however, been given the right to review any environmental report at any time and the power to revoke the decision of the Provincial EPA, if it deems this to be necessary.

Projects have been classified in the policy guidelines by expected degree of adverse environmental impacts. All projects proposed in environmentally sensitive areas (including Game Reserves and Wildlife Sanctuaries) require an EIA.

The procedures require proponents to prepare terms of reference for the environmental assessment reports. They require that all environmental assessment studies shall contain baseline data on the area and must contain a detailed assessment of the potential environmental impacts and the recommended mitigation measures. Consultations with the communities that are most likely to be affected as well as relevant NGOs are to be an integral part of the environmental impact assessment process.

The guideline on public consultation deals with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures the incorporation of their concerns in any impact assessment study. The guidelines on sensitive areas are more specific in that they identify the officially notified protected areas in Pakistan, including critical ecosystems and archaeological sites.

Rules of the Power Division (Ministry of Energy)

The Power Division of Federal Ministry of Energy is the GoP's executive arm for all issues relating to electricity generation, transmission and distribution, pricing, regulation, and consumption in the country, and exercises this function through its various line agencies as well as relevant autonomous bodies. It also serves to coordinate and plan the nation's power sector, formulate policy and specific incentives, and liaise with provincial governments on all related issues.

National Power Policy, 2021

The broad vision of National Power Policy (2021) is to ensure the development of most efficient and consumer centric power generation, transmission and distribution system that meets the needs of its population and boosts its economy in an affordable and sustainable manner.

The Ministry of Water and Power (as the Power Division was formerly known) developed the National Power Policy to support the current and future energy needs of the country. This strategy will set Pakistan on a trajectory of rapid economic growth and social development. Simultaneously, it will address the key challenges of the

power sector to provide much needed relief to the citizens of Pakistan. The main goals of this power policy are:

- Access To Affordable Energy; Accessibility of electric supply to all areas, including rural areas, at affordable rates is the cornerstone of socio-economic development
- Energy Security, including uninterrupted availability of energy sources, is an essential goal for the power sector
- Sustainability of Power Sector.

The Solid Waste Management Policy (2000)

This policy was promulgated by Pak-EPA. The Policy aims to facilitate control on waste by providing principles of good waste management and reducing waste at source.

Resettlement Policy of Pakistan, 2002

An important aspect of EIA is consideration of the displacement and relocation of the project affected population. A new resettlement policy has yet to be approved by Government but amendments to the Land Acquisition Act of 1894 (LAA) have been made from time to time. The policy has been formulated to ensure an equitable and uniform treatment of the resettlement issues throughout Pakistan. This policy will apply to all the development projects involving adverse social impacts, including land acquisition, loss of assets, loss of income, loss of business and other possible losses. The Resettlement Policy addresses those areas, which are not taken care of in the LAA, and will be applicable wherever any public sector or private development project affects people, families or communities, even when there is no displacement of population.

The legal procedures for land acquisition have the objective of providing adequate compensation for the economic loss to those who suffer loss of individual or communal property, including common assets, productive assets, structures, other fixed assets, income and employment, loss of community networks and services, pastures, water rights, public infrastructure like mosques, shrines, schools, graveyards and any consequential losses.

The Project Implementation and Resettlement Ordinance of 2001

The Government has promulgated an ordinance entitled “Project Implementation and Resettlement of the Affected Persons Ordinance 2001", later referred to as the “Resettlement Ordinance". This ordinance will be used to safeguard the interests of the persons/groups, who must be involuntarily resettled due to land acquisition caused by a proposed project. This Ordinance establishes that the resettlement of the involuntarily displaced persons is done as a matter of right and not by way of charity or any such sentiment. In addition, the Affected Persons (APs) shall be accepted as special groups, who in the supreme interest of the country have accepted/undergone involuntary displacement. The proposed Ordinance shall be supplementary to the Land

Acquisition Act of 1894, as well as other Laws of Pakistan, and, wherever such items are included in the Draft Resettlement Policy

The Land Acquisition Act, 1894 (Including Later Amendments)

The Land Acquisition Act of 1894 sets out the rules and procedures for acquiring land and immovable assets needed for development. The Act sets out the methodology for compensating the owners of affected land and assets. The Act comprises 55 Sections dealing with area notifications, surveys, acquisition, compensation, apportionment awards, dispute resolution, penalties and exemptions. However, it does not cover the aspect of resettlement of the affected population. In this respect, the GoP is in the process of formulating appropriate laws and policies with the assistance of the ADB.

It should be noted that there have been frequent revisions to the Land Acquisition Act and that the latest revisions will apply.

Applicable Labor Laws

Labor laws in Pakistan are governed by many legislative tools. Principal labor rights are provided by the constitution of Pakistan. In addition to constitutional rights, acts and ordinances have been enforced time to time for limiting working hours, minimum working age, and conditions of employment.

Of the 24 labor-related laws that existed in 2014 in Pakistan, those set out in **Table 2-1** relate directly to the core labor standards of the International Labor Organization's (ILO) and will broadly be applicable to 238 MW Kalam Asrit Hydropower Project.

Table 2-1 Laws Related Directly to the ILO Core Labor Standards

Legislation / Guidelines	Brief Description
Employment of Children Act (1991) **THE KHYBER PAKHTUNKHWA PROHIBITION OF EMPLOYMENT OF CHILDREN ACT, 2015. (Amendment of 1991 Act)**	Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines or any other hazardous employment. In accordance with this Article, the Employment of Child Act (ECA) 1991 disallows child labor in the country. The ECA defines a child to mean a person who has not completed his/her fourteenth years of age. The ECA states that no child shall be employed or permitted to work in any occupation set forth in the ECA (such as transport sector, railways, construction, and ports) or in any workshop wherein any of the processes defined in the Act is carried out. The processes defined in the Act include carpet weaving, *beeri* (type of cigarette) making, cement manufacturing, textile, construction and others).

KPK Bonded Labor System (Abolition) Act (2015)	The Bonded Labor System (Abolition) Act seeks to eradicate bonded labor practices prevailing in the respective provinces. The Act define the `Bonded Labor System' as a system of forced, or partly forced, labor under which a debtor enters, or is presumed to have entered into an agreement with the creditor to the effect that: ▪ In consideration of an advance obtained by him or by any of the members of his family (whether such advance is evidenced by any document) and in consideration of the interest, if any, due on such advance, or ▪ In pursuance of any customary or social obligation, or ▪ For any economic consideration received by him or by any member of his family.
KPK Minimum Wages Act (2013)	The Act states that every employer shall be responsible for the payment of minimum wages required to be paid under the Act to all workers employed, either directly or through a contractor, in his commercial or industrial establishment: ▪ Provided that where an employer provides housing accommodation to a worker, he may deduct from the wages of such a worker, an amount not exceeding that in the ordinance. ▪ Where the employer provides a worker with transport to and from the place of work, he may deduct from the wages of such a worker an amount not exceeding that specified in the ordinance. Draft Recommendation of Minimum Wages Board under the act is 21,000 PKR on 1st June 2021.
KPK Industrial Relations Act (2013)	This Act seeks to regulate formation of trade unions, regulation and improvement of relations between employers and workmen and the avoidance and settlement of any differences or disputes arising between them and ancillary matters.

Pakistan has ratified the ILO conventions for the core labor standards including:

- Freedom of association and collective bargaining (conventions 87 and 98)

- Elimination of forced and compulsory labor (conventions 29 and 105)
- Elimination of discrimination in respect of employment and occupation (conventions 100 and 111)
- Abolition of child labor (conventions 138 and 182).

Pakistan has also ratified the United Nations (UN) Convention on the Rights of the Child in 1990 but is not yet subscribed to the UN Convention of the Protection of the Rights of all Migrant Workers and Members of their Families.

River Protection Ordinance, 2002 Amended Act 2014

The Ordinance is instated to provide for the protection of the aquatic ecology, water quality, economic and environmental value of the rivers and their tributaries in the KP. The Ordinance states:

No Person shall-

a) construct, or undertake any related physical works of any commercial building or non-commercial building, or undertake any other developmental work, within two hundred feet to be measured along the slope (lay off land) beyond high water limit on either side of the rivers or their tributaries or on a space within the limits between the banks of a river.

b) place or deposit or release, directly or indirectly, any substance into the river or their tributaries, more than the National Environmental Quality Standards (NEQS) notified by Government from time to time.

c) dispose, directly or indirectly, any solid waste or hazardous waste or other additional substances specified and notified by Government into rivers or their tributaries.

The Explosives Act, 1884 (IV of 1884)

This Act may be called the Explosives Act, 1884; and it extends to the whole of Pakistan. This deals with the manufacture, possession, transportation, possessing, storage, using, selling or importation of dangerous explosives.

The Khyber Pakhtunkhwa Explosives Act, 2013

The Khyber Pakhtunkhwa explosives act 2013 define rules and regulations for handling of any kind of explosives. It is to regulate the manufacture, possession, licensing, use, sale, transportation of explosives in the Province of the Khyber Pakhtunkhwa. Hence, on the 238 MW Asrit Kalam hydropower Project site, contractors must stand by the regulations during quarrying, blasting and for other purposes in construction activities.

Highways Safety Ordinance of 2000

This Ordinance includes provisions for: licensing and registration of vehicles and construction equipment; maintenance of road, vehicles; traffic control offences,

penalties and procedures; and the establishment of a police force for motorways and national highways to regulate and control the traffic as well as keep the highways clear of encroachments.

The Local Government Ordinance of 1979

Section 93 of the Local Government Ordinance of 1979 pertains to environmental pollution. Under this Ordinance, the local councils are authorized to restrict activities causing pollution to air, water or land. They may also initiate schemes for improving the environment.

The Protection of Trees and Brushwood Act of 1949

The Protection of Trees and Brushwood Act of 1949 prohibits the cutting or lopping of trees and brushwood without the permission of the Forest Department. Forest department KPK is the custodian of this Act.

Industrial and Commercial Employment (Standing Orders) Act, 2013

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

The Project is required to comply with the clauses in this Act.

The Pakistan Power Generation Policy 2015

"The Power Generation Policy-2015" was announced on 3rd April, 2015 by Ministry of Water and Power to offer enhanced incentives and simplified processing to encourage the local and international investors to participate in the development of power projects in Pakistan. The objectives of the power policy are to:

(a) Provide sufficient capacity of power generation at the least cost.
(b) To encourage and ensure exploitation of indigenous resources, a win-win situation.
(c) To ensure that all stakeholders are looked after in the process.
(d) To safeguard the environment.

The Pakistan Environmental Protection Ordinance 1983

The Pakistan Environmental Protection Ordinance, 1983 (PEPO 1983) was the first legislation designed specifically for the protection of the environment in the country. The Pakistan Environmental Protection Agency was established in 1984. This is the primary government institution dealing with environmental issues. Significant work on

developing environmental policy was carried out by the late 1980s, which culminated in drafting of the Pakistan National Conservation Strategy. Provincial Environmental Protection Agencies were also established at about the same time. The National Environmental Quality Standards were established in 1993 and then revised in 2000. The enactment of PEPA No XXXIV of 1997, conferred broad- based enforcement powers to the Environmental Protection Agencies. The publication of the Pakistan Environmental Protection Agency Review of IEE and EIA Regulations (IEE- EIA Regulations), 2000, provided the necessary details on the preparation, submission, and review of Initial Environmental Examinations (IEE) and Environmental Impact Assessments (EIA).

In addition to the PEPA of 1997, Pakistan's statute books contain several other laws that have clauses concerning the regulation and protection of the environment. A summary of the laws and regulations relevant to the proposed project in the context of environmental assessment and management of the project are given in

Table 2-2Major Sectors of Pakistan Environmental Legislation

SECTOR	LEGISLATION
Environmental Protection	The Pakistan Penal Code (1860) Pakistan Environmental Protection Act, No. XXXIV of 1997
Land Use	The Pakistan Penal Code (1860) The Canal and Drainage Act (1873) The Baluchistan, Khyber Pakhtunkhwa, Punjab and Sindh Local Government Ordinance(s) (1979/80) On farm Water Management and Water Users' Associations Ordinance (1981) Indus River Water Apportionment Accord (1991) Statutory Notification S.R.R. 742 (1993)
Water Quality and Resources	The Pakistan Penal Code (1860) The Motor Vehicles Ordinance (1965) and Rules (1969) The Baluchistan, Punjab and Sindh Local Government Ordinance(s) (1979/80)

	Statutory Notification S.R.R. 742 (1993) Statutory Notification S.R.R. 1023 (1995)
Air Quality	The Motor Vehicles Ordinance (1965) and Rules (1969)
Noise	The Motor Vehicles Ordinance (1965) and Rules (1969)
Toxic or Hazardous Substances	- The Pakistan Penal Code (1860) - The Explosives Act (1884) - The Agricultural Pesticides Ordinance (1971) and Rules (1973)
Solid Waste and Effluents	- The Baluchistan, Khyber Pakhtunkhwa, Punjab and Sindh Local Government Ordinance(s) (1979/80) - Pakistan Environmental Protection Act, No. XXXIV of 1997
Marine and Fisheries	- The West Pakistan Fisheries Ordinance (1961) - The Khyber Pakhtunkhwa Fisheries Rules (1976)
Forest Conservation	- The Punjab Forest (sale of timber) Act (1913) - The Forests Act (1927). - The Khyber Pakhtunkhwa Hazara Forest Act (1936) - The West Pakistan Firewood and Charcoal (Restrictions) Act 1964 - The Punjab Plantation and Maintenance of Trees Act (1974) - The Cutting of Trees (Prohibition) Act (1975) - The Khyber Pakhtunkhwa Management of Protected Forests Rules (1975) - The Baluchistan, NWFP, Punjab and Sindh Local Government Ordinance(s) (1979/80)

	- The Khyber Pakhtunkhwa (Conservation and Exploitation of Certain Forests in Hazara Division) Ordinance (1980) - The Khyber Pakhtunkhwa Forest Development Corporation Ordinance (1980) - The Protection of Trees and Brushwood Act of 1949
Parks and Wildlife Conservation Protection	- The West Pakistan Ordinance (1959) - The Punjab Wildlife (Protection, Preservation, Conservation and Management) Act (1974) and Rules (1974) - The Khyber Pakhtunkhwa Wildlife (Protection, Preservation, Conservation and Management) Act (1975) and Rules (1976) - Northern Areas Wildlife Preservation Act (1975) - The Pakistan Plant Quarantine Act (1976) - Islamabad Wildlife (Protection, Preservation, Conservation and Management) Ordinance (1979/80) - The Baluchistan, Khyber Pakhtunkhwa, Punjab and Sindh Local Government Ordinance(s) (1979/80) - Export and Control Order (1982)
Mineral Development	- The Regulation of Mines and Oilfields and Mineral Development (Government Control) Act (1948)
Cultural Environment	- The Antiquities Act (1975) - The Punjab Special Premises (Prevention) Ordinance (1985)
Livestock	- West Pakistan Goats (Restriction) Ordinance (1959) - The Grazing of Cattle in Protected Forests (Range Lands) Rules (1978)

	- Pakistan Animal Quarantine (Import and Export of Animals and Animal Products) Ordinance (1979/80) - The Baluchistan, Khyber Pakhtunkhwa, Punjab and Sindh Local Government Ordinance(s) (1979/80)
Resettlement	- Land Acquisition Act 1894 - Project Implementation and Resettlement Ordinance - Draft Resettlement Policy of Pakistan, 2002 - The Telegraphy Act (1910) - The West Pakistan Water & Power Act (1958) - The Electricity Act IX (1910)
Public Health and Safety	- The Pakistan Penal Code (1860) - The Public Health (Emergency Provisions) Ordinance (1944) - The Baluchistan, Khyber Pakhtunkhwa, Punjab and Sindh Local Government Ordinance(s) (1979/80) - The West Pakistan Epidemic Diseases Act (1979/80)

Source: Pakistan Environmental Assessment Procedures, Pakistan EPA, Islamabad

2.6 Implementation of Labour Laws on 238 MW Asrit Kalam HPP

Of the 24 labour-related laws that existed in Pakistan2F[3] and which are applicable in KP3F[4] , the following relate directly to the International Labour Organization (ILO)'s Core Labour Standards which Pakistan has ratified (refer to Section 4.4):

a) Bonded Labor System (Abolition) Act, 1992

b) Employment of Children Act (ECA), 1991 (prohibits child labour in Pakistan under the age of 14)

c) Minimum Wages Ordinance, 1961

[3] http://www.ilo.org/ifpdial/information-resources/national-labour-law-profiles/WCMS_158916/lang--en/index.htm

[4] By December 2014, Khyber Pakhtunkhwa (KP) province had adopted seven laws relating to labour and welfare

d) Industrial Relations Act, 2010

e) West Pakistan Minimum Wages for Unskilled Workers' Ordinance, 1969

There are no laws covering equal remuneration for male and female workers undertaking work of equal value and removal of discrimination in respect of employment and occupation4F[5]. Key labour market regulatory requirements that are relevant to maintain labour rights for this Project include:

a) Maximum length of a single fixed-term contract: 9 months

b) Maximum working days per week: 6

c) Premium for work on weekly rest day (% of hourly pay): 100%

d) Maximum length of probationary period: 3 months

e) Notice period for redundancy dismissal (average for workers with 1, 5 and 10 years of tenure): 4.3 salary weeks

f) Severance pays for redundancy dismissal for a worker with 1 year of tenure: 4.3 salary weeks

g) Minimum wage for unskilled workers is 21,0005F6

h) According to the law, normal working hours per day are 8 hours and these should not be more than 48 hours per week6F[7].

Health, safety, and welfare of workers at factories, construction sites and labour camps are addressed in the Factories Act of 1934 (as amended). These regulations will be applicable to the Project and particularly during construction, placing responsibility on the EPC contractor to provide a healthy and safe environment to workers, including workers of subcontractors. The relevant provincial labour department is responsible to take the necessary measures to ensure compliance with the Act. There is no requirement to obtain any permit or license from the labour department to start construction of the Project.

The Antiquities Act, 1975

The protection of cultural resources in Pakistan is ensured by the Antiquities Act of 1975. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments etc. The act is designed to protect antiquities from destruction, theft, negligence, unlawful excavation, trade and export. The law prohibits new construction in the proximity of a

[5] See Sabeen Jamil, Pakistani Women Struggle for Equality at Work, May 2010, Newsline at http://www.newslinemagazine.com/2010/05/pakistani-women-strugglefor-equality-at-work/

[6] https://dol.kp.gov.pk/min-wages.html

[7] The Khyber Pakhtunkhwa Factories Act 2013.

protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area which may contain articles of archaeological significance. Under the Act, the Proponents are obligated to:

- Ensure that no activity is undertaken in the proximity of a protected antiquity, and
- If during the project an archaeological discovery is made, it shall be reported to the Department of Archaeology, Government of Pakistan.

No surface archaeological site was identified in the project area during the fieldwork for the EIA however, Proponent shall ensure that mitigation measures suggested in the EIA are being adhered with to avoid contravene with any provisions of the Act. It is also pertinent to mention that, as per SOP maps and list issued by the competent authorities, no protected archeological site falls within jurisdiction of project area or in influence.

Pakistan Penal Code, 1860

The Pakistan Penal Code, 1860 authorizes fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs to make them less fit for ordinary use.

2.7 Provincial Environmental Legislations

2.7.1 The KPK Environmental Protection Act, 2014

After passage of 18th constitutional amendment by the parliament, KPK Government has enacted its own environmental law. The KPK Environmental Protection Bill, 2014 was passed by the Provincial Assembly of KPK on 1st Dec 2014 and assented to by the Governor of KPK on 11th December 2014 as an Act of Legislature of KPK.

According to Part-13, *Environmental Examinations and Assessments*; *no proponent of a project shall commence construction or operation unless he has filed with the Agency an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) and has obtained from the Agency approval in respect thereof. As the proposed project will be in KPK, it falls under the jurisdiction of the KPK EPA.*

2.7.2 KPK Environmental Assessment Rules, 2021

In exercise of the powers conferred by Section 8 of the KPK Environmental Protection Act, 2014, the KPK Environmental Protection Agency (KPK EPA), with the approval of Government, issued the following regulations, namely '*The Khyber Pakhtunkhwa Environmental Assessment Rules, 2021,* which came into force at once.

Schedules II, III and IV attached to the IEE-EIA Regulations, 2021, list the projects that require IEE, EIA and GEA respectively.

The proposed project falls into the category that requires an EIA. The IEE-EIA Regulations, 2021 also provide the necessary details on the preparation, submission,

and review of IEEs, EIAs and Environmental Checklists. The following is a brief stepwise description of the approval process:

- A project is categorized as requiring an IEE, EIA or GEA using the three schedules attached to the Regulations.
- An EIA, IEE or GEA is conducted as per the requirement following the KPK EPA and guidelines.
- The EIA, IEE or GEA is submitted to the concerned EPA.
- A fee (**Rs. 500,000/-in current scenario**), depending on the cost of the project and the type of the report is submitted along with the document.
- The submittal is also accompanied by an application in the format prescribed in Schedule VI of the Regulations.
- The EPA conducts a preliminary scrutiny and replies mainly within 10 days of the submittal of a report, a) confirming completeness, or b) asking for additional information, if needed, or c) returning the report requiring additional studies, if necessary.
- The EPA is required to make every effort to complete the IEE, EIA and GEA review process within 90 working days, respectively, after the issuance of confirmation of completeness.
- The EPA will ask proponent to arrange a public hearing activity
- When the EPA's accord their approval subject to certain conditions. Before commencing construction of the project, the proponent is required to submit an undertaking accepting the conditions.
- Before commencing operation of the project, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of the IEE/EIA.
- An Environmental Management Plan (EMP) is to be submitted with a request for obtaining confirmation of compliance.
- The EPAs are required to issue confirmation of compliance within 15 days of the receipt of request and complete documentation.
- The IEE/EIA approval is valid for three years from the date of accord. This EIA for the proposed project was prepared following the guidelines of the KPK EPA and submitted for approval by Proponent.

Based on monthly monitoring, quarterly Environmental Monitoring Report is to be submitted to KPK EPA during construction and operational phase of the 238 MW Asrit Kalam hydropower Project .

2.7.3 The Khyber Pakhtunkhwa Environmental Protection Tribunal Rules, 2016

Government Of Khyber Pakhtunkhwa Forestry, Environment & Wildlife Department introduced tribunal rules for environmental affairs on 21st Nov 2016.

2.7.4 National Environmental Quality Standards (NEQS), 2010

The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and have been amended in 1995 and 2000. They have been revised and the latest NEQS were issued in 20107F[8]. The following standards that are specified in the NEQS are relevant to the proposed project

- **NEQS for Ambient Air – November 2010**, state the Maximum allowable concentration of pollutants (9 parameters) in gaseous emissions from vehicle exhaust.

- **NEQS for Drinking Water Quality – 2010,** describe the drinking water properties by outlining the defined physical and chemical parameters.

- **NEQS for Noise – November 2010**, states the maximum allowable limit of noise arising from vehicles in decibels (dB) separately for day and night times.

- **NEQS for Waste Effluents –2000,** states the Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea.

These standards apply to the gaseous emissions and liquid effluents discharged by batching plants, campsites and construction machinery. The standards for vehicles will apply during the construction as well as operation phase of the project. The standards are attached as Appendix-L in the appendices of this EIA report

Proponent will be required to comply with all applicable standards as prescribed in the law and report to KPK Environmental Protection Agency as per their requirements, bindings and imposed conditions.

2.7.5 Khyber Pakhtunkhwa Wildlife and Biodiversity Act, 2015

This KP Wildlife and biodiversity (Protection, Preservation, conservation and Management) Act 2015 provides for the preservation, protection and conservation of wildlife by the formation and management of protected areas and prohibition of hunting of wildlife species declared protected under the ordinance.

The act also specifies three broad classifications of the protected areas: national parks, wildlife sanctuaries and game reserves. Activities such as hunting and breaking of land for mining are prohibited in national parks, as are removing vegetation or polluting water flowing through the park. Wildlife sanctuaries are areas that have been set aside

[8] These NEQS are available at the Pak-EPA website (http://www.environment.gov.pk/info.htm)

as undisturbed breeding grounds and cultivation and grazing is prohibited in the demarcated areas. Nobody is allowed to reside in a wildlife sanctuary and entrance for the public is by special dispensation. However, these restrictions may be relaxed for scientific purpose or betterment of the respective area on the discretion of the governing authority in exceptional circumstances. Game reserves are designated as areas where hunting or shooting is not allowed except under special permits.

As the proposed 238 MW Asrit Kalam hydropower Project activities will be carried out far away from wildlife protected area therefore the project will not contravene with any provisions of the Act. However, Proponent shall ensure that the mitigation measures suggested in this EIA are being adhered with to preserve, protect and conserve the existing wildlife of the area. **Table 5-21**, **5-22, 5-23, 5-24, and 5-25** *lists down the recorded species from the project area covered under this Ordinance/Act*.

2.7.6 The KPK Irrigation Act, 1879 and the Canal and Drainage Act, 1873

This KPK Irrigation Act, 1879 covers the construction, maintenance, and regulation of canals for the supply of water and for the levy of rates of water supplied in the province of KPK. Canals are defined as channels, pipes and reservoirs constructed and maintained by the Government for the supply and storage of water. *Under section 27 of the Act a person desiring to have a supply of water from a canal for purposes other than irrigation shall submit a written application to a Canal Officer who may, with the sanction of the Provincial Government give permission under special conditions. The Act under section 61 also prohibits the damage, altering, enlarging, or obstructing the canals without proper authority.*

The Canal and Drainage Act, 1873 prohibits corruption or fouling of water in canals (defined to include channels, tube wells, reservoirs, and watercourses), or obstruction of drainage.

The canals and associated irrigation network also exist around the project area. None of the extensive project activity will be planned near these canals and associated irrigation network which could directly cause physical damage or alteration in surface water quality.

2.7.7 River Protection Ordinance, 2002 Amended Act 2014

The Ordinance is instated to provide for the protection of the aquatic ecology, water quality, economic and environmental value of the rivers and their tributaries in the KP. The Ordinance states:

No Person shall-

a. construct, or undertake any related physical works of any commercial building or non-commercial building, or undertake any other developmental work, within two hundred feet to be measured along the slope (lay "off land) beyond high water limit on either side of the rivers or their tributaries or on a space within the limits between the banks of a river.

b. place or deposit or release, directly or indirectly, any substance into the river or their tributaries, more than the National Environmental Quality Standards (NEQS) notified by Government from time to time.

c. dispose, directly or indirectly, any solid waste or hazardous waste or other additional substances specified and notified by Government into rivers or their tributaries

Under the Sector-5 (2) of the Act, "Any organization or individual, who intends to construct bridge, culverts, crossing structure and flood protection works on rivers, streams, nullahs, drains and water channels shall obtain an NOC, before the commencement of works".

Proponent will be required to comply with all applicable sections of the "River Protection Ordinance, 2002 Amended Act 2014"..

2.7.8 Fisheries Ordinance, 1961 (updated 2016)

The Khyber Pakhtunkhwa fisheries ordinance 1961 (updated 2016) regulates the laws and policies of fishing in water bodies of province Khyber Pakhtunkhwa. The general provisions described in this Act include prohibition to use explosives, the prohibition to use toxic and poisonous substances during the activities; the dimension and kind of nets to be used and as well the respective penalties in-terms on any nonconformity

Section	**Specific to Project**
Section 6: No person shall use 1[any dynamite, electric shock or other explosive substance] in any water with intent thereby to catch or destroy any of the fish that may be therein.	Destruction of fish by explosive
Section 7: No person shall put any poison, lime or noxious material into any water with intent thereby to catch or destroy any fish that may be therein.	Destruction of fish by poisoning water
Section 8: No person shall kill, capture, or possess any species of fish specified in the second column of the First Schedule, of a size less than that specified in the third column of the said Schedule against such species.	Fish that shall not be taken

Section 9: (1) No person shall use or employ for the capture of any species of fish, in any water other than private water, any net, cage, trap or other contrivance for taking fish or fixed engine, except during the period permitted. [Provided that in the case of trout, only such gear and in such number shall be used or employed as may be specified in the license or permit, (2) Licenses shall be issued by the authorities, on payment of fees and on conditions as may be prescribed.	Net, fixed engine trap, etc., shall not be employed without a permit or license.
Section 10: Every person in possession of any fishing license or permit shall produce his license or permit on a demand made by the Inspector of Fisheries or any other person authorized in this behalf by the Director of Fisheries.	Duty to produce license or permit on demand made by employees of Fisheries Department
Section 11: (1) Notwithstanding anything contained in this Ordinance, Government may, by notification, declare any water to be a sanctuary for fish mentioned in the First Schedule for a period, which may be specified, and during such period, no person shall kill, capture or possess such fish without a special permit issued under this Ordinance by the Director of Fisheries.	Power to declare any water to be a sanctuary for fish

Proponent is required to acquire Non-Objection Certificate from the Provincial Fisheries department as per requirements of EPA KPK.

2.7.9 The Forest Act, 1927

This act is applicable to all regions of Pakistan. It includes procedures for constituting and managing various types of forests, such as reserved forests and protected forests. The act empowers the provincial forest departments to declare any forest area as reserved or protected and prohibit the breaking up or clearing of forest for cultivation, grazing, hunting, removing forest produce, quarrying and felling, lopping and topping of trees, branches in reserved and protected forests. It also defines the duties and roles of forest related public servants and penalties for any infringement of the rules.

As per information collected from secondary sources, Survey of Pakistan (SOP) maps and from formal consultation with KPK Forest Department, the project area is located outside any reserved or protected forest area therefore, the project will not contravene with any provisions of the Act. However, Proponent shall ensure that all mitigation measures suggested in this EIA are being adhered with to protect the natural vegetation cover of the area and to avoid habitat loss and degradation of biodiversity. The Proponent is required to acquire Non-Objection Certificate from the Provincial Forest department as per requirements of EPA KPK.

2.7.10 Forest Ordinance, 2002

Khyber Pakhtunkhwa Forest Ordinance was formulated in 2002; it is the general law, which provides the protection, conservation, management and sustainable development of forest, flora and fauna in the province, wholly. This law aimed for the following objectives.

1. Development, protection, management and sustainable development of forests,
2. Economic wellbeing of local population and the people of the province,
3. Promotion and incorporation of participatory approach towards forest management.
4. Timely resolution of the conflicts related to forest.
5. Development of a comprehensive law on forest which fulfills environmental needs.

The Proponent will be required to abide by the Forest Ordinance, 2002.

2.8 KPK Forest Act, 2012

The Act authorizes Provincial Forest Departments to establish forest reserves and protected forests. The Act empowers the Department to protect, conserve, manage, and sustainably develop forests and biodiversity. The Act prohibits any person to set fire in the forest, quarry stone, remove any forest-produce or cause any damage to the forest by cutting trees or clearing up area for cultivation or any other purpose.

The project activities will have to be carried out in accordance with this Act. No activities will be carried out in any protected forests, and no unauthorized tree cutting will be carried out. The field investigations are carried out as part of the environmental and social assessments of the sub-projects and doesn't show any protected area within the project.

2.8.1 KPK Factories Act, 2015

In 2015 KPK Government issued KPK Factories Act, 2015 by revising Factories Act, 1934 and KPK Factories Act, 1975. The law covers requirements for workmen related to equipment safety, working hours etc.

2.8.2 Labor, Occupational Health and Safety and Resettlement Legislation

Labor rights are established in principle in the constitution of Pakistan. Labor laws are elaborated on national level through acts and ordinances that cover specific issues including limits to working hours, minimum working age and conditions of employment.8F9

The primary law in Pakistan, which was enacted following the country's ratification of Internal Labor Organization (ILO) Conventions 87 and 98 is the Industrial Relations Act, 2012.

Khyber Pakhtunkhwa (KP) province had adopted seven laws relating to labor and welfare, including the industrial relations law9F10 , including.

a) The Khyber Pakhtunkhwa Industrial Relations Act 2010

b) The Khyber Pakhtunkhwa Senior Citizen Act, 2014 (19th Nov 2014)

c) The Khyber Pakhtunkhwa Journalists Welfare Endowment Fund Act,2014 (19th March 2014)

d) The Khyber Pakhtunkhwa Tenancy (Amendment) Act,2014 (18th March,2014)

e) The Khyber Pakhtunkhwa Pension Fund (Amendment) Act,2014 (8th December 2014)

2.8.3 Implementation of Labour Laws on Kalam Asrit HPP

Of the 24 labour-related laws that existed in Pakistan10F11 and which are applicable in KP11F12 , the following relate directly to the International Labour Organization (ILO)'s Core Labour Standards which Pakistan has ratified (refer to Section 4.4):

a) Bonded Labor System (Abolition) Act, 1992

b) Employment of Children Act (ECA), 1991 (prohibits child labour in Pakistan under the age of 14)

c) KPK Minimum Wages Act, 2013

[9] https://s3.amazonaws.com/s3.documentcloud.org/documents/2070301/status-labour-rights-in-pakistan-the-year-2014.pdf

[10] Labour Force Survey 2012-13

[11] http://www.ilo.org/ifpdial/information-resources/national-labour-law-profiles/WCMS_158916/lang--en/index.htm

[12] By December 2014, Khyber Pakhtunkhwa (KP) province had adopted seven laws relating to labour and welfare

d) KPK Environmental Assessment Rules, 2021

e) The Khyber Pakhtunkhwa Industrial Relations Act, 2010

f) The Khyber Pakhtunkhwa Senior Citizen Act, 2014

g) The Khyber Pakhtunkhwa Tenancy (Amendment) Act,2014

h) West Pakistan Minimum Wages for Unskilled Workers' Ordinance, 1969

There are no laws covering equal remuneration for male and female workers undertaking work of equal value and removal of discrimination in respect of employment and occupation12F[13]. Key labour market regulatory requirements that are relevant to maintain labour rights for this Project include:

i) Maximum length of a single fixed-term contract: 9 months

j) Maximum working days per week: 6

k) Premium for work on weekly rest day (% of hourly pay): 100%

l) Maximum length of probationary period: 3 months

m) Notice period for redundancy dismissal (average for workers with 1, 5 and 10 years of tenure): 4.3 salary weeks

n) Severance pays for redundancy dismissal for a worker with 1 year of tenure: 4.3 salary weeks

o) Minimum wage for unskilled workers is 21,000PKR13F14.

Health, safety and welfare of workers at factories, construction sites and labour camps are addressed in the Factories Act of 1934 (as amended). These regulations will be applicable to the Project and particularly during construction, placing responsibility on the EPC contractor to provide a healthy and safe environment to workers, including workers of subcontractors. The relevant provincial labour department is responsible to take the necessary measures to ensure compliance with the Act. *There is no requirement to obtain any permit or license from the labour department to start construction of the Project.*

2.8.4 KP Land Acquisition Act 2020

Before the enforcement of The Land Acquisition (KPK Amendment) Act 2020, the Land Acquisition Act, 1894 was the prime policy governing land acquisition, resettlement and compensation in the country as well as the KPK province.

[13] See Sabeen Jamil, Pakistani Women Struggle for Equality at Work, May 2010, Newsline at http://www.newslinemagazine.com/2010/05/pakistani-women-strugglefor-equality-at-work/

[14] https://dol.kp.gov.pk/min-wages.html

The Land Acquisition Act (LAA) of 1894 amended from time to time has been the de facto policy governing land acquisition, resettlement and compensation in the country. The LAA is the most used law for acquisition of land and other properties for development projects. It comprises of 55 sections pertaining to area notifications and surveys, acquisition, compensation and apportionment awards and disputes resolution, penalties and exemptions.

The planned 238 MW Asrit Kalam hydropower Project by Proponent is in Swat district. The proposed project is being developed on the land purchased from private owners and Government in Kalam and Asrit villages of KPK province. *During the process Revenue Department KPK was taken on board during the whole process*.

2.8.5 Highway Safety Ordinance (2000)

The Highway Safety Ordinance includes provisions for licensing and registration of vehicles and construction equipment; maintenance of road vehicles; traffic control offences, penalties and procedures; and the establishment of a police force for motorways and national highways to regulate and control the traffic as well as keep the highways clear of encroachments. During the project implementation, the Contractor's vehicles and machinery may need to use the national highways accessing to the sub-project locations; therefore, this ordinance is applicable to the proposed Project.

2.8.6 The Khyber Pakhtunkhwa Factories Act, 2013

The Khyber Pakhtunkhwa factories act formulates all the admissible factors that deal with health, safety and welfare of the workers, management of solid waste and effluent, potential damages to private and public property in the state. It comprises the management of toxic and hazardous substances including their handling and disposal from. Since, construction activities are also considered as an industry, the rules and regulations as per the act will be applicable to the Contractors.

2.8.7 The Khyber Pakhtunkhwa Antiquities Act, 2016

The primary focus of this act is to deal with matters relating to the protection, preservation and conservation of any archaeological/ historical sites and monuments in Khyber Pakhtunkhwa province. It elaborates the restrictions on any construction (or other damaging) activity within 200 meters of such sites unless prior permission is obtained from the Federal Department of Archaeology and Museums. *No archaeological/ historical site was found near or around 500 m buffer around the project site. A chance find procedure is developed and annexed with this EIA, in accordance with this law.*

2.8.8 KPK The Local Government Ordinance of 1979

Section 93 of the Local Government Ordinance of 1979 pertains to environmental pollution. Under this Ordinance, the local councils are authorized to restrict activities causing pollution to air, water or land. They may also initiate schemes for improving the environment.

2.8.9 The Khyber Pakhtunkhwa Explosives Act, 2013

The Khyber Pakhtunkhwa explosives act 2013 define rules and regulations for handling of any kind of explosives. It is to regulate the manufacture, possession, licensing, use, sale, transportation of explosives in the Province of the Khyber Pakhtunkhwa. *Hence, on the project site, contractors must stand by the regulations during quarrying, blasting and for other purposes in construction activities.*

2.8.10 Laws Regulating Flow Releases for Hydropower Projects

Most of the hydropower projects under development are in public sector, the provincial government has embarked on a multi-pronged strategy for encouraging investment through Public, Private & Public Private Partnership sectors in that view the government of Khyber Pakhtunkhwa has decided to announce a new Hydropower policy(2016) which offers enhanced incentives and simplified processing mechanism for setting up of power generation plants to bridge the demand supply gap in the minimum time through generation of affordable electricity. To achieve these purposes, the KPK government has designated Pakhtunkhwa Energy Development Organization (PEDO) as the one window facilitator and implementation agency of this policy.

The main objectives of the Power Policy are:

- To encourage and ensure participation of investors in the development and implementation of Hydropower projects
- To provide least cost power generation
- To encourage private sector investment through full cost recovery and attractive rates of return
- To ensure fast track and transparent development of power projects ·
- To ensure participation, development and welfare of all stakeholders ·
- To provide green energy.

2.8.11 Integrated Water Resource Management Board Ordinance, 2002

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

The ordinance requirements will be implemented by the 238 MW Asrit Kalam hydropower Project as there will be influence on the flow of Swat River.

2.8.12 Telegraph Act, 1885

The Telegraph Act (1885) was enacted to define the authority and responsibility of the Telegraph

Authority. The law covers, among other activities, installation, and maintenance of telegraph lines and posts (poles). The Act defines the mechanism to determine and make payment of compensation associated with the installation of these lines and posts. Under this Act, the land required for the poles is not acquired (or purchased) from the owner, nor the title of the land transferred. Compensation is paid to the owner for any structure, crop or tree that exists on the land; the cost of the land is not paid to the owner.

National Transmission & Dispatch Company (NTDC) is the responsible agency for developing transmission line networks in the country and it has been following this act for building transmission line towers throughout the country.

2.9 International Standards

2.9.1 ADB Guidelines

The following ADB policies and guidelines shall be applicable to the proposed project:

• ADB Policies, Strategies and Operations Manuals including but not limited to:

o ADB's 2009 Safeguard Policy Statement (SPS) – Safeguards Requirement (SR) 1 on Environment, SR2 on Involuntary Resettlement (IR), and SR 3 on Indigenous Peoples (IP)

- ADB Social Protection Strategy (2001).
- ADB Gender and Development Policy (1998).
- Public Communications Policy (2011); and
- Relevant ADB Operations Manual (OM) such as OMF1 for Safeguards Policy Statement, OML3 for Public Communications, OMD10 for Non-sovereign Operations, OMC3 for Incorporation of Social Dimensions into ADB Operations, OMC2 for Gender and Development.

The ADB's environmental policy is grounded in its Poverty Reduction Strategy and its Long-Terms Strategic Framework. To ensure the reduction of poverty through environmentally sustainable development, the ADB's Environment Policy contains five main elements: (i) promoting environment and natural resource management interventions to reduce poverty directly, (ii) assisting developing member countries to mainstream environmental considerations in economic growth, (iii) helping maintain global and regional life support systems that underpin future development prospects, (iv) building partnerships to maximize the impact of ADB lending and non-lending activities, and (v) integrating environmental considerations across all ADB operations. Under the last element, the ADB pledges to address the environmental aspects of its

operations through the systematic application of procedures for (i) environmental analysis for country strategy and programming; (ii) environmental assessment of project loans, program loans, sector loans, loans involving financial intermediaries, and private sector loans; (iii) monitoring and evaluation of compliance with environmental requirements of loans; and (iv) implementation of procedures for environmentally responsible procurement. In the context of policy-based lending and policy dialogue, the ADB will identify opportunities to introduce policy reforms that provide incentives to improve environmental quality and enhance the sustainability of natural resource management. ADB classifies projects into category A (with potentially significant environmental impact); category B (with potentially less significant environmental impact); or, category C (unlikely to have significant environmental impact).4 An IEE is required for category B projects and an ESIA, requiring greater depth of analysis, for category A projects. No environmental assessment is required for category C projects although their environmental implications nevertheless need to be reviewed. The proposed project has been classified as a category A project for environment. The ADB's requirements for environmental assessment are specified in its Environmental Assessment Guidelines. The ADB requires that an environmental assessment report and a summary ESIA report be prepared for a Category A project. Important considerations in preparing the environmental assessment include assessing induced, indirect, and cumulative impact, examining alternatives, achieving environmental standards, designing least-cost mitigation measures, developing appropriate environmental management plans and monitoring requirements, formulating institutional arrangements, and ensuring meaningful public consultation. The format of the environment assessment report for program loans is flexible, but includes a matrix describing the environmental consequences and mitigation measures for the policy actions underpinning the program loan

The ADB requires public consultation and access to information in the environment assessment process. For a Category A project, it is required that the groups affected by the proposed project and local NGOs be consulted at least twice: (i) once during the early stages of ESIA field work; and (ii) once when the draft ESIA report is available, and prior to loan appraisal by the ADB. The public consultation process needs to be described in the ESIA and summary ESIA reports. The EMMP is a key component of the ESIA. The ADB places strong emphasis on the preparation of EMMPs during project processing. The EMMP sets out conditions and targets to be met during project implementation. It is also required to develop procedures and plans to ensure that the mitigation measures and monitoring requirements approved during the environmental compliance review will be carried out in subsequent stages of the project. The ADB, however, recognizes that the specific construction and operational activities may not be well enough defined at the feasibility stage of the project cycle to provide the details required for an effective EMP. The ADB therefore requires that the Borrower ensure that a revised EMMP be prepared

at the beginning of the implementation stage. The Company will be the project proponent and will be responsible for preparing the revised EMP.

2.9.2 ADB's Safeguard Policy Statement 2009

Built upon the three previous safeguard policies on the Involuntary Resettlement Policy (1995), the Policy on Indigenous Peoples (1998) and the Environment Policy (2002), the Safeguard Policy Statement was approved in 2009. The safeguard policies are operational policies that seek to avoid, minimize or mitigate adverse environmental and social impacts including protecting the rights of those likely to be affected or marginalized by the developmental process. ADB's safeguard policy framework consists of three operational policies on the environment, indigenous peoples and involuntary resettlement. A brief detail of all three operational policies have been mentioned below:

Environmental Safeguard: This safeguard is meant to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision making process. **Involuntary Resettlement Safeguard:** This safeguard has been placed to avoid involuntary resettlement whenever 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.

Indigenous Peoples Safeguard: This safeguard looks at designing and implementing 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 receive culturally appropriate social and economic benefits; do not suffer adverse impacts because of projects; and participate actively in projects that affect them. Information, **Consultation and Disclosure:** Consultation and participation are essential in achieving the safeguard policy objectives. This implies that there is a need for prior and informed consultation with affected persons and communities in the context of safeguard planning and for continued consultation during project implementation to identify and help address safeguard issues that may arise. The consultation process begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle. It provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people and is undertaken in an atmosphere free of intimidation or coercion. In addition, it is gender inclusive and responsive and tailored to the needs of disadvantaged and vulnerable groups and enables the incorporation of all relevant views of affected people and other stakeholders into decision making. ADB requires the borrowers/clients to engage with communities, groups or people affected by proposed projects and with civil society through information disclosure, consultation, and informed participation in a manner commensurate with the

risks to and impacts on affected communities. For projects with significant adverse environmental, involuntary resettlement or Indigenous Peoples impacts, ADB project teams will participate in consultation activities to understand the concerns of affected people and ensure that such concerns are addressed in project design and safeguard plans.

2.9.3 Social Protection Requirements

ADB's Social Protection Strategy (2001 SPS) requires the Borrower to comply with applicable labor laws in relation to the Project and take the following measures to comply with the core labor standards6 for the ADB financed portion of the Project.

2.9.4 Public Communications Policy 2011

The Public Communications Policy (PCP) of ADB, originally formulated in 2005 and revised in 2011, is aimed at promoting improved access to information about ADB's operations related to funded projects. It endorses greater transparency and accountability to stakeholders involved in a project. The PCP establishes the disclosure requirements for documents and information related to projects. It mandates project-related documents normally produced during the project cycle to be posted on the web.

2.10 Gender and Development Policy 1998

ADB's Gender and Development Policy (1998) adopts gender mainstreaming as a key strategy for promoting gender equity, and for ensuring that women participate in and that their needs are explicitly addressed in the decision-making process for development activities. The key elements of ADBs gender policy are: (i) Gender sensitivity, to observe how the project affects women and men differently and to take account of their different needs and perspectives in resettlement planning; (ii) Gender analysis, which refers to the systematic assessment of the project impact on men and women and on the economic and social relationships between them; (iii) Gender planning, which refers to the formulation of specific strategies to bring about equal opportunities to men and women; and (iv) Mainstreaming, to consider gender issues in all aspects of ADB operations, accompanied by efforts to encourage women's participation in the decision-making process in development activities. The SPS and safeguards requirements also reiterate the importance of including gender issues in the preparation of safeguards documents at all stages to ensure that gender concerns are incorporated, including gender-specific consultation and information disclosure. This includes special attention to guarantee women's assets, property, and land-use rights and restoration/improvement of their living standards; and to ensure that women will receive project benefits.

2.10.1 IFC Performance Standards

IFC applies the Performance Standards (PS) to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing for IFC member countries eligible for financing. The

Performance Standards may also be applied by other financial institutions electing to apply them to projects in emerging markets. Together, the eight Performance Standards establish that the clients are to meet throughout the life of an investment by IFC or other relevant financial institution:

- Performance Standard 1 – Social and Environmental Assessment and Management System
- Performance Standard 2 – Labor and Working Conditions
- Performance Standard 3 – Pollution Prevention and Abatement
- Performance Standard 4 – Community Health, Safety and Security
- Performance Standard 5 – Land Acquisition and Involuntary Resettlement
- Performance Standard 6 – Biodiversity Conservation and Sustainable Natural Resource Management
- Performance Standard 7 – Indigenous Peoples
- Performance Standard 8 – Cultural Heritage

Performance Standard 1 establishes the importance of (i) integrated assessment to identify the social and environmental impacts, risks and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the Proponent. management of social and environmental performance throughout the life of the project.

Performance Standards 2 through 8 establish requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment, and to improve conditions where appropriate. While all relevant social and environmental risks and potential impacts should be considered as part of the assessment.

Performance Standards 3 through 8 describe potential social and environmental impacts that require particular attention in emerging markets. Where social or environmental impacts are anticipated, the client is required to manage them through its Social and Environmental Management System (ESMS) consistent with Performance Standard 1.

In addition to meeting the requirements under the Performance Standards, clients must comply with applicable national laws, including those laws implementing host country obligations under international law.

IFC will apply the Performance Standards to projects it finances, consistent with the provisions in the accompanying IFC's Policy on Social and Environmental Sustainability. IFC's institutional disclosure of information will be pursuant to IFC's Policy on Disclosure of Information.

The term "client" is used throughout the Performance Standards broadly to refer to the party responsible for implementing and operating the project that is being financed, or the recipient of the financing, depending on the project structure and type of financing. The term "project" is defined in Performance Standard 1.

A set of Guidance Notes, corresponding to the Performance Standards, offers helpful guidance on the requirements contained in the Performance Standards, including reference materials, and on good sustainability practices to help clients to improve project performance.

2.10.2 IFC Guidelines for Environment, Health & Safety

The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP) and are referred to in the World Bank's Environmental and Social Framework and in IFC's Performance Standards.

The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology.

The World Bank Group requires borrowers/clients to apply the relevant levels or measures of the EHS Guidelines. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects will be required to achieve whichever is more stringent.

However, no specific Industry Sector Guidelines exist in the IFC EHS industry Sector Guidelines 2016 pertaining to Hydropower sector expect Hydroelectric Power guidelines "A Guide for Developers and Investors and Good Practice Handbook on Environmental Flows for Hydropower Projects".

2.10.3 World Bank Group Environment, Health & Safety (EHS) Guidelines

The principal World Bank publications that contain environmental guidelines are listed below:

- Environmental Assessment – Operational Policy 4.01. Washington, USA. World Bank 1999.
- Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues. World Bank Technical Paper Number 139, Environment Department, the World Bank, 1991.
- Environmental Assessment Sourcebook, Volume III: Guidelines for Environmental Assessment of Energy and Industry Projects. World Bank Technical Paper No. 154, Environment Department, the World Bank, 1991.
- Environmental, Health and Safety (EHS) Guidelines, International Finance Corporation (IFC) World Bank Group, 2007.

The first two publications listed here provide general guidelines for the conduct of an EIA and address the EIA practitioners themselves as well as project

designers. While the Sourcebook has been designed with Bank projects in mind and is especially relevant for the impact assessment of large-scale infrastructure projects, it contains a wealth of information which is useful to environmentalists and the Proponent.

The Sourcebook identifies several areas of concern, which should be addressed during impact assessment. It sets out guidelines for the determination of impacts, provides a checklist of tools to identify possible biodiversity issues and suggests possible mitigation measures. Possible development project impacts on wild lands, wetlands, forests etc. are also identified and mitigation measures suggested. The Sourcebook also highlights concerns in social impact assessment and emphasizes the need to incorporate socioeconomic issues in EIA exercises.

The Sourcebook dealing with the assessment of industry and energy projects is more specific. It contains a section on renewable energy projects and identifies the potential environmental impacts. These include surface disturbance from the building of access roads in undisturbed areas, disturbance from explosive charges and possible damage to cultural resources. Possible socio-cultural issues that may arise because of an influx of non-locals are also identified in the Sourcebook.

As of 30th April 2007, the documents published in Volume III of the Pollution Prevention and Abatement Handbook have been replaced by the new versions of EHS Guidelines published by IFC. The EHS Guidelines are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during the construction, operation and decommissioning phase of a project or facility. The EHS Guidelines have become globally applied references for private sector development with their use extending well beyond World Bank Group operations to a diverse external community, such as other international financial institutions, regulators, industry, academics and commercial banks, including the international banks that have adopted the Equator Principles. Separate sets of guidelines have been prepared addressing general EHS issues as well as guidelines specific to various industrial sectors.

2.10.4 World Commission on Weirs (WCD)

This EIA is also guided by the Report of the World Commission on Weirs (WCD)" and by findings of a workshop on „Large Weirs, learning from the Past, Looking at the Future" (IUCN and The World Bank; Workshop Proceedings Gland, Switzerland, April 11-12, 1997).

2.10.5 IFC's Environment, Health and Safety Guidelines for Electric Power Transmission and Distribution

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

2.10.6 Land Acquisition Handbook

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

2.11 International Conventions and Treaties

2.11.1 Climate Change Convention and Kyoto Protocol

The convention aims at stabilizing greenhouse gases (GHG's) concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the Legal and Regulatory Framework climate system. To achieve the objective of the convention, all parties are generally required to develop national inventories of emission; formulate and implement national and regional programs of mitigation measures; all developed country parties were specifically obliged to take measures to limit GHG emissions by the year 2000 at 1990 levels and the developing countries to take all measures in support of the protection of the atmosphere without any formal commitment on the quantified reduction of these gases in a time frame.

The Kyoto Protocol is an amendment to the United Nations Framework Convention on Climate Change (UNFCCC) an international treaty on global warming. Ratifying developed countries commit to reduce their combined greenhouse gas levels by 5%, including six GHGs, i.e., Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydropower fluorocarbons (HFCs), per fluorocarbons (PFCs), and Sulfur hexafluoride (SF_6).

As of November 2013, total of 191 countries have signed and ratified the agreement, with the notable exception of the United States of America.

If successful, the Kyoto Protocol is expected to reduce the average global temperature between 0.02°C and 0.28°C by the year 2050. The Kyoto Protocol proposes to set up framework for (a) Joint Implementation of projects aimed at reduction of GHGs, (b) establishment of Clean Development Mechanism (CDM), and (c) Emissions Trading, which could be availed by all developing country Parties, including Pakistan. Pakistan signed the United Nations Framework Convention on Climate Change (UNFCCC) in

Rio in 1992. It was ratified in June 1994, and it became effective for Pakistan, as Party, with effect from 30th August 1994. 137 developing countries have ratified the protocol. Developing countries including Pakistan have no obligation beyond monitoring and reporting emissions.

2.11.2 The Convention on Biological Diversity

The Convention on Biological Diversity was adopted during the Earth Summit of 1992 at Rio de Janeiro, Brazil. The Convention requires parties to develop national plans for the conservation and sustainable use of biodiversity, and to integrate these plans into national development programs and policies. Parties are also required to identify components of biodiversity that are important for conservation and to develop systems to monitor the use of such components with a view to promoting their sustainable use. Moreover, in accordance with the Article 26 of the convention, parties are also required to prepare national reports on the status of implementation of the Convention.

2.11.3 The Convention on Conservation of Migratory Species of Wild Animals, 1979 (Bonn Convention)

The Convention requires countries to take action to avoid endangering migratory species. The term "migratory species" refers to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or cooperate with other countries in matters of research on migratory species.

The Convention contains two appendices. Appendix I contain the list of migratory species that are endangered according to the best scientific evidence available. For these species, the member states to the Convention are required endeavor to:

- Conserve and restore their habitats.
- Prohibit their hunting, fishing, capturing, harassing and deliberate killing.
- Remove obstacles and minimize activities that seriously hinder their migration; and
- Control other factors that might endanger them, including control of introduced exotic species.

Appendix II lists the migratory species, or groups of species, that have an unfavorable conservation status as well as those that would benefit significantly from the international cooperation that could be achieved through intergovernmental agreements. See Table 5-22, 5-23,5-24,5-25 and 5-26 for list of recorded species.

2.11.4 The Convention on Wetlands of International Importance, Ramsar, 1971

Pakistan is a signatory to the said Convention. The principal obligations of contracting parties to the Convention are:

- To designate wetlands for the List of Wetlands of International Importance.
- To formulate and implement planning to promote wise use of wetlands, to make EIA before transformations of wetlands, and to make national wetland inventories.
- To establish nature reserves on wetlands and provide adequately for their wardenship and through management to increase waterfowl populations on appropriate wetlands.
- To train personnel competent in wetland research, management and wardenship.
- To promote conservation of wetlands by combining far-sighted national policies with coordinated international action, to consult with other contracting parties about implementing obligations arising from the Convention, especially about shared wetlands and water system.
- To promote wetland conservation concerns with development aid agencies; and
- To encourage research and exchange of data.

So far 19 sites in Pakistan have been declared as wetlands of International Importance or Ramsar Sites. No Ramsar site is declared in and around the vicinity of the project site.

2.11.5 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

This Convention came into effect on 3rd March 1973 in Washington. In all, 130 countries are signatory to this convention with Pakistan signed the convention in 1976.

The convention requires the signatories to impose strict regulation (including penalization, confiscation of the specimen etc.) regarding trade of all species threatened with extinction or that may become so, in order not to endanger further their survival. The Convention contains three appendices:

- Appendix I includes all species threatened with extinction which are or may be affected by trade. The Convention requires that trade in these species should be subject to strict regulation.
- Appendix II includes species that are not necessarily threatened presently but may become so unless trade in specimens of these species is subject to strict regulation.
- Appendix III includes species which any contracting party identifies as subject to regulations in trade and requires other parties to cooperate in this matter.

See **Table 5-20, 5-21**, **Table 5-22, Table 5-23 and Table 5-24** for list of recorded species covered under CITES Appendices.

2.11.6 International Union for Conservation of Nature and Natural Resources (IUCN) Red List

The Red List is published by IUCN and includes those species that are under potential threat of extinction. These species have been categorized as:

- Endangered – species that are seen to be facing a very high risk of extinction in the wild soon, reduction of 50% or more either in the last 10 years or over the last three generations, survive only in small numbers, or have very small populations.
- Vulnerable in decline – species that are seen to be facing a risk of extinction in the wild, having apparent reductions of 20% or more in the last 10 years or three generations.
- Vulnerable – species that are seen to be facing a high risk of extinction in the wild, but not necessarily experiencing recent reductions in population size.
- Lower risk – species that are seen to be facing a risk of extinction that is lesser in extent that for any of the above categories.
- Data deficient – species that may be at risk of extinction in the wild but at the present time there is insufficient information available to make a firm decision about its status.

  See **Table 5-21**, **Table 5-22, Table 5-23 and Table 5-25** for list of recorded species covered under IUCN Category. No species of such importance is identified during the Baseline survey by the specialist.

2.11.7 International and National Environment & Conservation Organizations

International environmental and conservation organizations such as International Union for Conservation of Nature (IUCN) and the Worldwide Fund for Nature (WWF) have been active in Pakistan for some time now in the districts of KPK. Both these organizations have worked closely with government and act in an advisory role about the formulation of environmental and conservation policies. Since, the convening of the Rio Summit, several national environmental NGOs have also been formed and have been engaged in advocacy and in some cases, research. Most prominent national environmental NGOs, such as the Sustainable Development Policy Institute (SDPI), Strengthening Participatory Organization (SPO), Shehri, Lead and Shirkatgah are members of the Pakistan National Committee (PNC) of IUCN.

Environmental NGOs have been particularly active in advocacy, as proponents of sustainable development approaches. Much of the government's environmental and conservation policy has been formulated in consultation

with leading NGOs, who have also been involved in drafting new legislation on conservation.

2.12 Project Categorization

The requirements for whether an Environmental Impact Assessment (EIA) is required under IFC PS depends upon the nature and complexity of the project and prediction of impacts that are likely to occur. As discussed in Section 1, these are embodied within PS-1 – Review and Categorization. As discussed previously the categories are Category A, Category B and Category C. Due to the scale of the project and potential environmental impacts; it would likely be classified as a Category B Project. Typically, Category B projects with potential limited adverse environmental impacts which are few, generally site specific, largely reversible and readily addressed through mitigation measures. Whilst a full EIA is not required, some environmental and socioeconomic analysis is required. This is primarily determined on the basis that the construction and operation of the project would result in only limited reversable impacts to the surrounding environment, and that impacts are likely to be readily managed. *238 MW Kalam- Asrit Hydropower Project falls in Category- "A" hence required an EIA.*

2.12.1 Triggered Performance Standards for Hydropower Project

It is understood, based on scoping that PS 5-8 are not triggered for the Project, since there is no involuntary resettlement (although the land will be purchased fulfilling all legal and regulatory requirements), *there are no major biodiversity areas or concerns as per Chapter-5 in the vicinity of the project that may be affected by the project, there are no indigenous peoples in the area. Further details are provided during the Section-5 Baseline Conditions of this report.*

2.12.2 KPK EPA Project Categorization

The proposed project falls under the project Schedule II of Category A: "Hydropower Project" as per the guidelines issued by the KPK Environmental Protection Agency (The Khyber Pakhtunkhwa Environmental Assessment Rules, 2021) and Section 13 of the KPK EPA Act, 2014. According to these guidelines, project under this category require an EIA to be conducted at planning stage.

3 Project Description

3.1 Introduction

This section provides a detailed description of the project assessed within this EIA. The project will have a power generation capacity of 238 MW and is expected to be operational for a period of 70-80 years. 238 MW Kalam-Asrit is a run of river hydropower project with a bypass tunnel of partial flow from Swat River via diversion weir, through a power waterway system connecting to the downstream where the powerhouse releases water to Swat River.

Construction is expected to take approximately sixty (60) months. The Project is being implemented by KOEN under KPK Hydropower Policy of 2016 and Federal Government Power Generation Policy of 2015 on BOOT (Build, Own, Operator, Transfer) basis. A Tripartite letter of support shall be asked by the PPIB and PEDO. At the time of this EIA study the company has obtained the Letter of Intent (April, 2018).

The Hydropower project will require the construction and operation of the following key elements:

- Weir structure.
- Desander
- Intake Portal and Head Race Tunnel
- Cavern Powerhouse.
- Machine Hall and Erection Bay.
- Tailrace channel.
- Flushing Outlet.
- In River Diversion Scheme.
- Construction Earthfall Cofferdam.;
- Construction Roads and Access Roads;
- Construction of substation and its connectivity with 220 kV overhead transmission line.
- Construction of O&M facility

3.2 Project Background

Kalam Asrit hydropower project (KAHPP) is located in Swat River in Khyber Pakhtunkhwa (KPK). Korea South-East Power Co. (KOEN) acquired information on KAHPP in March 2017 and accordingly KPK and (KOEN) signed a MOU in May 2017. KPK Government issued NTP to KOEN in October 2017. Then, Saman Corporation completed the preliminary feasibility study in January 2018. Further development on NOC was made in March 2018. Following NOC, Bank guarantee was submitted and

KPK issued LoI for the project. Tendering on the feasibility study was found by Saman in July 2018, and KOEN awarded the project to Saman in September 2018.

Saman initiated the feasibility study and submitted the commencement report in September 2018 to KOEN. The meeting with the Panel of Expert (POE) was held in October 2018 for the first time, and Saman's designers visited the field in November 2018. Saman awarded the contract for the field investigations to Engineering Imaginative Association (EIA) in February 2019.

3.3 Project Area

Swat River is economically important for future development of Pakistan. The catchment of the river is generally mountainous with elevations ranging from 360 m to 4,500 m from south to north. Vegetation is found between 1,800 m and 3,400 m. Glaciers are visible above 4,000 m.

3.4 Location and Site Setting

The Kalam Asrit Hydropower Project is located on Swat River in tehsil Bahrain, district Swat of Khyber Pakhtunkhwa, approximately 375 km northwest away from Islamabad.

The Project site falls administratively in the Swat district of KPK and located downstream of village Pushmal to the village Asrit on the Swat River, a confluence of Gabral and Ushu river at Kalam Valley which, on extreme south, enters to a narrow gorge and joins the Panjkora River and at Qalangi, it finally empties into Kabul River.

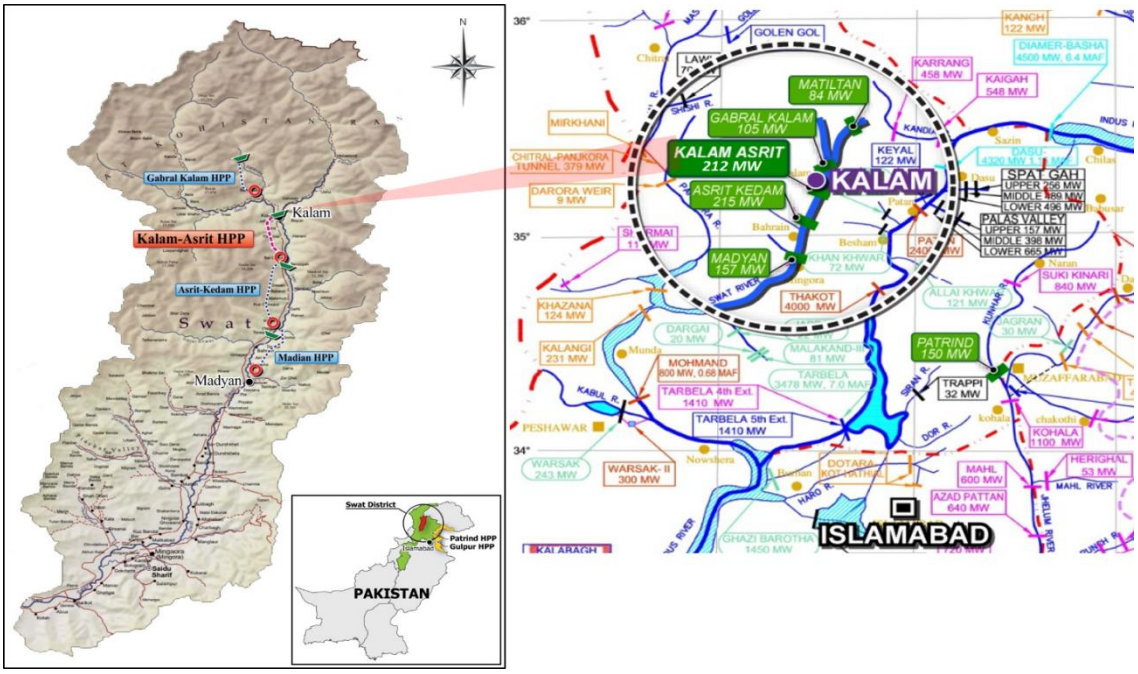
The Kalam Asrit Hydropower Project is located on Swat River in Tehsil Bahrain, District Swat of Khyber Pakhtunkhwa. The Project site falls administratively in the Swat district of KPK and located downstream of village Pushmal to the village Asrit on the Swat River approximately 360 km northwest away from Islamabad.

The Project components include dam, a weir and reservoir site, six disposal sites and a powerhouse.

- The weir site will be located in the Muhallah Shaid Bagh of village Pushmal and the Disposal Site-I will be 300m upstream of Pushmal Bridge.
- The Disposal Site-II and III will be located on Right And left Bank of Nullah Pushmal Khwar and 100m downstream of Aryanai Bridge respectively.
- Disposal IV and V is located in Gorel Village.
- Disposal Site VI is located at Muhallah Tuaetabad of Village Laikot.

The site is at about 85 km away from Saidu Sharif airport, Swat and is upstream to the 238MW Kalam-Asrit Hydropower Project. A key map of the project area showing the exact location for establishment of proposed Hydropower plant is presented as Figure 3.

Figure 3: Proposed Project Area



3.5 Project Saliant Features

The feasibility study has planned the power tunnel route in the right bank of Swat River as it is advantageous to workability and economy. The weir position will be at Kalam village about 2 km downstream from the confluence of Gabral and Ushu Rivers where the beginning point of Swat River. The HRT route is parallel to Swat River's flow direction, straight down to Asrit village. The powerhouse will be at near Asrit village before reaching the confluence of Asrit Khwar and Swat River, about 12 km downstream from the intake.

The project has the following major components:

a) Gated weir structure near Kalam village
b) Natural desander between Debris dam (U/S Coffer dam) and Weir
c) Bypass Tunnel (Diversion Tunnel)
d) Power Intake in the right bank adjacent to Headrace tunnel
e) Headrace tunnel with a length of around 12 km
f) Surge shaft
g) Vertical pressure shaft
h) Horizontal pressure tunnel
i) Steel penstock & branches
j) Surface type powerhouse
k) Tailrace channel

The Plant specifications Are:

- The installed capacity is 238 MW as of the expected role from the project in Pakistan's power system.

- The project is expected to deliver average annual generation of 912.9 GWh with the plant factor of 43.7%.
- The mean annual flow is about 88.4 m3/s. The estimated flow is using the local gauging station data. While there is some uncertainties due to the available information.
- Francis turbine with vertical shaft has been selected as the most appropriate turbine type for this project. Due to suspended sediments in the water, the turbine parts such as runner, guide vanes, etc. shall be considered an abrasion resistance coating.
- Main power supply scheme at powerhouse is that the applied connection scheme between the generators and four respective step-up transformers will be of conventional arrangement, with generator circuit-breaker and with tap-off to the excitation transformers and to the station service transformer.

The project Salient Features are given in Table Below:

Table 3-1 Salient Features of Kalam-Asrit HPP

Item		Unit	Pre-F/S, 2018	F/S, 2019	Remark
Location	River		Swat River	Swat River	
	Administrative District		Swat District	Swat District	
	Intake Area		Kalam Village	Kalam Village	
	Powerhouse Area		Asrit Village	Asrit Village	
Hydrology	Catchment Area	km^2	2,030	2,030	Weir Site
	Annual Average Run-off	m^3/s	88.4	88.4	Weir Site
Power Generation & Energy Estimation	Plant Discharge	m^3/s	120.0	130.0	
	Gross Head	m	210.0	222.1	
	Head Loss	m	12.6	17.81	
	Installed Capacity	MW	212.0(4 Units)	238	
	Annual Average Power Generation	GWh /year	835.8	912.9	
	Plant factor	%	45.0	44.1	

Diversion Tunnel	Diversion Discharge	m^3/s	390.5	400.4	2 Year return period
	Size	m	D-shaped, 7.6 x 6.6 x 3.8	D-shaped, 7.5x 7.5x3.75	B x H x R
	Length	m	402.5	514	
Upstream Cofferdam	Type		Rockfill Dam with secant pile	Concrete Dam	
	Dam Crest Level	EL. m	1,960	1,944	including 1.0 m freeboard
Downstream Cofferdam	Type		Rockfill Dam with secant pile	Rockfill Dam with secant pile	
	Dam Crest Level	EL. m	1,940	1,935	
Weir & Spillway	Type		CGD	CGD	Concrete Gravity Dam
	Design Discharge	m^3/s	749.9 (200yr)	1,252 (1,000yr)	
	Safety Check Discharge	m^3/s	1,284.9	1948.0	10,000yr including GLOF
	Weir Crest Level	EL. m	1,956.0	1,947.0	
	Spillway Crest Level	EL. m	1,949.0	1,939	
	Length	m	77.3	83.5	

	Height	m	17.3	18.3	
	Spillway Gate	m	10.0 x 6.0 x 3	10.0 x 6.0 x 3	B x H x Nos.
	Sluiceway Gate	m	5.0 x 4.5 x 2	5.0 x 4.5 x 2	B x H x Nos.
Desander Basin	Type		Natural Type Desander	Design Particle 0.2 mm	
	Width	m	11.5, 5 chambers (1 spare)	Var.	Natural Desander Volume: 199.104 m3
	Height	m	15.5	12	
	Length	m	130.0	230	
Intake	Type		Bellmouth circular	Bellmouth circular	Box shape
	Invert Elevation	EL. m	1,935.7	1930.0	
	Inlet Diameter	m	7.4	7.4	Trash-rack W 8.0 × H 10.9 for FS
	Length	m	15.0	19.3	
Headrace Tunnel	Type		Circular	Circular	Excavation: Modified Horse Shoe
	Diameter	m	7.4	7.4	
	Length	m	10,981	11,530.6	
	Type		Circular	Circular	

Vertical Pressure Shaft	Diameter	m	7.4 (Con'c)	7.4 (Con'c)	
	Height	m	174.0	126	
Horizontal Pressure Tunnel	Type		Circular	Circular	Excavation: Modified Horse Shoe
	Diameter	m	7.4	7.4	
	Length	m	85.9	85.9	
Surge Shaft	Type		Restricted Orifice	Restricted Orifice	
	Size	m	D 15.0	D18.0	
	Height	m	68.0	81 (incl. Orifice)	
	Orifice size	m	D 2.5	D5.0	
	Max. up-surging water level	EL. m	1,978.0	1,969.6	
	Min. down-surging water level	EL. m	1,928.0	1,903.8	
Penstock (Manifold)	Type		Circular Steel lined	Circular Steel lined	Excavation: Modified Horse Shoe
	Diameter	m	5.6 ~ 2.2	5.6 ~ 2.1	

	Length	m	312 (straight distance) D 5.6, L 277.1, D 4.7, L 5.6, D 3.7, L 15.2, D 3.0, L 82.4, D 2.2, L 27.9	338.7 (straight distance) D5.6, L 296, D3.0, L 29.06, D2.1, L 10.45	
Powerhouse	Type		Surface	Surface	
	Size (W x L x H)	m	30.5 x 72.0 x 32.2	41.7 x 100.65 x 54.2	
	Turbine Type		Francis	Francis	
	Turbine Capacity	MW	212	238	
	Number of Units		60 MW x 3 Units 32 MW x 1 Unit	68.8 MW x 3 Units 33.2 MW x 1 Unit	
	Turbine-Center Level	EL. m	1,738.0	1,713.7	
Construction Period		month	60.0	60.0	Including 6 month of testing period
Project Cost	Cost level		Dec. 2017 (1USD=Pak. Rs 105.39)	Mar, 2019 (1USD=Pak. Rs 140.0)	
	EPC cost		399.6	387.0	

	Total Cost	Million USD	533.5	512.1	

3.5.1 Weir

The concrete gravity type was selected considering satisfactory foundation conditions, minimum environmental disruptions and structural stability. The length of weir and the height is planned as 83.5 m and 18.3 m respectively. On top of the weir structure a road is planned to provide access to the intake structure and the control structures. The specifications for the designed weir are as shown below

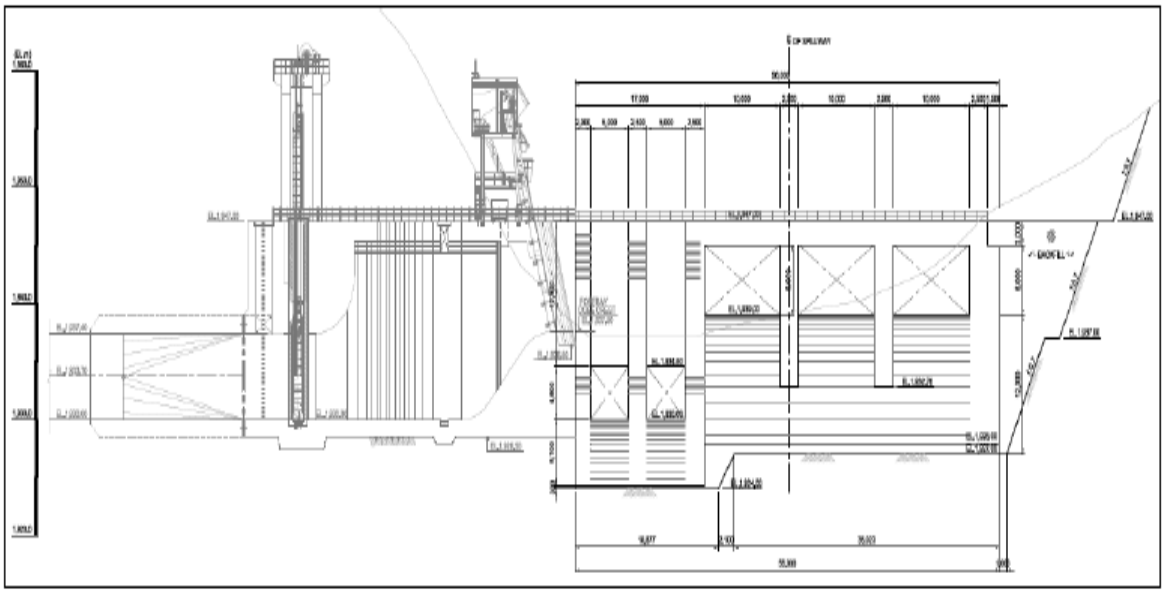


Figure 4: Plan of Weir Site

3.5.2 Intake Structure

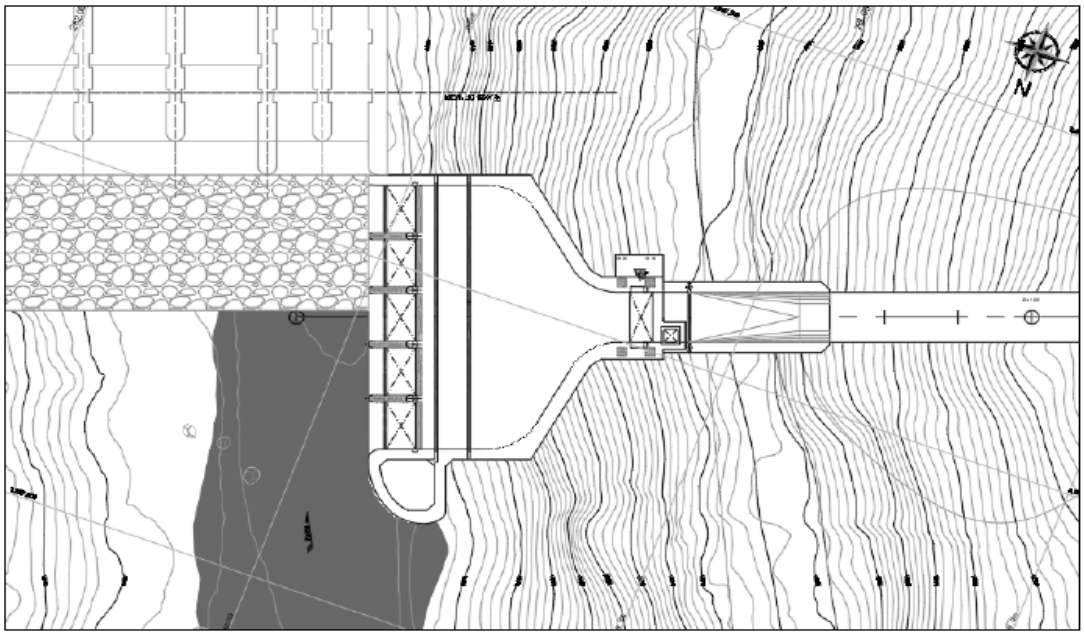
Intakes are generally divided into two types, i.e., vertical morning glory and horizontal bell mouth type. The project area is situated between steep gullies so that the vertical morning glory type is not appropriate for this terrain. Therefore, the horizontal bell mouth type is preferred given the operation and maintenance issues.

Vortex formation in the intake could cause many problems such as reduction of power generation due to reduced inflow amount with entrained air, pressure pulsation phenomena due to discharge fluctuation, possible damages to the waterway structure and increase of head loss.

The invert elevation of the power intake was possible to be set from the elevation of EL.1,930.8 m. However, considering safety issues and making the invert elevation deeper to discharge the inflow towards powerhouse without any voids, the elevation of EL.1,930.0 m was carefully set as the invert elevation of the power intake In general,

if the plant discharge is large, the approach velocity toward power intake is allowed up to around 1.0m/s, and the approach velocity of an intake with trash rack is around 0.6 ~ 1.5 m/s. Design approach velocity of power intake for Kalam-Asrit HPP is conservatively planned about 0.6 m/s to improve efficiency of natural settlement pool and to prevent inlet loss and vibrations to the trash racks. Its cross section has been designed in order to induce smoothly the discharge of 130.0 m3/s and to make the allowable velocity less than 0.6 m/s.

Figure 5: Plan of Intake



The calculation results brought the intake width of 7.0 m. The sill elevation is set at EL.1,937.5 m, and the average velocity is below 0.6 m/s so that water is fluently flown into power intake

3.5.3 Powerhouse

Hydropower is the generated electricity using the potential energy of water. Powerhouse has turbines, and those are designed considering some conditions such as, heads, flow duration curves, topography, geology, conveyance, construction materials, drainage area, estimated electricity load and transmission facilities to make it as economic as possible. The surface type powerhouse has been adopted in this project.

The powerhouse is a permanent structure so that it must be safe against the flood discharge from Swat River. Considering the 1,000 years frequency flood water level, the powerhouse shall be on EL. 1,730.90 m with clearance

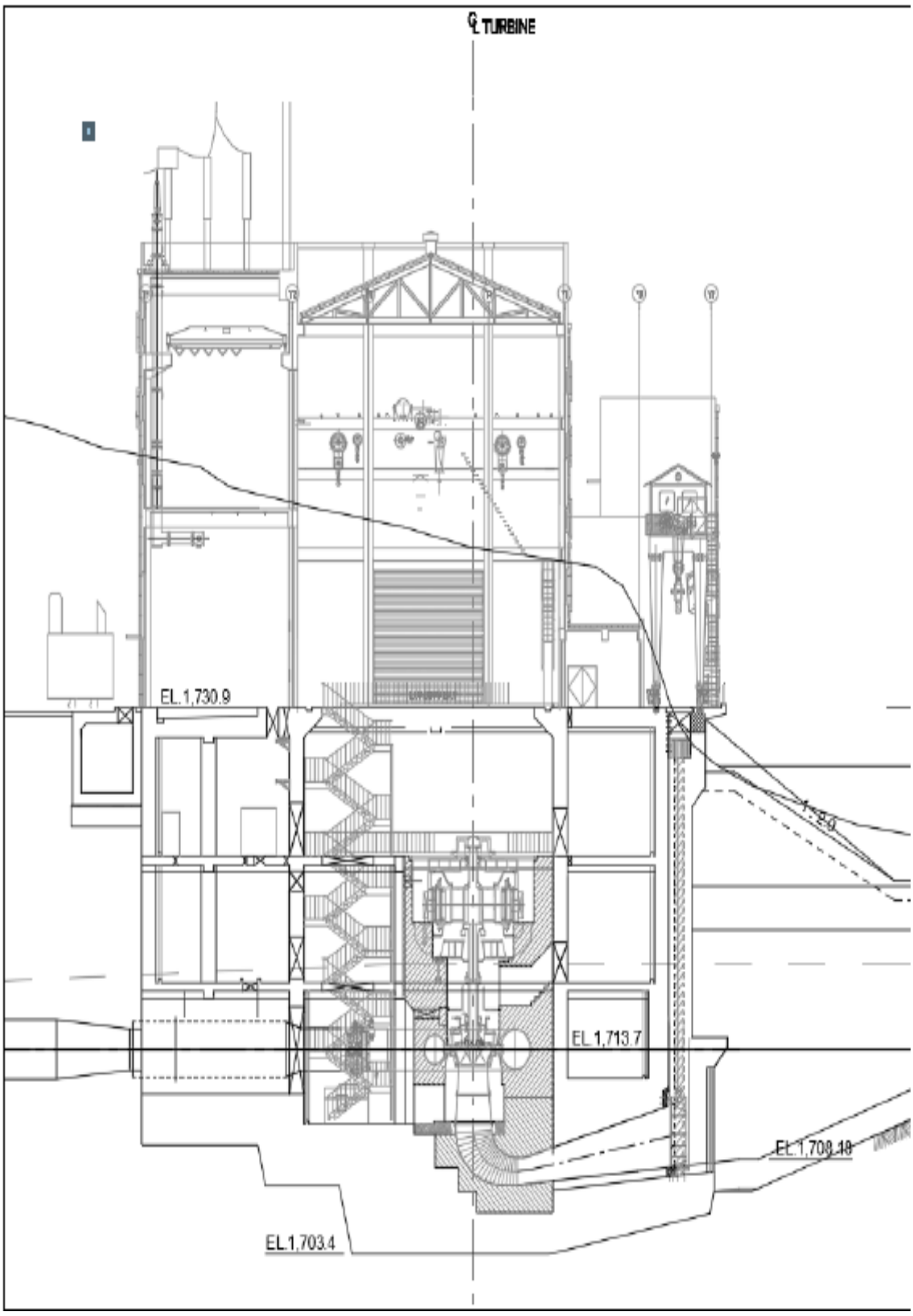


Figure 6: Powerhouse Profile

The mechanical equipment and main mechanical auxiliaries in the powerhouse consists of following items:

- • Turbine I: three (3) vertical shaft single-stage Francis-turbines including hydraulic/electronic turbine governors
- Turbine II: one (1) vertical shaft single-stage Francis-turbines including hydraulic/electronic turbine governors

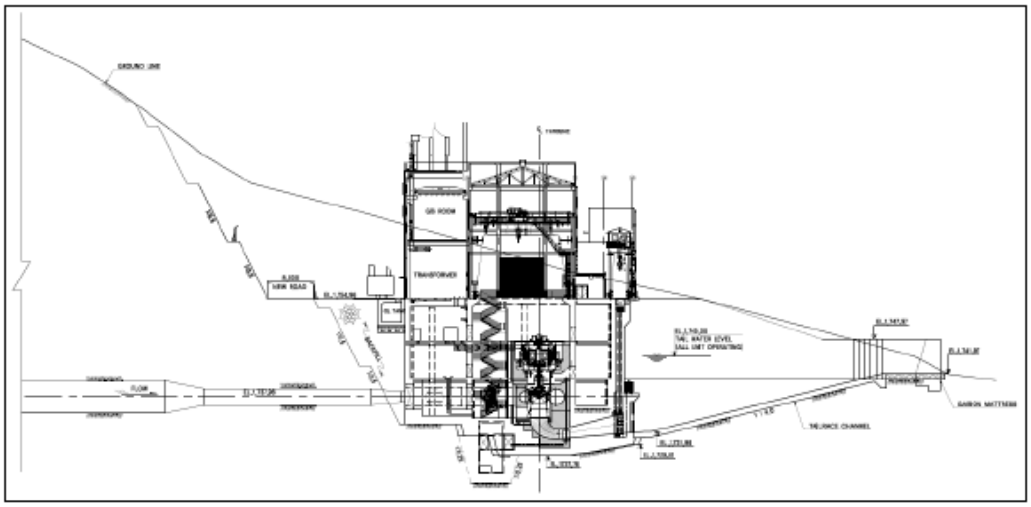


Figure 7: Powerhouse Transverse Section

3.5.4 Headrace Tunnel

The alignment is based on the only feasible construction of conventional drill and blast method and the anticipated time of construction. The headrace tunnel has a length of

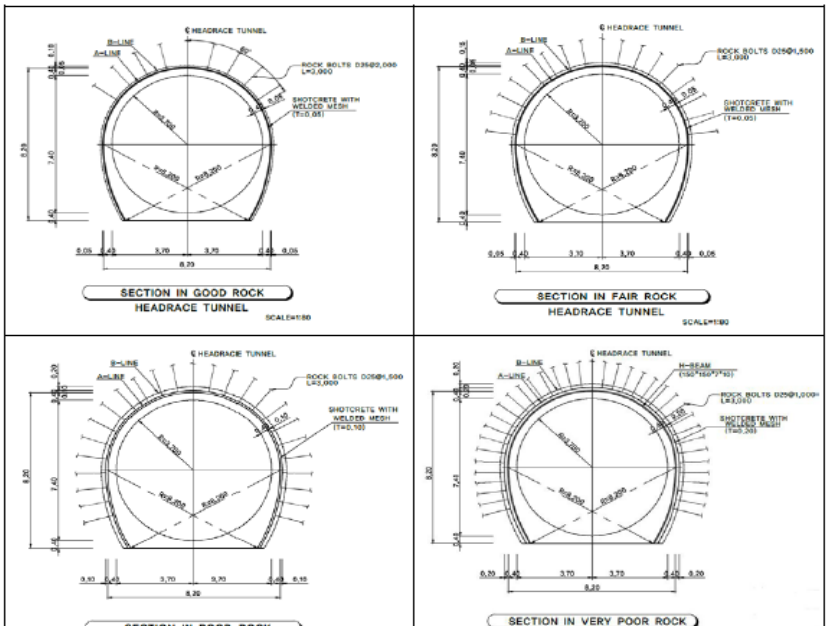


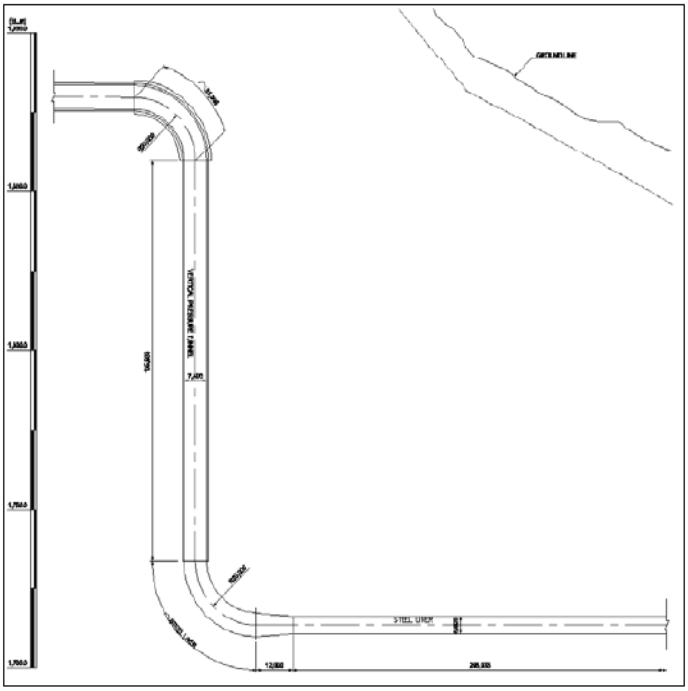
Figure 8 Cross Section of Headrace Tunnel

approximately 10.98 km, a diameter of 7.4 m, longitudinal slope of 0.25 % and the thickness of reinforced concrete liner of 400 mm. The headrace tunnel diameter of 7.4 m is selected considering adequate velocity and existing plan.

3.5.5 Pressure Tunnel

In the pressure tunnel, the surrounding rock of the pressure tunnel is in charge of cut-off role. However, in case that the minimum principle stress of the surrounding rock is smaller than the internal water pressure, seepage water to the rock causes Hydraulic Jacking at the surrounding rock. In order to assure the hydraulic and structural stability of the surrounding rock against Hydraulic Jacking, watertight liner that can prevent water from leakage to the surrounding rock, should be considered.

Figure 9: Pressure Tunnel Profile



In the Pre-F/S, the penstock length is determined by empirical formula considered rock depth. The estimated installation length is estimated about 312 m.

3.5.6 Surge Tank

Maximum upsurging water level is estimated as EL. 1,977.2 m, the minimum down surging water level is estimated as EL. 1,928.1. The final diameter of the surge tank is estimated as 15 m with 2.5 m of orifice diameter.

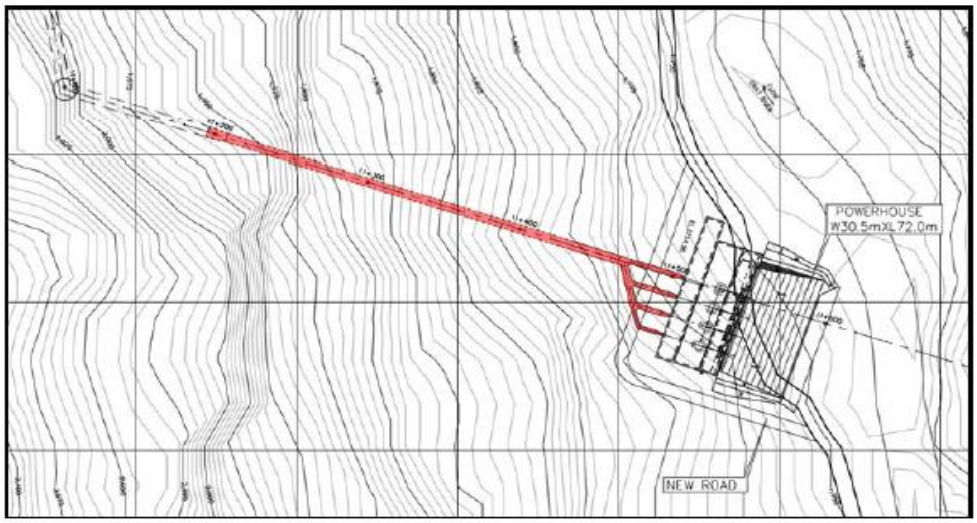


Figure 10 View of surge Tank

3.5.7 Waterway Tunnel

The layout of waterway tunnel, connecting from the Power Intake at the reservoir to the powerhouse, should be first determined considering the location of the surge chamber and the powerhouse. The optimum design of the waterway tunnel was performed throughout review of the topographical and geometrical conditions, the powerhouse direction and the hydraulic conditions such as water hammer and surging phenomenon

The waterway tunnel is connected from the power intake at the reservoir to the powerhouse. It consists of power intake, headrace tunnel, vertical and horizontal pressure tunnel, and steel penstock and its total length is 12.1 km. The surge chamber is located between headrace tunnel and vertical pressure tunnel in order to reduce the hydraulic transient in the pressure tunnel. The steel penstock divides in front of the powerhouse to supply the plant discharge for 4 turbines.

The longitudinal alignment of waterway tunnel is satisfied with natural drainage, therefore, the maximum longitudinal slope will be below 1.5%. The steel penstock slope is level for workability.

3.5.8 Reservoir Operation Level

A normal operating level is generally determined by cost efficiency studies on construction costs per normal operating level and the annual energy generation. However, this cascade type scheme has a limitation in planning alternatives including installed capacity and gross head. Hence, the study most importantly considers the topographic conditions for the optimization process.

Site visit found many habitants and houses locate near Swat River affecting the limitation in normal operating water level. The study determines the normal operating water level at EL.1,944 m at the weir site for optimal power generation along with maintaining the gross head of 222.1 m and the tail water level of EL.1,721.9 m, which is approximately 400 m upstream of the proposed weir site in 238 MW Asrit Kalam hydropower Project

3.5.9 Power Waterway Alignment

The feasibility study finds the alignment suitable in the right side from the north to south direction given the geological conditions are the efficiencies in workability provided the existing roads

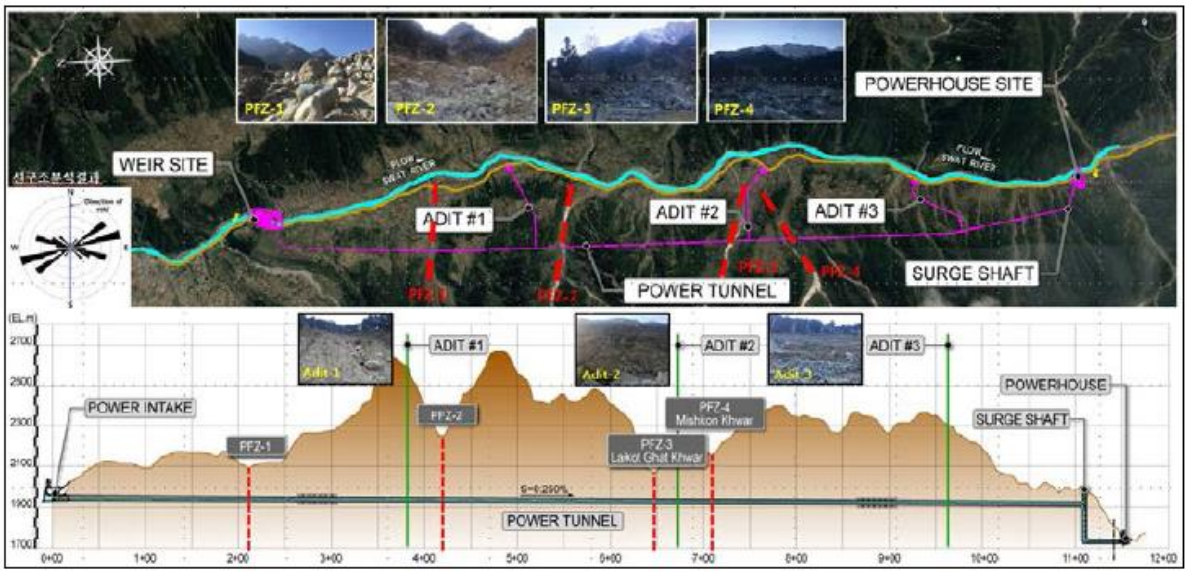


Figure 11: Power Waterway Location and Alignment

3.5.10 Concrete Lining

In the section that the internal water pressure is high and the deformation modulus of the surrounding rock is small, tension crack could occur along the reinforced concrete liner. Therefore, steel liner backfilled with concrete should be adopted. Application of reinforced concrete liner or steel liner depends on the internal water pressure at the installed location and the deformation modulus of the surrounding rock. Especially, in case that the surrounding rock is permeable in pressure tunnel, steel liner should be considered. .

3.5.11 Power Intake

The intake with a forebay locates at the end of the desander. The invert of EL. 1,935.7 m is set to ensure stable inflow pattern and minimum head loss. The intake is a reinforced concrete structure which has a horizontal bell-mouthed rectangular entrance and is equipped with a trash rack. At the design discharge of 120 m^3/s, the

intake has an entrance water velocity of 1.0 m/s. No gates are required for the design since the tunnel can be emptied by closing the stop logs installed at the end of the desander

3.5.12 Reservoir

This run-of-river project has no usable storage in the reservoir for other than hydropower. The operating water level maintains the constant elevation. Furthermore, in a cascade project, the reservoir operation with seasonal storage is not allowed due to the possible downstream effects such as flow rate variation.

Table 3-2: Specifications of Weir & Intake Structure

Type	Concrete Gravity Dam
Max Flood Water level	EL.1,946.0 m
Normal Operation Water Level	EL.1,944.0 m
Weir Crest Elevation	EL.1,947.0 m
Length of the weir	90.3m
Height of the weir	23.0m
Overflow spillway Size	W10.0 m × H6.0 m × 3 nos
Crest	EL.1,939.0 m
Sluiceway	W5.0 m × H4.5 m × 2 nos

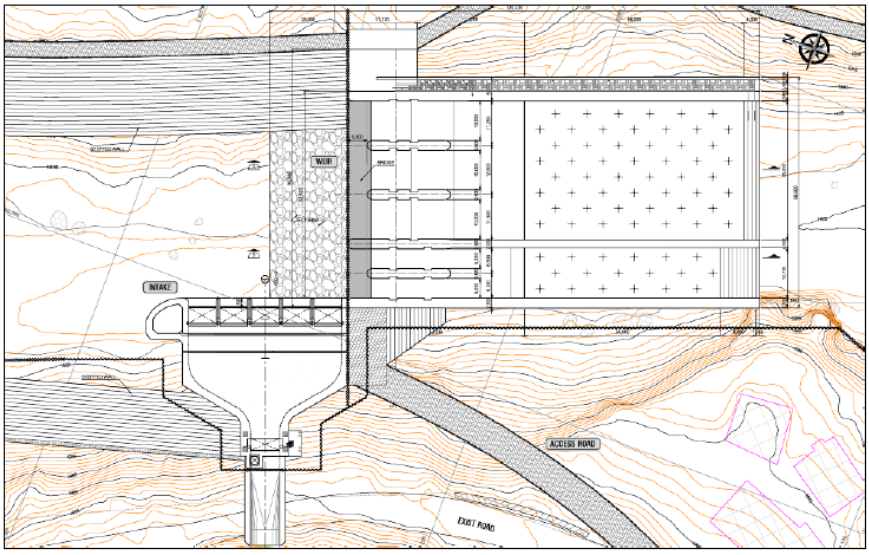


Figure 12: Layout of Weir Site for Kalam-Asrit HPP

3.5.13 Desander

Accordingly, an attempt to improve trap efficiency has been made by applying concept of "Natural Desander" which consists of;

- A bypass tunnel, under normal operation diverting flow in excess of 130 m3/s and also acting as a flushing device for accumulation of sediments upstream of the concrete cofferdam in the reservoir.
- A Natural Desander between the upstream concrete cofferdam and the Weir

3.5.14 Coffer Dam

The upstream coffer dam will be a permanent structure and will be used as a barrier for trapping large size boulders. The coffer dam will trap the sand, gravels & boulders and will flush through bypass tunnel. This scheme will also protect the intake structure and associated mechanical installation in weir structure from rolling stones which may get damage in conventional sand trap scheme. The basic concept of Natural Desander applied is to allow only the plant discharge to flow into the natural settlement pond in order to let the sediment be settled in the pond, during normal operation. The dimensions of natural desander are adjusted in a way that the velocity will be kept minimum i.e. 0.2 m/sec, enabling sediments to settle properly.

3.5.15 Sediment Flushing

The study estimated the sediment amount using the actually measured data from 1963 to 2010. The sediment transport at the weir site is estimated with the monthly sediment concentration and the average flow, 88.4 m³/s at the weir site.

The average annual suspended sediment yield is estimated at 0.35 million metric tons, corresponding to a specific yield of approximately 172 t/km2. It should be noted that the Swat River carries a small quantity of suspended sediment when compared to other rivers in Pakistan. Results also indicate that more than 88.9 % of the solid flow occur during the monsoon months (May to September).

3.5.16 Spillway

The design floods are determined as small size and low hazard potential according to ICOLD 1992 Selection of Design Discharge, Bulletin 82, p.175~177, Paris. Regarding the weir height and storage capacity, it is suggested as small category. The reservoir capacity is satisfactory, but the weir height is classified in Intermediate. Generally, the effect of the downstream is largely dependent on the reservoir capacity.

Considering the weir height and the possibility of its damage, design floods for the spillway size and weir height are suggested as following.

- Spillway: 200 year return period, 749.9 ㎥/s
- Safety check
- 10,000 years return period and GLOF, 1,035.3 ㎥/s + 249.6 ㎥/s = 1,284.9 ㎥/s.

- 1 gate out of operation for spillway design flood

The release capacity on the selected design floods is as follows. The planned spillway and sluiceway gates in this study show enough release capacity of design floods.

3.6 Associated Facilities

3.6.1 Grid Connection

238 MW Hydro Power Project' will be modeled in the NTDC grid system by Power Planners International (PPI) Consultants. The PPI will issue Grid Interconnection Study (GIS) which will evaluate options for power evacuation of '238 MW Hydro Power Project' in addition to the load flow analysis, transient stability analysis and short circuit analysis. Currently the GIS for cascade Projects has been submitted by the PPI Consultants to NTDC. After approval of the NTDC, the GIS for Kalam Asrit will also be submitted to the NTDC for approval.

3.6.2 Camps and Offices

A construction worker camp, providing accommodation for approximately 4,000 workers during the peak construction period will be set up.

All components of the Project such as workshops, offices, labor camps, fabrication yard, residential colonies site etc. are proposed within a distance of 1 km from the weir site in Asrit and subsequently within 1km of Powerhouse site at Asrit. The batch plant and quarry areas are planned between the weir and powerhouse structures.

Residential camps at individual level will accommodate 700 resident each at each camp, while the rest of the labor workforce will use their local accommodations.

3.6.3 Reservoir Operation & Annual Energy Generation

Effective delivery of power using the available flows within the site needs to find the optimal plant discharge. The plant discharge is determined as 130 m3/s for full units, which is 28.57 % in the exceedance time of the flow duration curve. It appears full units are operated for 104 days in a year. By adopting the small unit of 18 m3/s, 76 % (277 days) of the year can produce the power.

3.7 Project Phases and Activities

3.7.1 Project Development Phase

Letter of Intent (LOI)

The first step for the development of a project is to obtain a Letter of Intent (LOI). The sponsors of the Project (KA POWER LTD.) successfully filed their application and obtained their LOI from Private Power Infrastructure Board (PPIB) on April, 2018. The LOI is the official mandate for the Project Company to commence working on the Project, with the support of the PEDO. The LOI heralds the commencement of activities leading to the preparation of a feasibility study and acquisition of land for the Project.

Acquisition of Land

Private and government land will be required for the project facilities. Land measures 571.15 Kanal of area, therefore, there are proceedings involved of the Land Acquisition Act.

Submission of Feasibility Study

The Project Company submitted a detailed feasibility including simulation study and Electrical Grid Studies to the PEDO.

Generation License

To produce and sell electricity in Pakistan, a project is required to obtain a "Generation License" from the regulator, NEPRA. The Project Company is therefore required to make an application to NEPRA for its Generation License. An application for the generation license along with necessary documents will be submitted to NEPRA. Generation License is expected to be granted by National Electric Power Regulatory Authority (NEPRA) to Proponent in future.

Tariff Determination

A separate application will be submitted by the Proponent to NEPRA for approval of its power tariff and determination of tariff.

Power Purchase Agreement (PPA)

The agreement between the Power Purchaser and the Project Company is called the Power Purchase Agreement (PPA). This agreement lists terms and conditions for the sale and purchase of electricity between the two parties. Discussions relating to the PPA normally commence as soon as the feasibility study is submitted, and the tariff petition is filed with NEPRA.

Financial Close

Upon approval of feasibility study, grant of generation license, approval of tariff, and the signing of Project documents (EPA, EPC and loan agreements); the Project Company shall move forward to financial close. Based on the project's schedule, Financial Close is expected by 2022 with construction commencing immediately after financial close.

Commercial Operation Date (COD)

The Project is expected to achieve Commercial Operation Date (COD) by mid of 2026.

3.7.2 Pre-construction Phase

Pre-construction primarily covers the project's permitting process. This stage also covers the acquisition of land, completion of different studies e.g., environmental assessments, topographic surveys, flood risk assessment, feasibility study, generation

license issuance, contractor evaluation, selection and finalization, tariff approval and financial close.

Proponent will apply in Feb 2022 for the environmental approval from KPK Environmental Protection Agency (KPK EPA) based on this document.

Site Survey

Survey activities including topography, soil investigation/geotechnical survey for technical and structural design have been undertaken and analyzed/assessed to be incorporated in the design of the proposed hydropower project. The results of the topography survey will help detailing the elevation and slope data required for the detailed design.

Socialization and Public Consultation

Socialization and public consultation activities have been undertaken by the Proponent. during the preparation of EIA report. A detailed household survey covering socioeconomic parameters have been conducted along with resettlement surveys. Results of survey will be used to understand the micro level social baseline and for the preparation of CSR Plan highlighted as requirement by the EPA.

3.7.3 Construction Phase

Temporary Site Facility Construction

Prior to the physical activity in the construction phase, construction camps covering offices and accommodation will be constructed for the construction staff and workers enabling them to carry out different phase project activities at the project site during the entire construction period of approx. 60 months.

IFC Guidance document on Workers Accommodation will be used as reference for the construction of accommodation blocks or camps.

Mobilization of Equipment and Materials

Construction activities require materials and several adequate heavy equipment. The necessary heavy equipment mainly includes excavators for excavation, dump trucks for transporting materials, welding equipment and compactors for compaction.

Transportation of the equipment can cause partial disruption of traffic along the national highway road leading from Swat to Kalam/Asrit. Possible types of equipment used during the construction phase for Hydropower plant can be electric welder, steel bar cutter, steel bars bending machine, abrasive wheel cutting machine, bar straightener, electric hand drill, bench drill, percussion drill, backhoe, grader, dump truck, boom truck, cranes including tower cranes, compactors and forklift.

The material needed for the construction of Hydropower has a very specific specification as it relates to the construction activities in the Hydropower projects. Besides the use of imported materials and/or materials assembled domestically, local materials for Hydropower project such as stone, sand, cement, wood and others will also be used which will be acquired locally.

Land Preparation

The construction works will begin with measurement of building site and land clearance requirements. Land preparation such as earth works; site compaction, site levelling and excavations will be required to prepare the site for construction. This will be completed by heavy machinery such as excavators and graders that will include clearing and removal of existing vegetation according to detailed engineering design.

3.7.4 Construction Activities

Access Roads.

The project is located along the Swat-Kalam road. A metaled road suitable for trucks and transportation of the equipment's exist along the Swat River. Some additional access roads are planned for diversion routes. Therefore, construction of new roads is planned.

River Diversion

The project concept is run-of-river scheme with bypass tunnel of a partial flow from Swat River using a diversion weir, and through a power waterway system connecting to the downstream, the powerhouse releases water to Swat River again.

The coffer weirs will be constructed using riverbed material, including coarse and fine aggregates and impervious earth fill material.

Weir

Compacted concrete is planned to be transported from the batching plants by dump trucks near the Weir site. In addition, other preliminary works and earthwork activities shall be part of the weir construction works.

Powerhouse

The powerhouse is planned to be surface type construction while considering the topography of the site. Civil works for the powerhouse cavern to be constructed at the weir toe are also on the critical path. Embedded parts of the turbines (Vertical Francis Turbine) and generators, installation work of electromechanical equipment and construction of the superstructure, are part of this activity.

Water Conveyance System

The water conveyance system mostly consists of power intake structures, penstock, sediment flushing outlets, low level outlets etc. and is one of the main construction activities.

Tunneling and Excavation

A tunnel boring machine method will be used for tunneling. This process will involve a number of steps, including drilling, mucking, dumping, self-shotcrete, concrete lining etc. Drill and blast methods will also be used for other underground excavations required for the Powerhouse and other structures. This process will involve drilling, blasting, mucking and dumping.

Construction Timeline

Consultant during the process of feasibility studies estimated the construction period for the entire Project will be 5 years. The critical path for the schedule includes preparation work, construction of diversion under weir structure, closure of the riverbed, filling of cofferdam and drainage of foundation pit, foundation pit excavation of the riverbed of weir, concrete placement and metal structure installation in the weir sections, closure of open channel and filling of cofferdam, concrete placement and metal structure installation in the weir sections, impoundment, power generation of the first unit and power generation of subsequent units.

3.7.5 Operation Phase

Once each phase of the facility is complete and operational, the project will have a lifespan of at least 70-80 years. Measuring the performance of the Hydropower plant will be done locally and remotely, using telemetric monitoring. Day to day facility operations will involve both regular on-site preventive and corrective maintenance tasks to keep the Hydropower plant in optimal working order throughout the operational period.

The list of activities to be carried out in the Operation and Maintenance phase would be:

- Turbine functional checks and inspection.
- Turbine bearing lubrication and inspection.
- Gearbox inspection.
- Gearbox oil condition analysis and oil changes.
- Gearbox bearing inspection and lubrication.
- Drive belt inspection and replacement.
- Drive coupling inspection.
- Generator inspection.

- Generator bearing inspection and lubrication.
- Hydraulic system inspection.
- Hydraulic system oil condition analysis and oil changes.
- Check all sensors operate correctly.
- Check controller functions correctly.
- Inspection of intake area, impounding structures, pipeline, sluice(s)..

3.7.6 Post-Operation/Decommissioning Phase

The Hydropower facility will be decommissioned after 30 years. In case of decommissioning, 238 MW Asrit Kalam hydropower Project intend for the salvage value to cover the cost of decommissioning. If the plant will be decommissioned, the site will be rehabilitated to its original state by applying the following actions:

- Shutting down the generating facilities;
- Removal of electrical and mechanical structures;
- Electrical equipment (transformers) will be disposed of by selling to KPK EPA's approved waste disposal company;
- Gravel/chip stone on the access roads, onsite service roads, and guardhouse foundations will be removed;
- Buildings, such as the watch towers can be taken over by the landowner for operational purposes, alternately all the reusable material can be removed, the structures demolished, and the rubble transported to a municipal waste site; and
- Disturbed land areas will be rehabilitated,

3.8 Resource Requirements

3.8.1 Land Requirement

It is estimated that the Project will involve the acquisition of about 256.7 kanal of land for permanent land acquisition whereas 314.45 Kanal will be required for temporary facilities. The total land to be acquired includes land required for the construction of weir, powerhouse, access roads, project camps, realignment of roads, disposal areas and other civil structures; ponding area as well as a buffer zone. Based Resettlement Action Plan, about 218 timber and fruit trees will be affected by the Project.

3.8.2 Transport Corridor

Kalam-Asrit HPP is located upstream of the 229 MW Asrit-Kedam Hydropower Project.

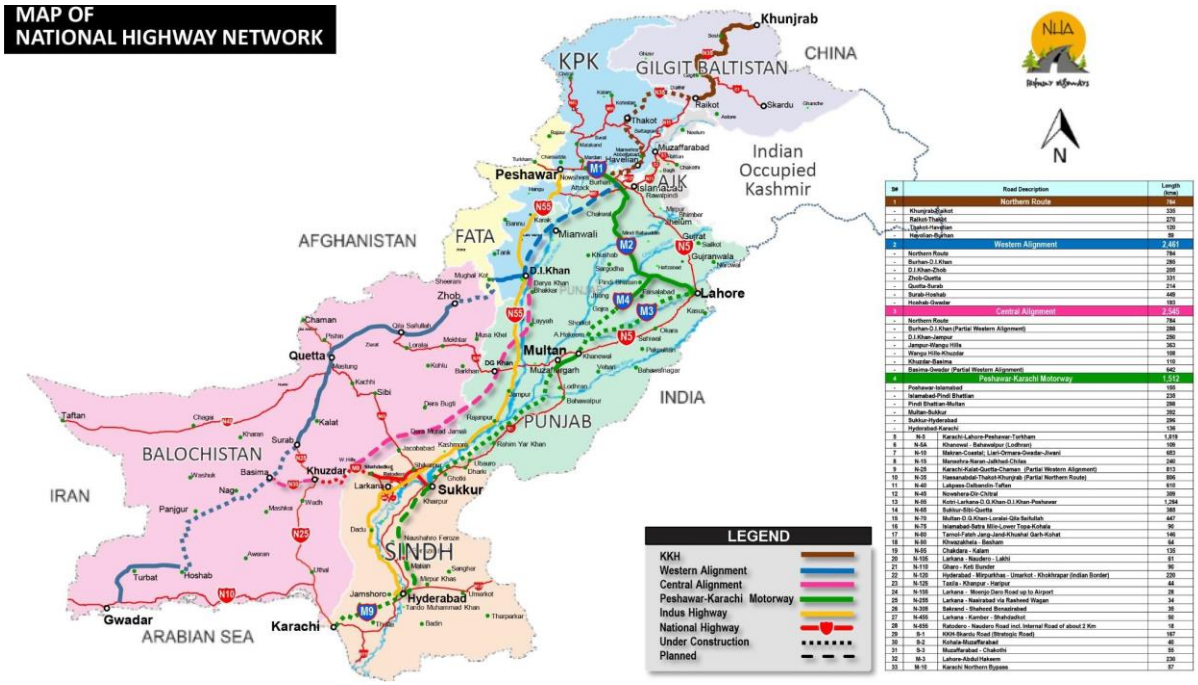
The Project site is accessible via metaled road route. Details of each route are

provided below:

- Islamabad – Kalam-Asrit Hydropower, total (330 km)

- Islamabad -M-1 and M-16 to Malakand,
    - total distance 186 km
- Chakdara to Bahrain Road/N-95,
    - total distance 109 km

Figure 13: Tunnel Boring Machine Transportation Route



3.8.3 Manpower

The total number and qualifications of workers to be recruited will depend on the type of activities involved in the Hydropower construction phase and the availability of appropriate skills and expertise within the local area, or nationally. While specialist civil, electrical and engineering skills will be required during construction and operation. There are also likely to be some non-specialist jobs generated during construction.

Worker recruitment will be handled directly by the contractors hence workforce numbers are yet to be confirmed but are expected to be approximately 4,000 people during peak construction period. Proponent Admin will monitor the hiring procedure as well as compensation and benefits systems followed by each contractor to ensure compliance of Pakistan Labor Laws and provincial KPK labor laws as well as International best practices with respect to control over child labor, grievance handling etc.

Most roles are unskilled which may present short term employment opportunities for local workers. Local labor from surrounding communities will be prioritized; however, the project may need to source labor from elsewhere for specific roles and depending on the skill levels of the local workforce.

During operations, skilled operators will be always required onsite. The total operational workforce requirements will be decided once the EPC Contract is in place.

3.8.4 Labor Accommodation Facility/ Colonies

As explained in Section 3.7.3, 1 TSF will be provided during the construction phase for non-local workers. However, if it is deemed necessary, the worker accommodation plan will follow IFC/EBRD requirements regarding workers' accommodation.

3.8.5 Water Requirements

Water will be required during construction but will generally be limited to workers' daily needs, dust suppression and to support equipment installation, noting that concrete batching will occur offsite. The estimated average volume of water required for the construction phase is ±70 m³/day. Drinking water is expected to be delivered to site or RO plant will be installed at site, while construction water supply will also be sourced from the private water suppliers (if any) through tankers.

Water Abstraction

Construction and installation activities of Kalam-Asrit hydro project requires water.

Abstraction of surface water will not be done for construction activities. In order to meet the water requirements during the construction, existing Government approved water supply Contractors will be used where applicable.

3.8.6 Fuel Requirements and Storage

The onsite fuel requirement during construction phase will be about approximately 1,500 liters per day, which will be used in construction machinery and generator. A storage tank will be constructed/installed for bulk storage of fuel with provision for secondary containment.

For operation, it is estimated that 150 liters of fuel will be used per transportation vehicles and for generator (for backup power).

3.8.7 Power Requirement

Electricity supply during construction will be secured through diesel generator while during operation phase, project generated electricity will be used and diesel generator will be used only if the grid is tripped.

3.8.8 Fencing and Security

It is intended that the security fence that will surround the Hydropower plant for the duration of its life will be erected to keep it secure during this phase.

The fencing will be designed and constructed to have a minimal visual effect. It is proposed that fencing will consist of brick/block masonry wall of 2.0 m height topped

with barbed wire. This type of fencing will provide adequate security in addition to suitable access.

A health and safety board identifying potential hazards will be updated daily, with all visitors required to sign in and adhere to on-site health and safety practices. All personnel working on site will be required to wear a high visibility vest or jacket, steel cap boots, and a hard hat as well as any other activity-specific safety gear.

3.9 Environmental Considerations

3.9.1 Waste Management and Control

A specific waste yard should be laid out and labelled to facilitate the separation of materials for potential reuse, recycling and disposal. Recycling and waste receptacles are to be kept clean and should be marked clearly to avoid contamination of materials.

Potential major waste streams during the construction and installation processes include the following:

- Packaging material. Electrical materials typically arrive on wooden pallets, and these will be either returned to the manufacturer or forwarded to a pallet management company for reuse. This material will be segregated and then removed from the site on a regular basis.
- Packing materials for other various components, such as screws, cabling and mounting frames. Any non-recyclable waste will be segregated for regular removal to a KPK EPA's approved waste contactor or appropriate waste site.
- Food waste from workers. Personal rubbish will be collected along with non-recyclable packaging materials, for disposal at an appropriate site.
- Appropriate welfare facilities including toilets should be appropriately managed for the duration of the construction period.

To prevent silt runoff and dust generation, any waste soils that have been excavated from the site will be re-used as filling and backfill material.

3.9.2 Noise and Vibration

Proposed project execution contractor should prepare a method statement and to comply with the recommendations set out in local and international guidelines. Contractors will also be required to comply with relevant provisions of the Environmental Quality Standards (NEQS) and the KPK Environmental Protection Act, 2014.

Technique and choice of equipment will depend on the nature of the surrounding environment. Noise generating plants or equipment should be sited as far as is practicable from noise sensitive receptors.

Vehicles and other machinery used for the purpose of the works should be fitted with effective exhaust silencers and maintained in good and efficient working order and operated in such a manner as to minimize noise emissions.

3.9.3 Lighting

Where possible a daylight construction schedule will be adopted to minimize adverse lighting. However, it is unavoidable that construction work may require work at nighttime to meet the construction targets in this case, use of handheld lighting or flood lights may be required. Efforts will be made to minimize disruption in case of nighttime construction works.

The site (excluding the construction area) will not be lit other than recommended working hours to avoid disturbance to the surrounding areas. Elements of the site and construction compound will be lit to provide the security to site. The storage and supplies unit will be permanently lit to always maintain visibility to security personnel. All additional lighting would be removed once construction is completed.

3.9.4 Pollution Control

Any hazardous substance (including liquids and solids) will be stored within impermeable, bunded areas, to remove the risk of migration to localized surface or groundwater.

Topsoil stripping and use of construction machinery will be kept to a minimum. Vehicles movement will be limited to the developed access tracks and cable trenches will be sealed properly to prevent water impounding.

3.9.5 Emissions

The Hydropower plant does not create airborne emissions during its operation whereas emissions during construction and installation activity will include:

- Dust emissions during construction and installation – these will be controlled by periodic water sprinkling and good construction management;
- Dust emissions during road travel – these will be controlled by avoiding off-road travel, observing speed limits and track maintenance; and
- Exhaust emissions from vehicles, heavy equipment/machinery and generators during construction and installation – these will be controlled by proper maintenance (exhaust emissions from generators at the construction camp, which generally meet the NEQS).

3.9.6 Unplanned Events

Hydropower projects are typically associated with emergency risks however, there is the potential for unplanned events to occur during the construction and operation of the project. This includes:

- Floods
- Earthquake events

- Environmental incidents such as hydropower carbon or chemical spills.
- Vehicle's accident.
- Natural events such as Strong winds, gusts
- fire/explosion; and
- Medical emergencies such as injury, illness or fatalities.

Specific Emergency Preparedness and Response Plan will be prepared to manage these emergencies.

3.9.7 Environmental Flows

All the definitions of the reserved or ecological 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 calculations of reserved or minimum flow. However, most common used formula adopted is the Cemagref Formula. The formula developed for environmental flow by CEMAGREF Agricultural and Environmental Research Institute, Antony, France is Q = [(0.0651 Qmm+2) /100] Qam where Qmm is monthly mean and Qam is annual mean discharge of the KAHPP. According to this formula the environmental flow required is 2.58m3/s using values given in table

Month	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**
Monthly Mean	15.40	14.10	17.80	49.70	135.60	250.20
Month	**July**	**Aug**	**Sept**	**Oct.**	**Nov.**	**Dec.**
Monthly Mean	256.40	167.70	79.80	35.60	22.90	17.90
Qam (Mean Annual Flow)						88.59
Mean Minimum Monthly Flow						14.10

Cemagref Formula: Q = [(0.0651 Qmm+2)/100]

	Qmm	**Qam**	**(0.0651* Qmm +2)**	**(0.0651* Qmm +2)/100**	**E-Flow**
Feb	14.10	88.59	2.918	0.029	2.585

Percentile of Time at the Weir Site

Percentile of Time (%)	**10**	**50**	**90**	**Average**
Flow duration curve (m^3/s),(1961~ 2006)	245	46.8	15.2	88.4

Minimum release for ecological discharge

The study adopts the minimum release for ecological flow for 3 m3/sec of river flow. The following table shows the monthly minimum release for ecological flow.

Estimated Ecological Flow at the Weir Site

Flows	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
AverageFlow (m^3/s)	15.4	14.1	17.8	49.7	135.6	250.2	256.4	167.7	79.8	35.6	22.9	17.9
Eco.Flow (m^3/s)	3.0	3.0	3.0	3.0	3.0 with Surplus spill				3.0	3.0	3.0	3.0

3.9.7.1 Operating Level

3.9.8 Operating Conditions

This run-of-river project has no usable storage in the reservoir for other than hydropower. The operating water level maintains the constant elevation. Furthermore, in a cascade project, the reservoir operation with seasonal storage is not allowed due to the possible downstream effects such as flow rate variation.

Table 3.1: Operating Conditions

Outage		Unit	F/S
Installed Capacity		MW	238 (3+1 Units) at metering point [68.8 MW x 3 + 33.2 MW] at generator
Plant Discharge		m3/s	130
Min. Plant Discharge		%	40 % of unit
Annual Average Daily Flow		m3/s	88.4
Operating Water Level		EL. m	1,944
Gross Head		m	222.1
Head Loss (Full Units Operation)		m	18.12
Efficiency	Turbine	%	94.0
	Generator	%	98.2
	Transformer	%	99.5
Ecological Flow		m3/s	Approx 3.0
Internal Consumption		%	1.0
Scheduled Outage		%	2
			5 for small unit
		days	5
		GWh	59.8

3.9.9 Flow Regime

There are two gauging stations on the Swat River. The daily average flow data had been observed at the Kalam gauging station up to 2006. During the update of feasibility study, it was found that the Kalam gauging station was destroyed and only monthly flow data from 2007 to 2009 and partial data of 2010 were collected. The average flow rate of the collected data is slightly greater than the existing flow data, 1961 to 2006.

These stations were established and have been maintained by Water and Power Development Authority (WAPDA). The proposed Project site lies between Kalam and Chakdara gauging stations. Average flows at the gauging station are shown in Table 3-1 and discussed below. The locations of the gauging stations are shown in Table 3-2.

Table 3.2: Monthly Average Flow at the Dam

Name	River	Latitude	Longitude	Elevation (EL. m)	Catchment Area (km2)
Kalam	Swat	35˚28'10"	72˚35'40"	1,921.0	2,020
Chakdara	Swat	35˚29'15"	72˚35'45"	1,951.0	5,776

The hydrology at dam site is typical of Himalayan rivers, characterized by peak flows in the month of May associated with melting of snow at higher elevations in the catchment, followed by declining flows in the summer supported by monsoon rainfall and continuing snowmelt in the months of July and August. The dry or low flow winter season typically extends from October through February when the flows are reduced to the order of one sixth of peak in the month of May. Failure of winter rains associated with westerly systems can result in extreme lower flows, while unusual rain events in the catchments in the monsoon season cause extreme floods that are known to cause significant damage to infrastructure and property.

Table 3.3: Monthly Average Flow at the Dam

Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Monthly Average	15.4	14.1	17.8	49.7	135.6	250.20	256.40	167.70	79.80	35.50	22.90	17.90

3.9.10 Peaking vs. Non-peaking

Hydropower dams with storage can be operated in the peaking mode in the dry season when the river flow drops. In this mode of operation, water is typically stored in the reservoir during the day and released through power generation turbines for three to four hours in the evening to meet the peak electricity demand. Environmental issues that are of concern with such a mode of operation include an adequate release of water through the dam when water is being stored in it to support aquatic life (environmental flow), and the impact of sudden changes in flow on aquatic life when the water is released from the dam for peaking purposes.

The powerhouse will be operated continuously or at baseload without resorting to peaking in the low flow dry season. In other words, the dam can be operated in a true Run of the River mode where water coming into the reservoir can be allowed to flow through the powerhouse without storing it in the reservoir created by the dam. This will minimize the impact of the flow release from project on the river biodiversity downstream of the dam.

Non peaking operation coupled with optimized operational regime will help to reduce the changes due to surges in flow and rapid change in hydraulic parameters of the habitat, mainly velocity and depth of water which is important for ecological integrity of River.

3.9.11 KA Power Operational Optimized Regime

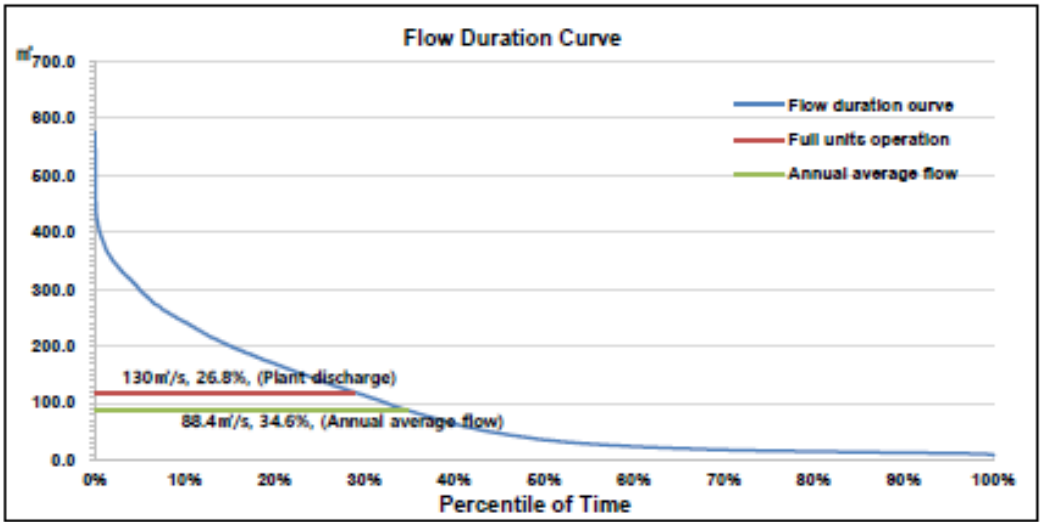
However, to save unnecessary loss of water without power generation, the company will liaise with the power purchaser to devise and implement optimal operational regime without compromising the environmental flows. This optimized operational regime will only become applicable in low flow months for shorter period and time and a free board of about m shall be used to implement this optimized operational regime without surging the water outflows.

3.9.12 Fish Passages

The height of the dam is more than required heights for fish ladders, and even if a fish channel is constructed, it will be challenging for fish to negotiate, Traveling, and drifting through an extended water channel under strong pressure from the current will exhaust the fish if they are able to swim upstream at all and injure them possibly resulting in mortalities. In Pakistan there is no experience with the use of fish passages except in river barrages. Even in those cases they are non-functional, and no success has been reported. Further investigations and research to address barrier related impacts on fish will be carried out by the Institute for Research on River Ecology of Gulpur and Karot HPP for better understanding.

3.9.13 Dam Site Hydrology

The Project Feasibility Study calculated the dam site flows for the period of 1961-2009 by using the combined flow records of Kalam gauging station. The average calculated mean monthly flow at the dam site is shown in Table 3.3. The annual average flow at the dam site is 88 cubic meter per second (m3/s).



The annual average suspended sediment is 0.37 million metrics.

Table 3.4: Sediment Concentrations

Month	Jan	Feb	Mar	Apr	May	June

Sediment Concentration (PPM)	**72.5**	**82.2**	**80**	**103**	**99.5**	**115.1**
Month	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Sediment Concentration (PPM)	**180**	**132.5**	**71.4**	**103.8**	**47.2**	**61.4**

The flow duration curve was developed using 10 day mean flow times series formulated for the dam site and is incorporated into the feasibility studies.

Table 3.5: Catchment Area

	Kalam Station	**Dam Site**	**Tailrace Outlet Site**
Catchment Area (km2)	2,020	**2,030**	**2,180**
Ratio	1.0	**1.005**	**1.079**

With the catchment area ratio, the monthly average flow at the dam site is 96.4m^3/s.

3.10 Project Construction Schedule

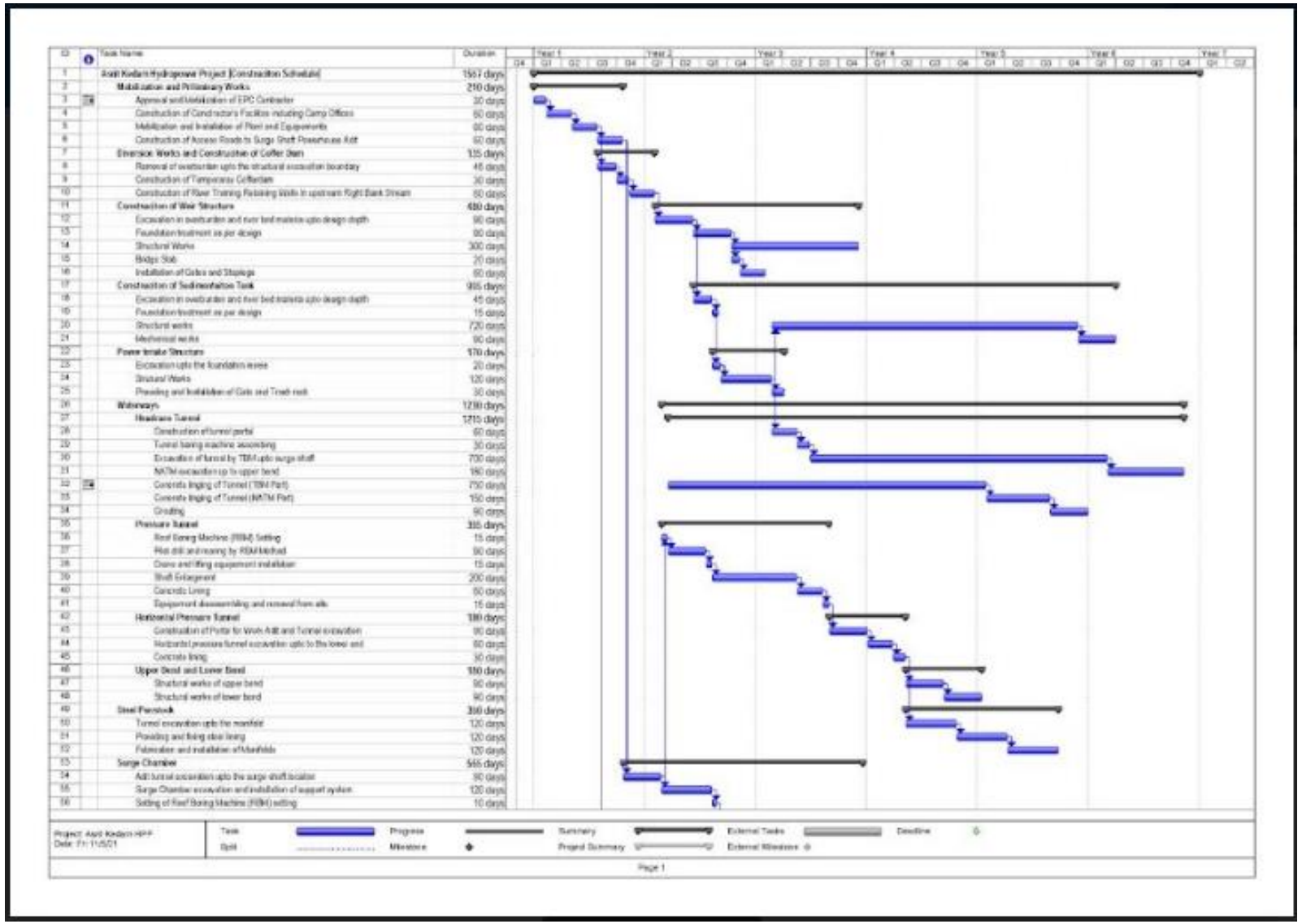
Based on the project scope, bill of quantities, sequence of activities and their dependence on the expected hydrological conditions at the site, a construction period of approximately 5 years has been planned. The implementation schedule assumes that the contract will be awarded to an experienced and qualified contractor with international experience in similar projects and local conditions.

The construction sections for completing the Kalam Asrit Hydropower Project within the construction period of 5 years are largely classified into the upstream weir section, power waterway section and the lower powerhouse section to be planned for parallel construction. :

3.11 Project Organizational Structure

Project organizational structure is provided Figure 16:

Figure 14: Proposed Kalam-Asrit Construction Schedule



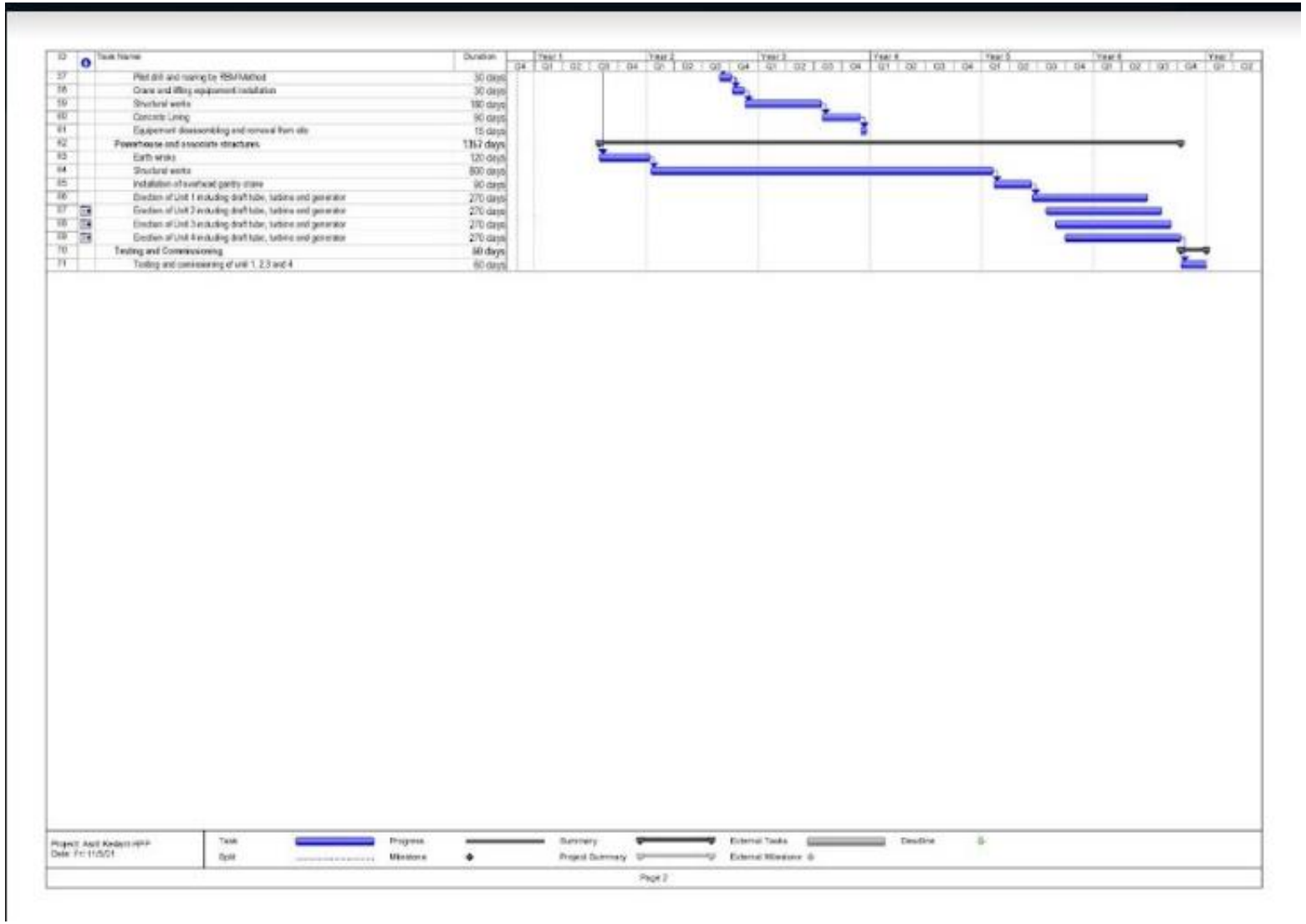
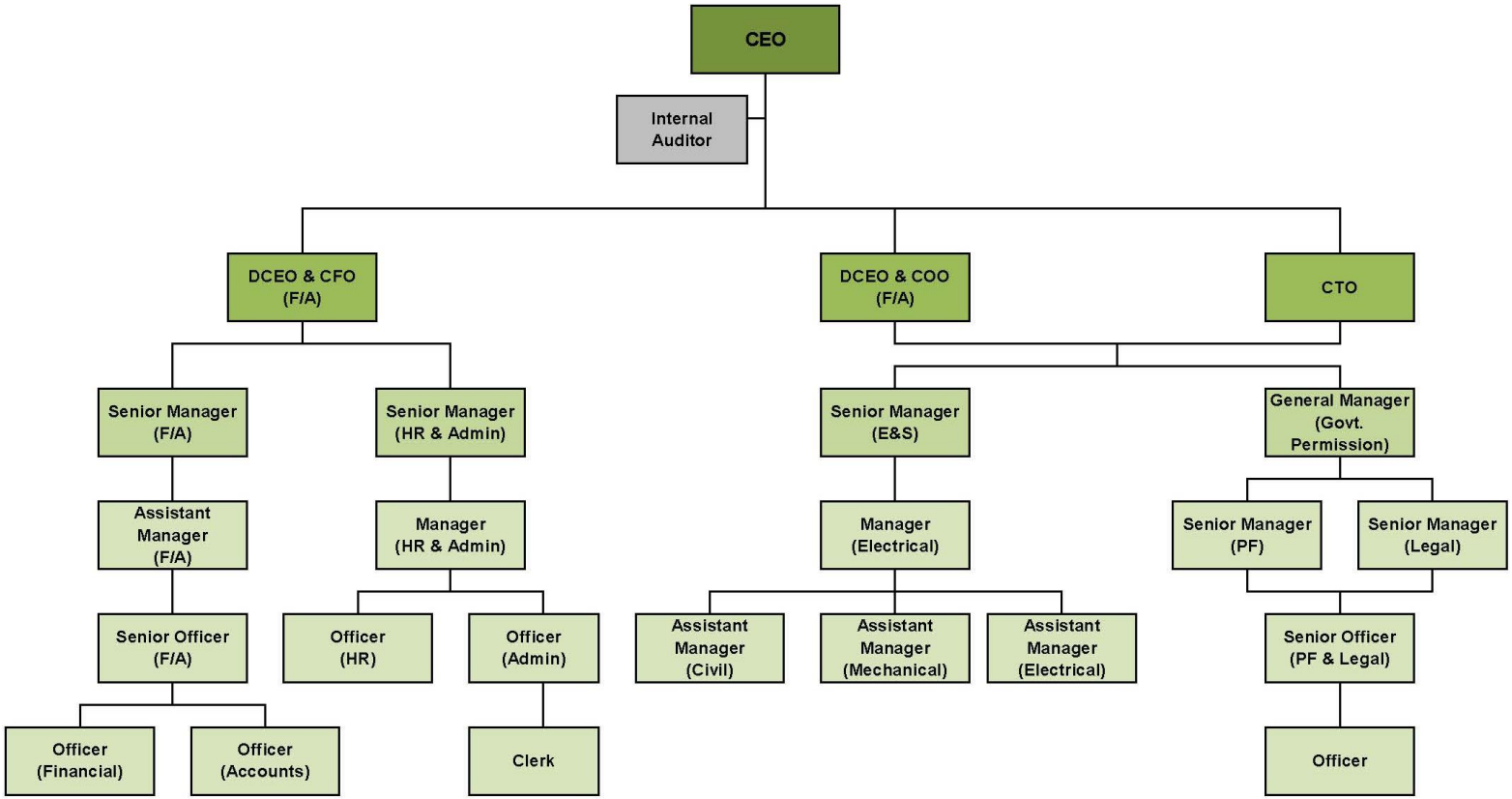

Pilot drill and reaming by RBM Method 30 days
Crane and lifting equipment installation 30 days
Structural works 180 days
Concrete Lining 90 days
Equipment disassembling and removal from site 15 days
Powerhouse and associate structures 1312 days
Earth works 120 days
Structural works 600 days
Installation of overhead gantry crane 90 days
Erection of Unit 1 including draft tube, turbine and generator 270 days
Erection of Unit 2 including draft tube, turbine and generator 270 days
Erection of Unit 3 including draft tube, turbine and generator 270 days
Erection of Unit 4 including draft tube, turbine and generator 270 days
Testing and Commissioning 60 days
Testing and commissioning of unit 1, 2,3 and 4 60 days
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

Figure 15: Project Organizational Structure



4 Analysis of Alternatives

4.1 Introduction

Hydropower Projects throughout the world are considered as non-polluting energy generation projects with specific environment and social impacts which are site specific in nature. During the analysis of alternatives for the project design/layouts-oriented approaches were considered during the feasibility studies by consultant.

One of the key components of the EIA process is the consideration of alternatives. Most guiding principle use terms such as 'reasonable', 'practicable', 'feasible' or 'viable' to define the range of alternatives that should be considered. Essentially there are two types of alternatives:

- incrementally different (modifications) alternatives to the project; and
- fundamentally (totally) different alternatives to the project.

Project Alternatives are fundamentally, diverse ways in which the developer can feasibly meet the project's objectives, for example by carrying out a different type of action, choosing an alternative location or adopting a different technology or design for the project. At the more detailed level, alternatives combine into mitigating measure where specific changes are made to the project design or to methods of construction or operation to avoid, reduce or remedy environmental effects. The EIA also requires developers to reflect mitigation (i.e., measures to avoid, reduce and remedy significant adverse effects).

This section highlights the various project management and design alternatives that were considered and carefully examined during the feasibility stage mainly with respect availability of land, and curtailments, Hydropower plant capacity, technical feasibility.

4.2 Project Needs Case

Pakistan is facing an acute crisis in the energy sector due to a combination of high reliance on expensive thermal power, an inefficient power transmission and distribution system, and a significant deficit in energy supply versus demand. Despite a period of strong economic development and rising energy demand during the past decade, no significant gains have been made in reducing this deficit through development and installation of new generation capacity. Moreover, rapid demand growth and considerable transmission losses due to outdated infrastructure have worsened the situation; power cuts are a common phenomenon in Pakistan. The current generating capacity shortfall in Pakistan ranges from approximately 3,300MW to 7,300MW in the summer and winter seasons respectively.

The importance of Hydropower projects in overcoming Pakistan's energy shortages is also apparent in Pakistan's National Power Policy (2013) developed by the Government of Pakistan in consultation with all federal units and other stakeholders.

Making Pakistan self-sufficient in energy resources is the overriding objective of the policy. To achieve this, the policy highlights the need for a shift from an oil-based generation focus to one where Hydropower plays a key role. Given the challenge of meeting the energy demands of the country, while also keeping energy costs affordable for consumers, the Government of Pakistan has prioritized Hydropower developments across all territories under its control.

The Kalam Asrit HPP figures significantly within Pakistan's future energy ambitions with 238 MW sustainable, green electricity.

To assess the environmental impacts in terms of the KP environmental protection act 2014 and KP review of IEE-EIA Regulations (2021) (as amended), feasible alternatives are required to be considered as part of the environmental investigations. An alternative in relation to a proposed activity refers to the different means of meeting the general purpose and requirements of the activity. In this section an analysis of available alternatives to the proposed Hydropower generation power plant has been carried out to ensure the best possible management and technology options will be employed during the project implementation. The following alternatives have been identified and are discussed in further detail below:

- No project options
- Alternative site option

4.3 No Project Option

From physical and environmental points of view, the 'do-nothing' is preferable to any project implementation, since it would avoid creation of any of the adverse impacts associated with the project. But the 'without project alternative' is not acceptable since this will strongly reduce the potential for socio-economic development of the country. Despite having great potential, the industrial growth is retarded mainly due to inadequacy of electricity.

During current scenario of 'No Project Option' alternative is the option of not establishing new Hydropower plant at the identified site in the Swat district of KPK province thus no environmental or social impacts in the area.

Energy is the prime mover of current day economies, and is vital to the sustenance of economic growth, which depends crucially on the long-term availability of energy from sources that are accessible, affordable, sustainable and environment friendly.

The energy sector plays a key role in the development and growth of Pakistan's economy. Through its history, Pakistan's economy has trodden an unsteady path with extended phases of low growth following moderate stints of high growth. If one looks at the pattern of energy supplies, Pakistan has remained an energy deficit country, dependent upon imports, mostly oil & oil products. While the share of renewable energy is increasing steadily. Pakistan currently relies mostly on Oil and Gas as a primary energy source to meet the energy demands of the country. Pakistan spends billions of dollars on import of crude oil and other petroleum products. Because of its increased demand in energy production, the gap between its demand and supply is

widening steeply and as a result import costs are on the rise for every fiscal year. To reduce its trade deficit the government is now implementing to maximize substitution of furnace oil, diesel and natural gas with alternative and renewable sources of energy. Hydropower generation is strategically important for increasing the share of indigenous energy supplies and reducing energy imports in the country. If renewable projects such as 238 MW Asrit Kalam hydropower Project is not executed, conventional sources of energy would be used (i.e., oil and coal fired projects) to fulfill the country's growing energy needs which would potentially have significant negative impacts on environmental and social wellbeing. Another possible alternative for hydropower is solar and wind projects, however, keeping in view the growing energy needs solar and wind cannot cope all this demand and has the inherent problems like intermittency, reliability, and grid stability. Worldwide combination of hydropower and solar/wind is considered one of the best courses of action for sustainable energy and energy security. In view of the country's growing demand for energy, 'No Project Option' seems to be a highly unfavorable option. Therefore, the no-go option is not being considered for this propos0ed project.

Renewable energy technologies range along with Hydropower, solar and wind, and biomass. Hydropower generation has emerged as one of the most rapidly growing renewable sources of electricity globally. Hydropower energy today is the cleanest, one of the cheapest and the most abundant renewable energy source available in Pakistan. Hydropower generation has several advantages over other forms of electricity generation:

- Hydropower energy production does not require fossil fuels and is therefore not dependent on this limited and expensive natural resource.
- Hydropower generates electricity with a limited impact on the environment as compared to other renewable resources (power generation from LNG/imported natural gas based combined cycle gas turbines "CCGTs"), coal fired steam plants, and fuel oil-based diesel engines.
- 238 MW Asrit Kalam hydropower Project is expected to generate and enhance the tourism sector with its futuristic vision of bringing scenic tourism during the project operation phase by benefiting the affected communities with tourist sites.
- Ancillary benefits of the Hydropower are gargantuan like its contribution in grid stability with reactive power which shall otherwise be compromised due to excessive wind and solar power.
- Generation of peaking power when needed.
- Hydropower emergency shadows the demands curve thus doesn't create a capacity trap.
- It's a great contribution in economy.

Other consequences of proceeding with the no project option are:

- Loss of an opportunity to offset multiple tones of greenhouse gas emissions per year and convert them into carbon credits under CDM mechanism; and
- Loss of opportunities for companies to begin or to continue expanding their renewable energy development interests in Pakistan.
- Increased burden on foreign currency reserves due to additional import of energy
- Reduction in reliability of grids due to addition of intermittent solar and wind energy

Therefore, it is concluded that the '***No Project Option'*** alternative is undesirable, and the potential energy, sustainability and socio-economic benefits of implementation of such a project far outweigh the adverse impacts, all of which can be controlled and minimized to an allowable level.

4.4 Alternative Site Option

In determining the most appropriate sites for the establishment of the Kalam-Asrit Hydropower plant, various alternatives were investigated. Analysis of site alternatives helps to justify the need for starting, stopping, or continuing of selection of a site for a particular project. They are done because decision makers need reliable, objective assessments of the options for providing required capabilities. Analysis of site alternatives identifies potentially viable solutions and provide comparative cost, effectiveness, and risk assessments of each solution to a baseline. This site selection process considered the following criteria:

- The availability and accessibility of primary resources required for the operation of the power plant, such as water;
- Availability of land to locate the site and associated infrastructure;
- The availability and accessibility of infrastructure for the provision of services, manpower and social structure for the construction and operation of the power plant;
- General environmental acceptability in terms of social impacts, water utilization, general ecology etc.

Through a series of feasibility and desktop screening studies undertaken, the proposed location is ranked as the most favorable area for the establishment of the new Hydropower generation plant in Swat district. Furthermore, the alternative analysis shows that there is no alternative or additional space left within the Swat River basin . Land availability near in the downstream for proposed developmental project will cause high level adverse environmental as well as social impacts due to higher volume of populations and resettlements along the River Swat.

4.4.1 Location Identification and screening for alternative sites

One of the alternatives which the Proponent and Consultant exercised for the alternatives is .

Alternate Weir Site Selection

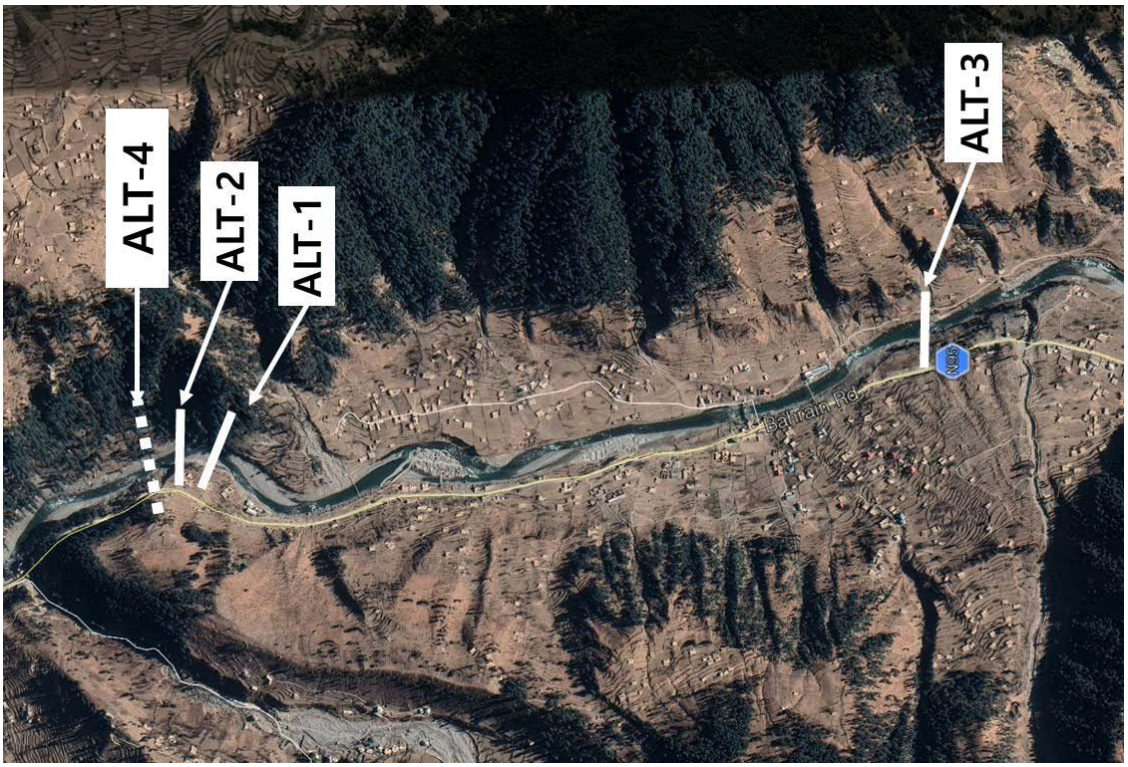
The preliminary F/S reviewed three alternative locations as possible weir position and found an area, 2 km downstream from the confluence of Gabral and Ushu Rivers. The locations of alternative weir positions are shown in Figure 1-3 and a description of their alternative areas are tabulated below:

Figure 4-2: Locations of Reviewed Alternates of Weir Site

Classification	Original Site (Pre-F/S, 2006)	Alternative-1	Alternative-2
Location	Approx. 1.2km downstream from confluence of Gabral & Ushu Rivers	Approx. 600m downstream from original weir site	Approx. 150m downstream from alternative site-1
Topographical Conditions	Both banks are steep	The right bank is steep, but the left bank forms gentle terrace	The right bank is gentle terrace, but the left bank forms steep terrain

Geological Conditions	Favourable bedrocks are well exposed in both banks	In the right bank, bedrocks are extended to upper access road. In the left bank is covered with thick overburden	In the right bank, overburden is widely distributed, but the left bank consists of bedrocks
Applied			

Figure 4-3: Alternates of Weir Site



4.4.2 Selection of Powerhouse Location

The study reviewed three locations including the scheme in the pre-F/S.

- Alt P/H Location-1	Pre-F/S scheme (Surface Type)
- Alt P/H Location-2	A surface type scheme for minimizing the slope by adjusting the location around the pre-F/S position
- Alt P/H Location-3	An underground powerhouse type for minimizing generation of a large slope during powerhouse installation

4.4.3 Selection of Headrace Tunnel Alignment

Massive landslide occurred in the headrace tunnel planned in the Pre-F/S, and the tunnel is planned to be built on the right bank of Swat river where existing access road (N-95) is established, which is more advantageous in structural plan, accessibility, and

constructability than the left bank section of Swat river where numerous low overburden valleys develop due to the unfavorable geological condition.

The feasibility study has considered and reviewed the schemes with the location of Alt Weir Site -2 shifting the power waterway alignment in the pre-F/S about 170 m towards the Swat River side.

The technical aspect considered is the depth of rock cover over the headrace tunnel. Minimum rock cover of approximately 150 m has been planned over the headrace tunnel because of possible leakage from the tunnel to the surrounding rock. The maximum rock cover is planned to be approximately 640 m in consideration of squeezing and rock bursting, which may occur under excessively thick rocks.

Classification	Route 1 (on the right side)	Route 2 (on the left side)
Ground Properties	□□The depth of the headrace tunnel is about 100 m deep, so the tunnel is located on the rock under the colluvium □□Good conditions because the Headrace tunnel passes through the rock	□□The bedrock is partially exposed, and colluvium at the beginning of the tunnel and colluvium and alluvial at the end of the tunnel are relatively broad and deep
Characteristic	□□No temporary bridges and roads are required for Headrace tunnel □□Extension of Headrace tunnel is shorter on the right bank than on the left bank.	□□Construction of temporary bridges and temporary roads is needed to enter equipment for tunnel construction at the start and end of tunnel □□Extension of Headrace tunnel is longer on the left bank than on the right bank
Applied		

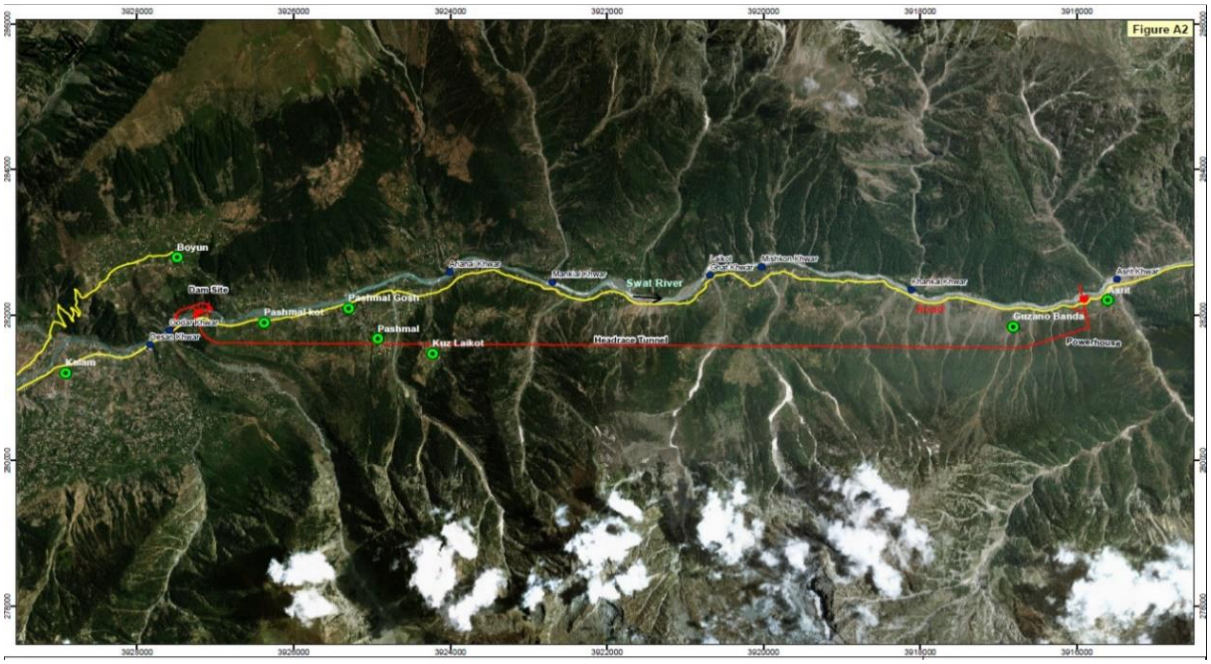


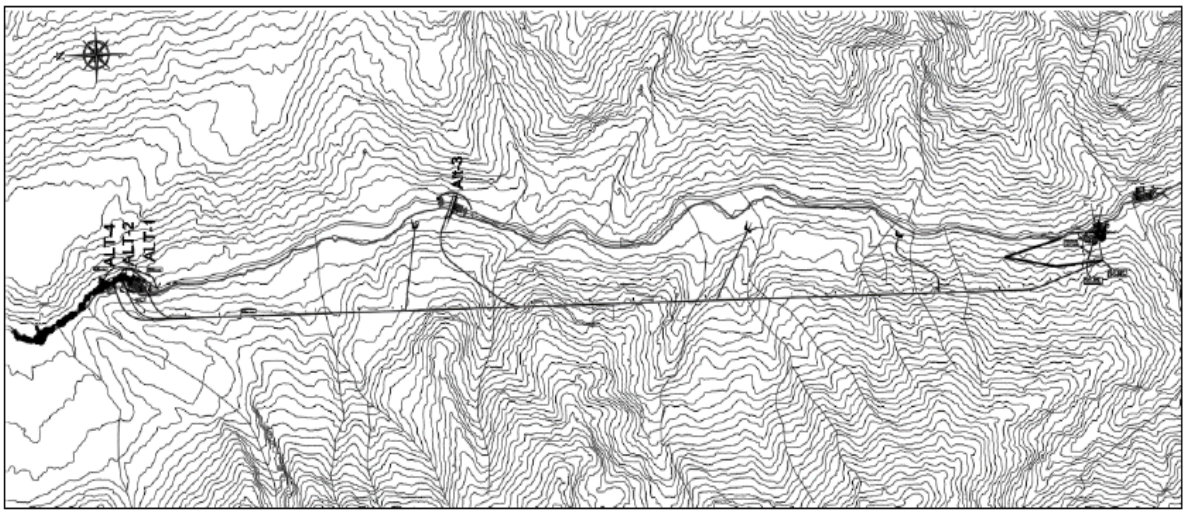
Figure 4-4: Alternative Tunnel Routes

4.4.4 Alternative Locations and Rationale

For the project layout of Kalam Asrit HPP, total 9 project alternatives were compared considering the weir location and powerhouse location (Type) in Section 7.4. Alt P/H-3 of underground powerhouse was excluded in the project alternative due to excessive construction cost.

- Alt Project Layout-1 : Alt Weir Site-1 + Alt P/H Location-1 (Pre F/S)
- Alt Project Layout-2 : Alt Weir Site-2 + Alt P/H Location-2
- Alt Project Layout-3 : Alt Weir Site-3 + Alt P/H Location-2
- Alt Project Layout-4 : Alt Weir Site-4 + Alt P/H Location-2

Figure 16: Locations of Reviewed Alternates



Project Alternate Layout-1

Pre-F/S adopted Alt Project Layout-1 and it uses the large area in the right weir to install the desander, and the intake, headrace tunnel, vertical pressure tunnel, surge tank, horizontal pressure tunnel, steel penstock & Y-Branch, surface type powerhouse and tailrace channel are planned for water conveyance. The total length of the power waterway is 10.95 km.

Pre-F/S adopted Alt Project Layout-1 and it uses the large area in the right weir to install the desander, and the intake, headrace tunnel, vertical pressure tunnel, surge tank, horizontal pressure tunnel, steel penstock & Y-Branch, surface type powerhouse and tailrace channel are planned for water conveyance. The total length of the power waterway is 12 km.

Project Alternate Layout-2

Alt Project layout-2 consist of Alt Weir-2 and Alt P/H-2. Alt Project Layout-2 is the same as Alt P/H-2, which adjusted the location of the powerhouse area in the pre-F/S to minimize the large excavation occurring in the powerhouse area.

Project Alternate Layout-3

Alt Project layout-3 consist of Alt Weir-3 and Alt P/H-2. However, Alt Weir-3 has a large land acquisition and resettlement of many houses. Also, the height of weir is almost 60, which is bigger than other alternatives.

Project Alternate Layout-4

Alt Project layout-4 consist of Alt Weir-4 and Alt P/H-2. Alt Project Layout-4 installs a natural type desander to reduce construction cost of desander. The scheme uses the space between the weir and upstream coffer dam. The inflow amount from the upstream coffer dam pass through the natural type desander and flow into intake, headrace tunnel, vertical pressure tunnel & surge tank, horizontal pressure tunnel, steel penstock & Y-Branch, surface type powerhouse and tailrace channel. The total length of the power waterway is approximately 12.1 km. Alt Weir-4 has better geological condition than other alternative relatively.

4.4.5 Selection of Sustainable Alternate

The study compared alternative project layouts reviewing power potential, geological risks, construction conditions, environmental & social impacts as well as economic analysis. Alt project layout 4 is not with enough space for constructing a desander therefore a natural type desander was considered. Alt project alyout-1,2,3 and 4 have different locations of weir and existence of desander. The size of weir in Alt project layout-2&4 is less affecting the upstream areas socially and environmentally. While, Alt project layout-1 locates beside private houses and hotel in the right side comparatively having more social and environmental impacts than Alt project layout-2.

Therefore, Alt Project Layout-4 is the optimal layout after comparing with other alternatives.

4.4.6 Project Optimization

The analysis has found the optimal installed capacity is 238 MW with the design discharge of 130 m3/s. The study finds the installed capacity of 238 MW, most suitable for the current terrain and the layout. The installed capacity enables delivering the annual energy generation of 912.9 GWh with a plant factor of 43.7 %.

5 Overview of Baseline Conditions

5.1 Introduction

This section of EIA establishes the baselines environmental and socio economics status of the project site and its surrounding area to provide a context of scope of impacts of the proposed 238 MW Kalam Asrit Hydropower project.

In order to assess the E&S impacts of the proposed construction, operational and decommissioning phases of the 238 MW Kalam Asrit Hydropower project (details provided in **Chapter 3**) may have on the E&S receptors of the area were considered and to propose the mitigation measures, a detailed understanding of the baseline conditions of the project area including physical, biological and socioeconomic environment has been established and provided in this chapter. The description of the baseline has the following objectives:

- To identify the key environmental, socioeconomic, cultural and health conditions in a defined Area of Influence, focusing on the resources/receptors that may be impacted by the proposed project;
- To describe and, where possible, quantify their characteristics (nature, condition, quality, extent); and
- To inform parameters where possible about the sensitivity, vulnerability and/or importance of resources/receptors.

5.2 Methodology

The E&S baseline has been assessed specifically for the Kalam-Asrit Hydropower project covering an area of 1 km diameter (500m left/right each across river), which will be referred hereinafter as the Study Area. A detail reconnaissance survey of the Study Area was conducted by a team of experts to identify E&S sensitive spots located within the Study Area of the EIA study .

5.2.1 Primary Data Collection

The Consultant engaged internal teams and external consultants to collect and analyze the existing baseline conditions of the ground water quality, surface water quality and soil quality. Consultant EIA experts conducted rapid ecological surveys and consultations to collect the information pertaining to biological environmental conditions of the project site and the Study Area. The primary baseline data was collected for various baseline components which are detailed in table 5-1.

Table 5-1: Primary Baseline Data Collection for EIA Baseline Study

No.	Environmental Attributes	No of Locations	Remarks
	Ground Water/Surface water	12	Ground water and surface water samples were collected from water sources in the Study Area
	Noise	3	Noise tests were conducted within the project Study Area
	Ambient Air	6	Ambient air quality tests were conducted in the Study Area
	Flora	Study Area of 500m radius	Ecological survey for Flora was conducted within the Study Area to access the aspects at the project site
	Fauna	Study Area 500m radius	Ecological survey for Fauna was conducted within the Study Area to access the aspects at the project site
	Archaeology	Study Area of 1 km diameter	Archaeological survey for identification of archaeological importance within the Study Area

5.2.2 Area of Influence

Scoping of the Hydropower Project and previous experience with the sector determine the types of impacts that might occur, to whom they would occur and in which areas. To baseline establishment and impact assessment, an Area of Influence (AoI) has been identified. This sub-section provides an understanding of the AoI thus identified and the reasons for the same.

a) Study Area

The project study area mainly includes areas where the weir, reservoir, staff offices, headrace tunnel, powerhouse, contractor camps/labor camps, etc. will be constructed. In addition, it also includes the surrounding areas where the influence of the project implementation will occur.

The Study Area considered for EIA includes an area within 500m (500m buffer) radius from the project site. The Study Area of has been selected based on the location of project site and its footprint, nature and spatial distribution of potential E&S impacts

(based on similar type of projects) by the EIA team of experts and further consultation with KPK EPA authorities. Further details on the study zones are provided in the below sections. The exact T&D route of the transmission network as well as the location of the grid stations through which the 238 MWAsrit Kadem Hydropower Project will be connected is going to be finalized after the approval of the integrated project study by NTDC and Grid Interconnection Studies by the consultant.

b) Aquatic Study Zone

Swat River stretches starting from Kalam(Swat River) which is considered the upstream section of proposed HPP to the downstream (Asrit) is taken as aquatic study zone. The length of the river is approx. 12 km which include the tributaries in the stretch is considered as study area for aquatic studies.

c) Terrestrial Study Zone:

500m buffer is taken on each side of the river where Project-related facilities are to be located as well as the reservoir.

d) Socio-economic Study Zone:

During the socio-economic studies 500m buffer on each side of the river including the settlements are considered. In over to cover the communities around the permanent project facilities or the temporary, a 500m cover as buffer radius is taken to identify range of communities around the project facilities.

e) Project Footprint Area

The project footprint is the area that may reasonably be expected to be physically affected by the project activities, across all phases. Proponent project site covers approximately approx. 721.15 kanal of land. The project footprint includes land used for weir, reservoir, staff residential colonies/offices, headrace tunnel, powerhouse, contractor camps/labor camps and access roads.

f) Project Area of Influence (AOI)

The effects of the project and project activities on a particular resource or receptor will have spatial (distance) and temporal (time) dimensions, the scale of which is dependent on a number of factors. These factors are considered in the definition of the Project's Area of Influence (AoI). The AoI considered for the project with respect to the environmental and social resources is derived from consideration of the following:

- Project site boundary, immediate vicinity, access road and surroundings, i.e. a Study Area of approximately 12 km (hereafter also referred to as the AoI) distance from project site has been used to collect the primary data for the above mentioned environmental attributes;
- Air Quality – Dust emissions and fugitive dust (typically up to 100 m from operations and maintenance area);

- Noise – Noise impact area (defined as the area over which an increase in environmental noise levels due to the project can be detected) – typically 1 km from operations;
- Land Environment – The impacts on soil and land – typically up to 500 m from project footprint area;
- Ecological Environment – This includes:
- (a) the direct footprint of the project;
- (b) The areas immediately adjacent to the project footprint within which a zone of ecological disturbance is created through increased dust, human presence and project related activities (e.g. compacting, transportation activities); and
- Social and Cultural – The project footprint is limited to nearby villages within 1 km of the project site (even though the footprint area was limited, experts conducted its survey beyond the defined boundaries).

Core and Buffer Zone

The AoI is further divided into a core and buffer zone. The core zone is defined as the area within maximum 500m radius from the project footprint, based on the understanding that the majority of the impacts from the project (during the mobilization, construction, operations and decommission phase) would be contained in terms of spread and intensity within this area. While the more farther 1 km area(500m on each side) is defined as the buffer zone which appear to have limited interaction with the project.

Environmental Data Sources

All available published and unpublished information pertaining to the baseline E&S conditions were obtained and reviewed. All data sources were carefully reviewed to collect the following information:

- Physical environment – topography, geology, seismology, soils, geomorphology, surface and groundwater resources and climate;
- Biological environment – habitat types, flora and fauna (particularly rare or endangered species), critical habitats, vegetation and their communities within the area of operation.
- Socioeconomic environment – settlements, socioeconomic conditions, infrastructure and land use; and
- Heritage aspects – sites of cultural, archaeological or historical significance(ifany)

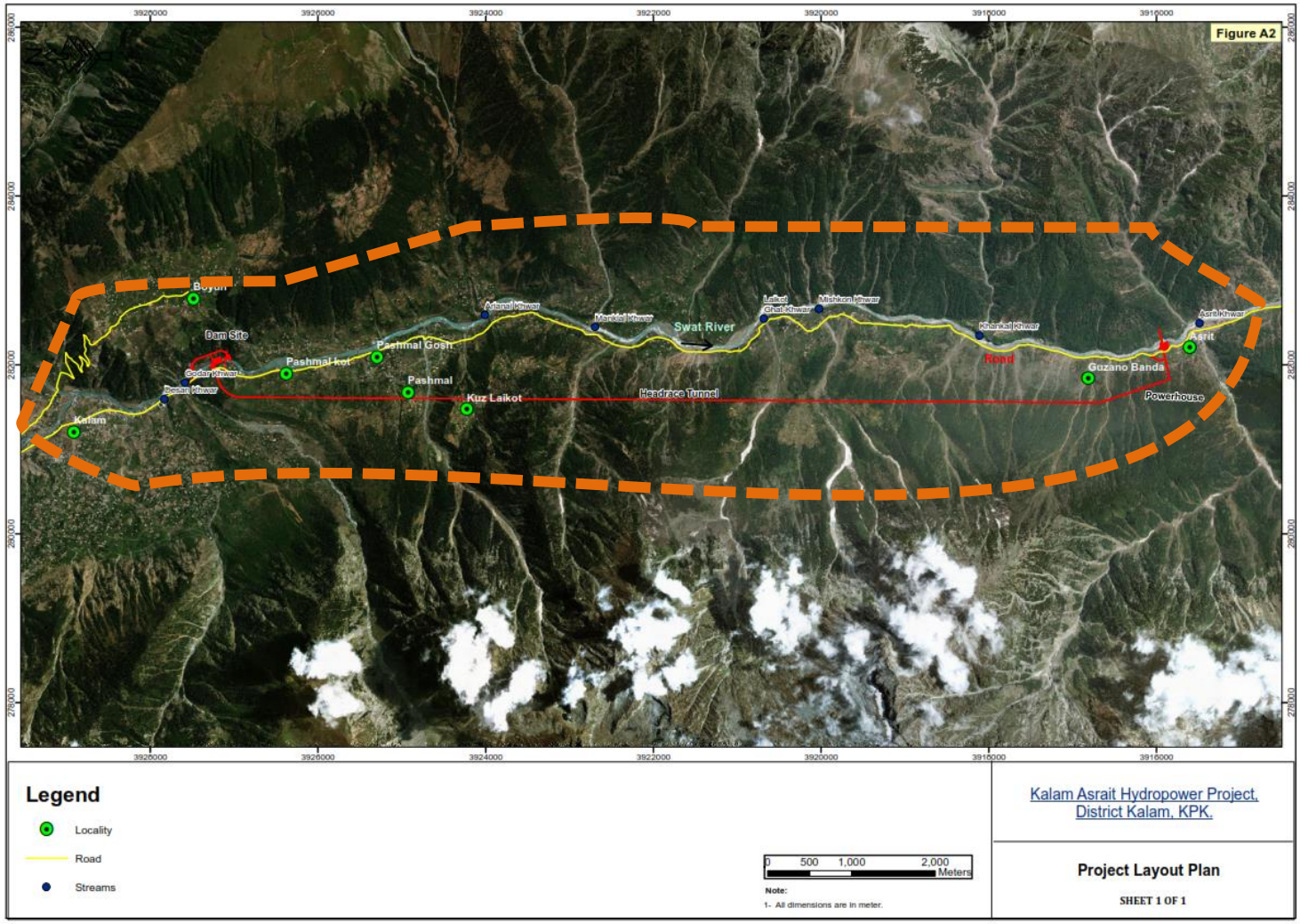


Figure 17: Kalam-Asrit Area of Influence

Figure 18: Kalam-Asrit Project Layout

5.3 Physical Baseline Conditions

A data collection survey that included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, land use patterns associated with socioeconomic conditions was carried out through collection of available secondary information and field surveys. Data collected was used to establish the baseline conditions for the soil, climatic conditions, water (surface and ground) resources, flora, fauna, ambient air and noise.

Primary data was collected for noise, water quality, ambient air, flora, fauna and socioeconomic factors of the project area.

Secondary data was collected for land, geology, ecology and climate conditions for the proposed Hydropower project.

5.3.1 Physiography & Topography

This section covers the existing physical environment of the project study area and has been derived from field surveys, desk studies, visits to the Government departments and other relevant agencies, discussions with the affected people and notables of the area. Physical environment includes topography, geology, seismology, climate, land-use and water resources.

5.3.2 Land Use and Land Cover

The land exists in the district of swat is ranged into cultivated, non-cultivated, government owned forests and government or privately owned wastelands (KPK Land-Use Statistics 2016-17). Most of the land that project sites cover, belong to the forest department of Khyber Pakhtunkhwa, it contains the hilly and mountainous areas majorly covered with Diyar (Cedar) trees with some portion of Sufaida (eucalyptus). It also includes the privately owned settlements on high benches that are used for cultivation and agricultural activities. The proposed components of the project i.e. Reservoir Area, Weir/ intake structure, headrace tunnel and powerhouse are located partially on the government land, out of which a major chunk of Powerhouse, Reservoir and Intake area exists in the privately-owned land. However, it also encloses the structures, which will not be directly affected due to construction activities. Likewise, a big fraction of disposal sites and the land required for construction workers' camps and colonies belong to the forest department of government.

Swat is a mountainous region, located among the foothills of the Hindukush mountain range. This range runs in the general direction of North and South and has a varied elevation within the Swat area, beginning from 600 meters above sea level in the South and rising rapidly up towards the North, to around 6,000 meters above sea level. The land of Swat region is generally home to lush green valleys, snow-covered glaciers, forests, meadows and plains which are used majorly used for housing, agriculture and business purposes.

5.3.2.1 Land Holding by Project Components

The total land acquisition either government or private is summarized below:

Table 5-2: Land Covered Under Project Components

Project Component	Permanent (Kanal)		Temporary (Kanal)	Total (Kanal)
	Private	Government	Government	
Reservoir Area	47.60	-	-	47.60
Weir/Intake	29.85	0.35	-	32.20
Disposal Site-I	8.85	-	-	8.85
Disposal Site-II	1.80	0.10	-	1.90
Disposal Site-III	25.55	-	8.95	34.50
Disposal Site-IV	-	-	111.65	111.65
Disposal Site-V	-	-	37.90	37.90
Disposal Site-VI	-	-	60.95	60.95
Power House	117.60	25.00	45.00	187.60
Worker Camp	-	-	50.00	50.00
Total	**231.25**	**25.45**	**314.45**	**571.15**

5.3.2.2 **Project Land Ownership and Tenure**

In the project area the total landholding is 721.15 Kanals which comprises temporary government owned land of 449.45 Kanals out of which cultivable land is 230 Kanals and barren land is 219.45 Kanals. Permanent land comprises of private & Government owned; Out of 231.25 Kanals (private land) which 3.10 contains residential settlements, 173 cultivable and 55.15 wasteland. Government owned land is 40.45 Kanals.

Table 5-3: Permanent Land Holding

Village / Mauza	Private Land (kanal)				Government (kanal)			Grand Total
	Residential	Cultivable	Waste land	Total	Cultivable	Waste land	Total	
Pushmal – UC Balakot	2.85	96.45	14.35	113.65	5	.45	5.45	119.1
Laikot – UC Balakot	0.25	76.55	440.8	117.60	35	-	35	152.60
Total	3.10	173	55.15	231.25	40	0.45	40.45	271.7

Table 5-4: Temporary Land Holding

Village / Mauza	Government (kanal)		
	Cultivable	**Wasteland**	**Total**
Pushmal – UC Balakot	45	-	45
Laikot – UC Balakot	185	219.45	404.45
Total	**230**	**219.45**	**449.45**

Figure 19: An upstream looking view of the Kalam valley from the right bank near proposed weir site

Figure 20: A downstream view of Swat River valley at weir site

Figure 21: Upstream view of Swat River valley at weir site

Figure 22: Downstream View of Weir

Figure 23: Land use in AOI

Figure 24: An Upstream View of Weir

Figure 25: An downstream view of the weir site from the left bank of Swat River

Figure 26: An broad view of the tunnel outlet and powerhouse area

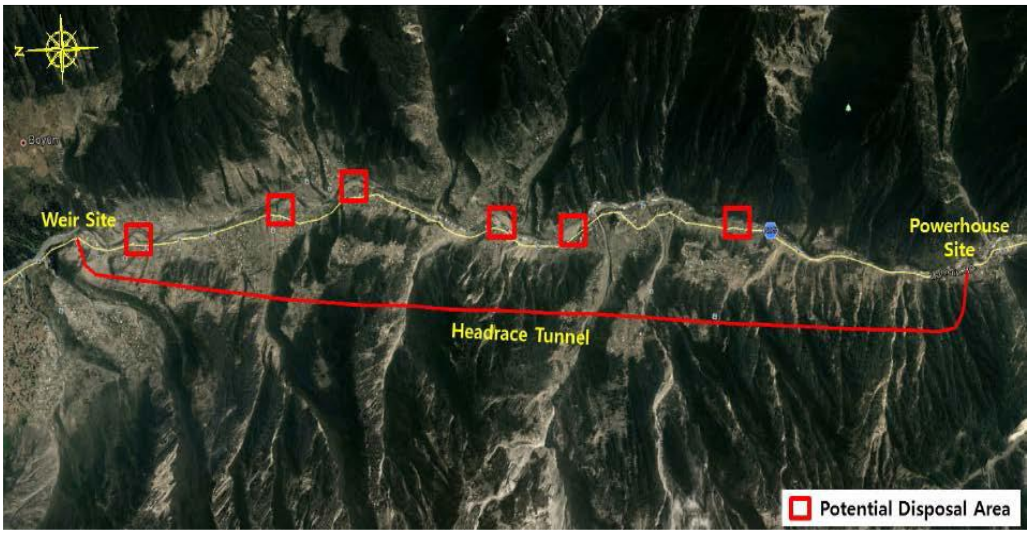


Figure 27: A Location of Disposal Areas

Figure 28: A Location of Disposal Area-1

Figure 29: A Location of Disposal Area-2

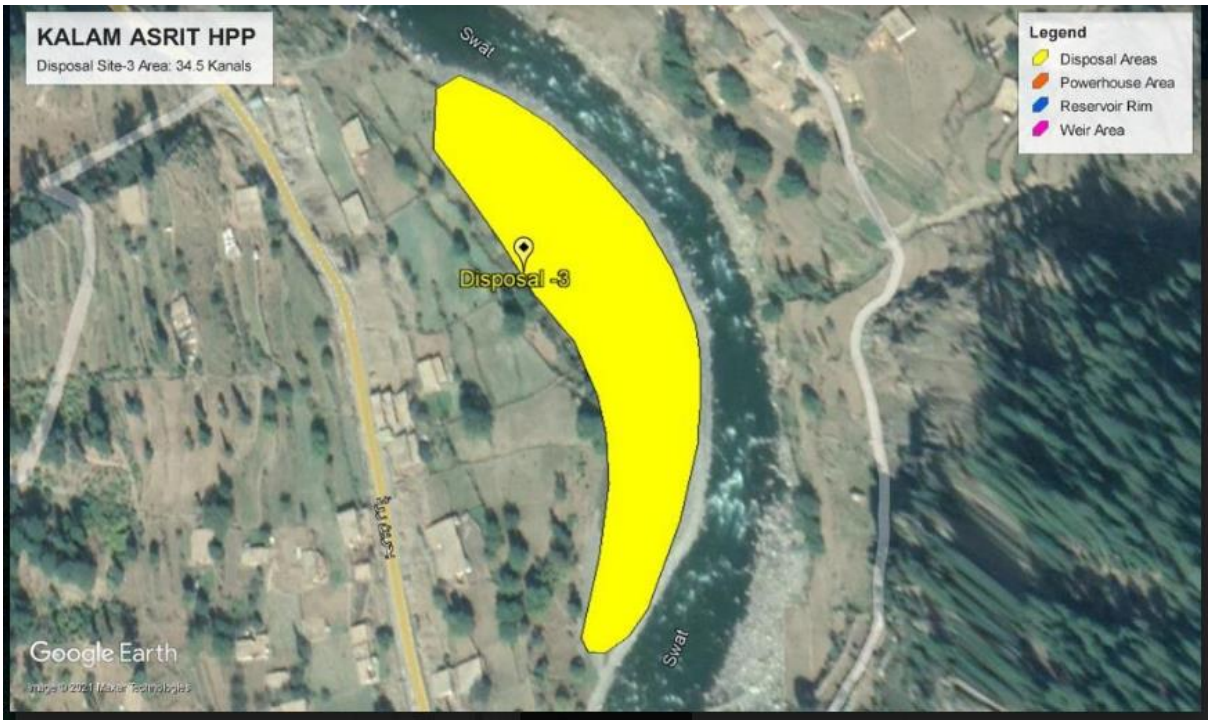


Figure 30: A Location of Disposal Area-3

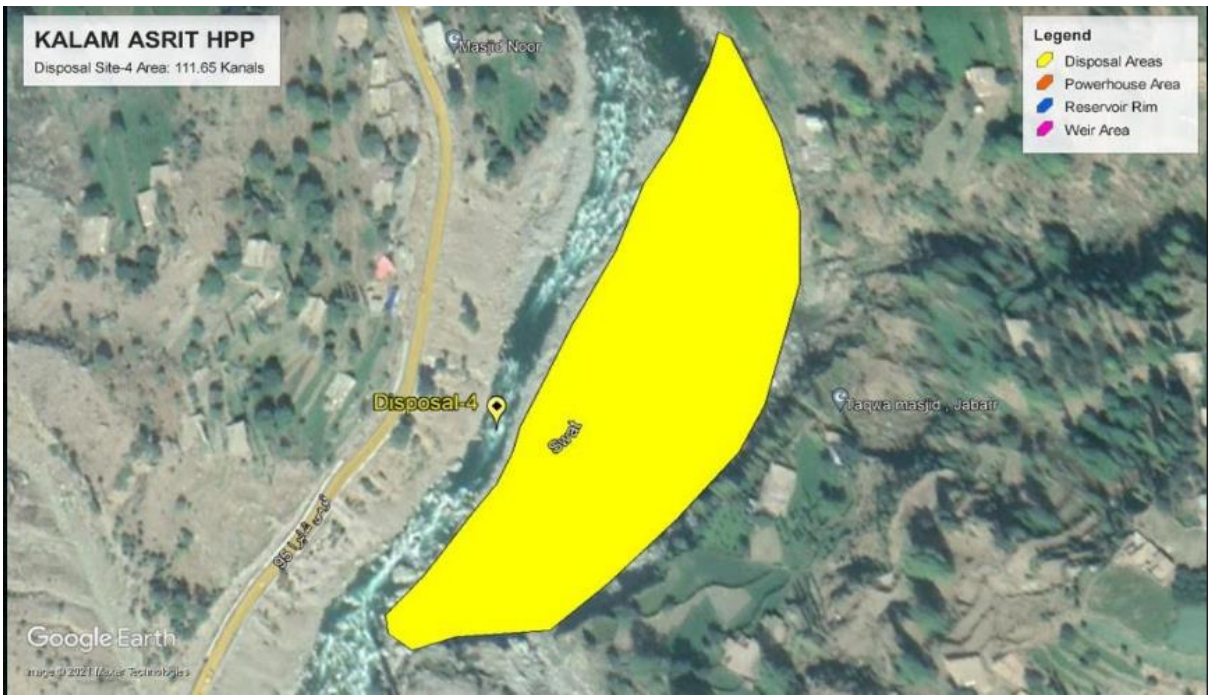


Figure 31: A Location of Disposal Area-4

Figure 32: An Location of Disposal Area-5

Figure 33: An Location of Disposal Area-6

5.3.3 Topography

Swat is a mountainous region, located among the foothills of the Hindukush mountain range. The elevation of Swat river valley, at the southern boundaries of the district, is over 600 meters above sea level (masl) and rises rapidly towards the north. There are several mountain peaks ranging from 4,500 to over 6,000 masl. The Swat region, containing the meandering Swat River, is also home to lush green valleys, snow–covered glaciers, forests, meadows and plains.

Two mountainous fringes project from the Hindu Kush forming the valley. The western mountain range forms the boundary between Swat and Upper and Lower Dir district Swat-Dir divide), while the Eastern mountain range acts as a watershed between Swat and the Indus River catchments. These ranges runs in the general direction of North to South and has a varied elevation within the Swat, beginning from approximately

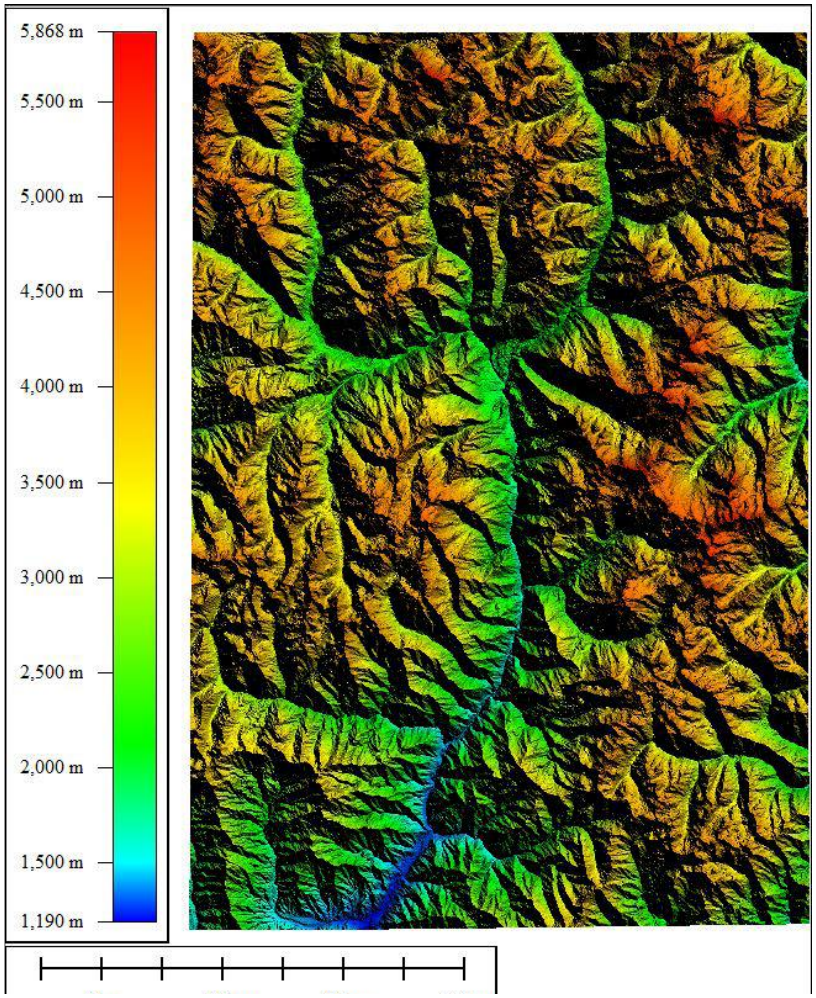


Figure 34 An Topographic Map of Study Area

599.8 meters above mean sea level in the South and rising rapidly up towards the North, to around 19,685 meters above sea level, shown in elevation

5.3.4 Geological Settings

The project area is situated in the middle-western part of the Kohistan Tectonic Zone and comprises plutonic igneous rocks. The predominant rock type at the site is a medium-grained slightly foliated gabbroic rock, classified as Norite. This rock type is in intrusive contact with another plutonic igneous rock called Diorite. The contact between the two rock types passes almost midway between Kalam and Asrit. Minor rock types in the area include Amphibolite's, Pegmatites and fine grained basic dykes. None of them are in significant large proportions to affect the mechanical strength of rocks in the site area. Geological map is shown in the Himalaya-Karakoram collision zone of northern Pakistan includes the southern part of the Eurasian continental plate and the north-western part of the Indo-Pakistan subcontinental plates.

The project area is located between the MKT (Main Karakoram Thrust Fault -Shuok Suture Zone) and MMT (Main Mantle Thrust Fault -Indus Suture Zone, KT - Kohistan Fault) in an area of NNE-SSW trending Amphibolitic and Granitic Mesozoic to Pliocene rock formations

Swat valley is occupied by the so-called Kohistan Island Arc Sequence of Post-Eocene age, consisting of granites, diorites, pyroxene-granulite (norites, garnet granulite's slates, quartzites and green stone). Just 10 to 15 km south-east of Madyan and Fatehpur, the Kohistan island Arc is bordered by the Main Mantle Thrust Fault (MMT), which divides it from the Indian Mass consisting of granites and 94 kinds of pelltic (slates) and carcareous rocks, called Besham group. The Kohistan Island Arc proper consists of many different rock units belonging to the Kohistan Complex; the incorporated five mainly mafic and ultramafic rock types are from south to north the Patan Granulite's, Jijal Ultramafic, Kamila Amphibolite's, Bahrain Pyroxene Granulites, and the Deshai Diorite. Around Kalam, project area, and along Gabral and Ushu rivers the main outcrops of Cretaceous Kalam group exist, consisting of quartzites, limestones, and slates accompanied by volcanic rocks and slates of Eocene-aged Dir Group. The geological location map is attached in Figure 5-18.

The purpose of the geological lineament analysis is to understand the characteristics of regional geological structures around the project area and to obtain the basic data which provides the direction of investigations such as detailed geological mapping, borehole drilling and geophysical explorations etc. Regional geological lineaments are one of the most important factors when design and stability assessment of civil structures are performed. Therefore, this analysis was carried out in order to

preliminary evaluate the main structures of Kalam-Asrit HPP using the satellite photograph. However, ground trothing of these lineaments will be undertaken during

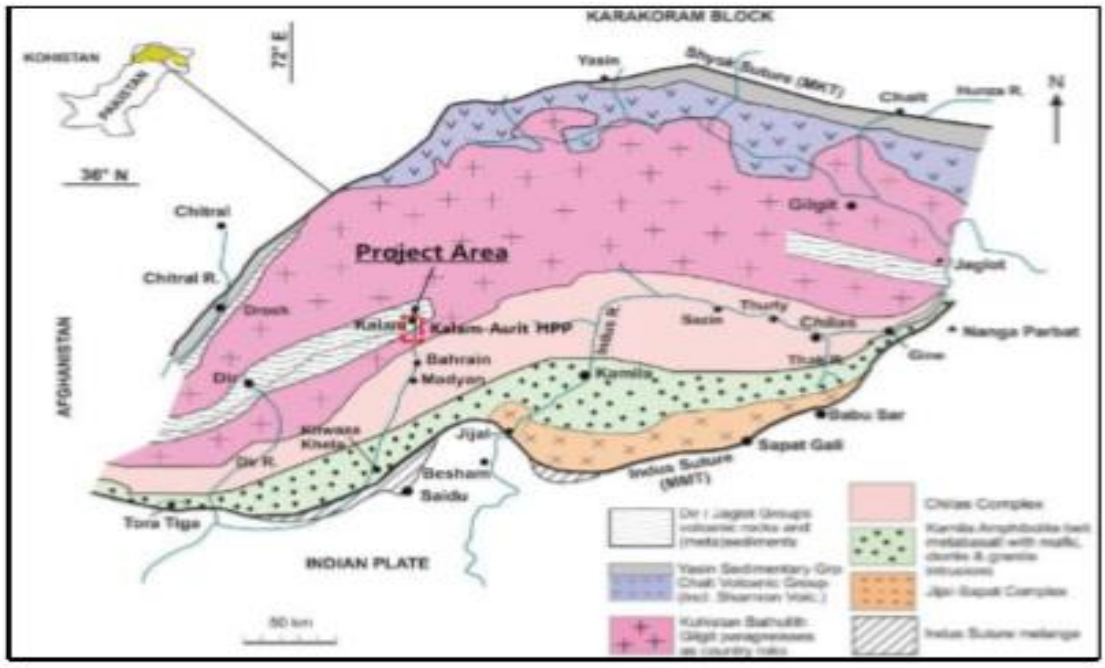


Figure 35 Regional Geological Map

geological mapping.

5.3.5 Geology Of Project Layout

At the weir foundation area is covered with the river bed material comprising sandy gravel, cobbles and boulders derived from mostly from igneous rocks lying in catchment area of Swat River. At the weir and coffer dams' sites, mostly material is gravel and cobble sized with occasional boulders in sandy gravelly matrix which is highly permeable. The thickness of the overburden material seems deep (>30m) corresponding to the valley width in this area. The river bed material is loose at top and is likely to be dense to very dense at greater depth due to the overlying load. Provision of grout curtain or blanket or cut-off wall will be helpful in controlling the seepage.

At the headrace tunnel, the rock outcrop is exposed at the tunnel intake portal (0+000-0+070) but, as per surface geology, it is underlain by glaciofluvial deposits from 0+070 to 2+000. These deposits make a terrace along the right bank of the Swat River. From 2+500 to 3+150, the proposed tunnel passes through meta-sedimentary rock of Shou Quartzite which comprises mainly quartzite. The rock is medium strong to strong having foliation same as that of the diorite. From 3+150 to 11+000, the tunnel is again in diorite and gabbro of Kalam Quartz Diorite. These rock units exhibit moderately high to very high strength and are massive to foliated. Along the tunnel route, of rock mass

was undertaken to have an assessment of rock mass classification along the proposed tunnel route. The rock mass classification was performed based on RMR and Q value.

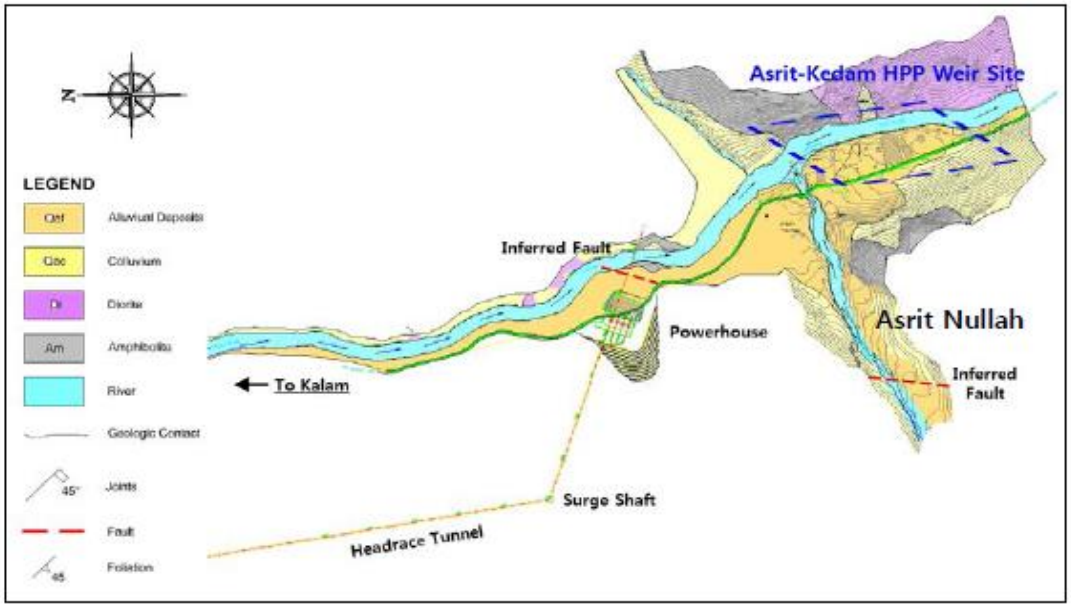
At the powerhouse area, mostly the powerhouse area is occupied by the unconsolidated deposits that are believed to be slope wash material extending upslope to the right bank rock outcrops. This material comprises angular to subangular rock fragments from gravel to boulders sized of diorite/ gabbro embedded in fine matrix. Through the invested map, the rock has been interpreted to be at 20-30m depth at the river valley and towards hill side. From the interpreted geology, it is inferred that the rock mass is good massive to foliated under the powerhouse site.

Disposal area for the rock mucks produced from excavations of main structures such as weir, headrace tunnel and powerhouse will be situated at the left & right bank with large space. During the site survey, numerous potential disposal areas were confirmed. However, it is judged that existing access road can be utilized, so it is necessary to ensure the available disposal areas of the right bank with favorable accessibility.

It was reported that the sands from Kalam show strong potential for alkali silica reaction with ordinary Portland cement. However, results of other tests performed in some HPP,

The preliminary F/S found a surface type powerhouse is suitable near N-95 road around Asrit village before reaching the confluence of Asrit Nullah and Swat River but the surface or underground type powerhouse was recommended by doing additional geological investigations at the powerhouse area.

Figure 36: Geology of Powerhouse Site



5.3.6 Seismicity

On the basis of Peak Ground Acceleration (PGA) values obtained through Probabilistic Seismic Hazard Assessment (PSHA), Pakistan is divided into five (05) seismic zones in line with the Uniform Building Code (UBC), 1997 of the Pakistan. Seismic map of the project site with respect to other seismic zones of Pakistan is shown in **Table 5-5**.

Table 5-5 Seismic Zones of Pakistan

Sr. No.	Zone	PGA (g)
1	1	0.05 to 0.08
2	2A	0.08 to 0.16
3	2B	0.16 to 0.24
4	3	0.24 to 0.32
5	4	> 0.32 g

Horizontal and vertical seismic forces transmitted to the support structures by the ground during earthquake may cause extremely high mechanical stress to engineering structures as well as roads, seismic adaptation which is primarily related to the appropriate design of support structures and connections between the units. The project area is located in Seismic Zone 3 (high hazard), where 3 represents peak horizontal ground acceleration from 0.24g to 0.32g.

As a natural hazard, earthquakes pose a multitude of hazard to weirs, either by direct and excessive loading of the structures or by initiating a continuous sequence of events that may lead to weir failure. The geological setup of the proposed project areas lies under the compressional region in North-West (NW) of Himalaya. It consists of many regional and local faults passes through the area. Seismicity of the region has many small to moderate and large earthquakes occur in past. The major thrust fault Main Mantle Thrust (MMT) passes through the region including Main Boundary Thrust (MBT) and Oghi Share Zone and other small-scale faults which eventually may cause the moderate to large earthquakes. According to the hazard zonation study of the Pakistan by the Pakistan Meteorological Department, Tehsil Bahrain of district Swat is laying in Zone III, based on the previous seismicity record, therefore it indicates that earthquakes are the potential hazard in all the UC's of Tehsil Bahrain due to the available faults and epicenter data of the region. The Risk may multiply with the slope failure factors from ground shaking in the area.

The proposed hydropower project is located in the Kohistan Island Arc physiographic province, a tectonically active region which is sandwiched between the converging Indian and the Eurasian tectonic plates. The Project region is very active seismically and has been subjected to damaging earthquakes in the past .

Figure 37: Seismicity Map of the Project Region

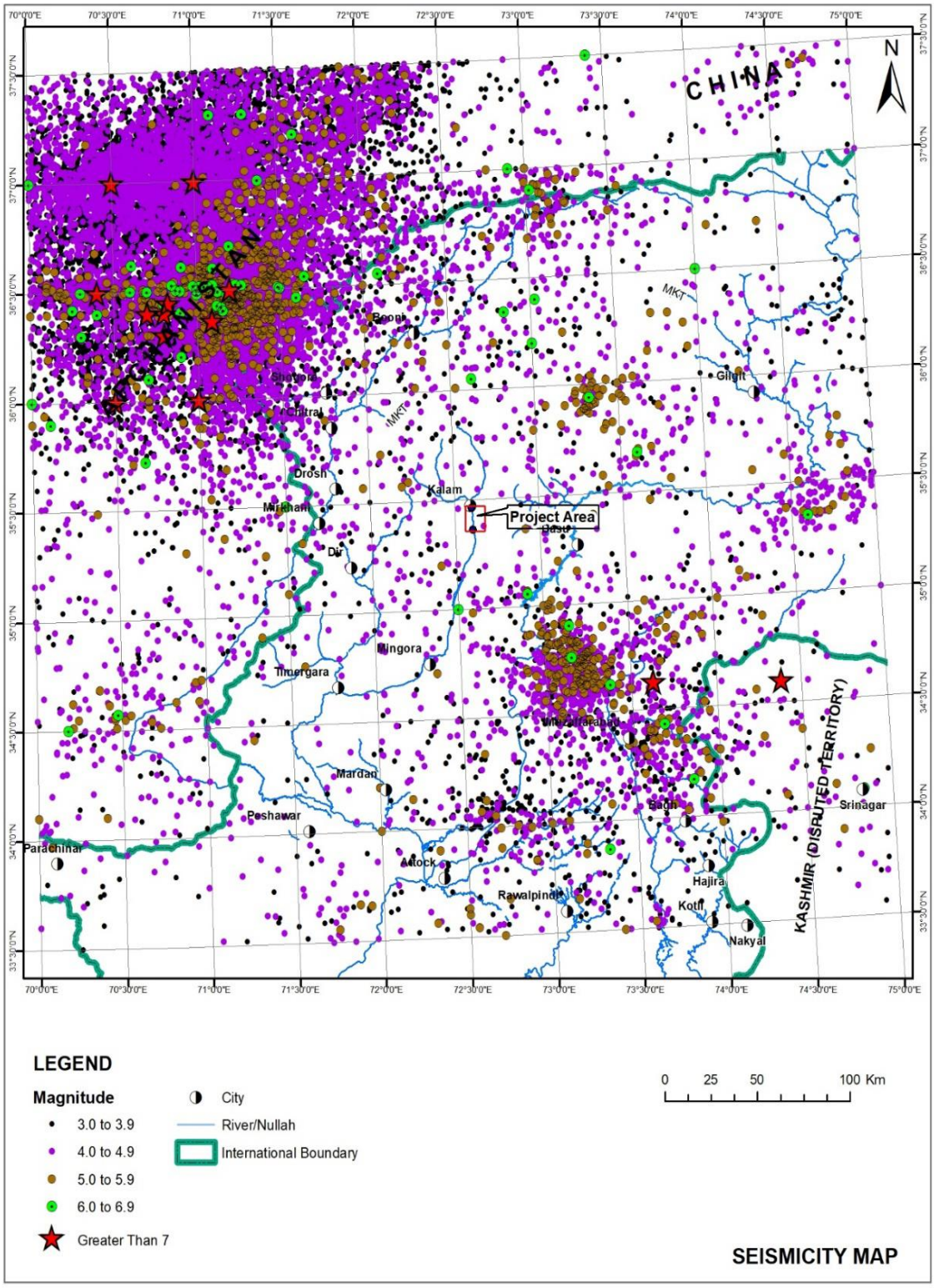


Figure 38: Project Disposal Area Map

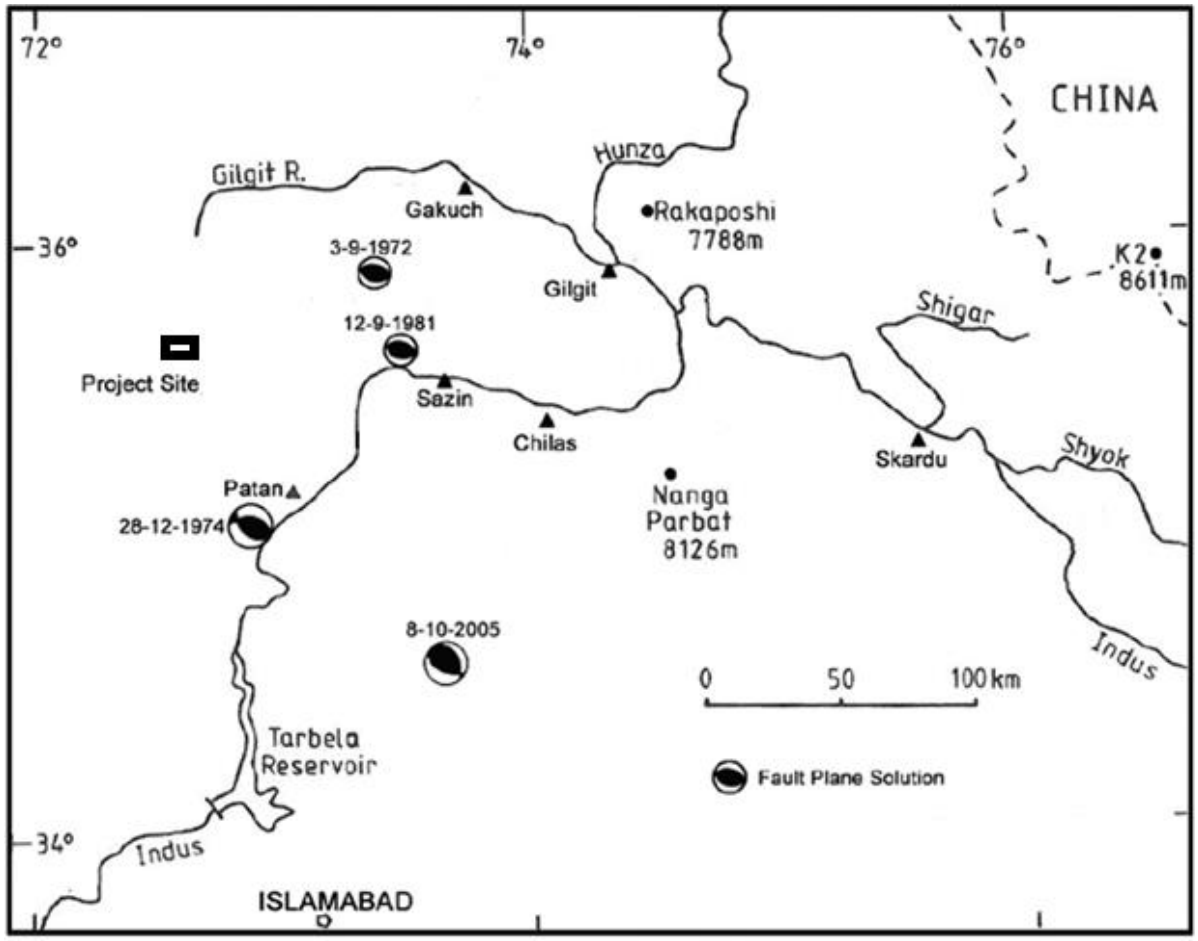
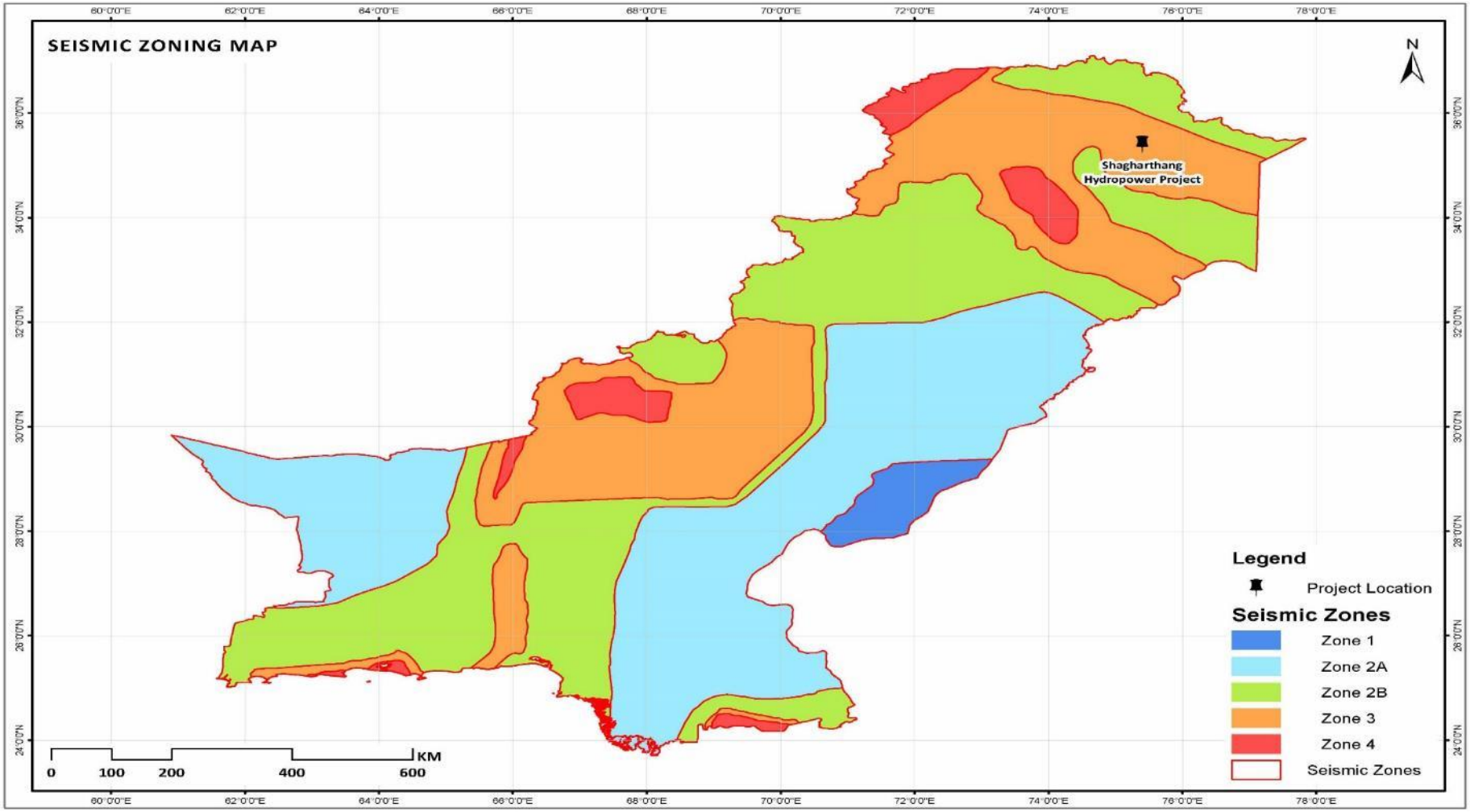

72°
74°
76°
CHINA
Hunza
Gilgit R.
Gakuch
Rakaposhi
7788m
36°
3-9-1972
Gilgit
K2
8611m
Shigar
12-9-1981
Project Site
Sazin
Chilas
Skardu
Shyok
Patan
28-12-1974
Nanga
Parbat
8126m
8-10-2005
Indus
0
50
100 km
Tarbela
Reservoir
Fault Plane Solution
34°
Indus
ISLAMABAD

Figure 39 Fault Plane Solutions of Significant Events of Kohistan Region

Figure 40 Seismic Zoning Map



5.3.7 Climate & Meteorology

Generally, the project area falls in sub-humid and sub-tropical zone of district swat. It has moderate summer and extreme cold winter. The hottest month is June with mean maximum and minimum temperature of 33°C and 16°C respectively, and the coldest month is January with mean maximum and minimum temperature of 11°C and -2°C. With respect to the variations within tehsils of swat district a mild and generally warm and temperate climate is observed in tehsil bahrain, with a humid subtropical climate while the annual precipitation averages 866 mm (34.1 in). Consequently, the weather is pleasant in the months of March to May and August to October.

Seasonal variation includes that duration of winter season depends on altitude; however, it generally lasts from November to Mid-March in proposed project area. It is characterized by heavy frost in the lower areas and some snowfall at higher elevation. Rain and snow during winter season come from Cyclonic Current from the Mediterranean Sea, and snowfall starts at higher elevations towards the end of November or early in December. There is an apparent characterized spring season in the area, during the months of March to April. However, Summer season is characterized by dry spells in April to June followed by frequent showers in the moist or wet zone. At this time of the year the lower valleys are hot subjecting hot winds causing intense summers. It influences with the advent of monsoons either towards the end of June or early in July and lasts till middle or sometimes up to the end of September. (Development Profile of Swat, KPK, 2015). These data were derived from the stations designated by Pakistan Meteorological Department, which states that apart from the Saidu-Sharif station and Kalam station, there are no other meteorological stations exist in the district of swat. The mean maximum and mean minimum temperatures from 1991 – 2015 are 16.74 0C and -3.22 0C respectively while the mean annual rainfall is 26.13 mm .

Saidu Sharif Weather Station is the nearest weather station of Pakistan Meteorological Department for collection and recording of meteorological data for the upgradation of the hydropower Project. The average data for the various climatic parameters such as temperature, rainfall, relative humidity, wind speed and direction has been acquired for the year 1981 to 2010 (recent 30-year average normal meteorological data) which is being discussed as below.

5.3.7.1 Temperature

Temperature distribution at Kalam (EL 2,100) is shown in Table 5.3 Air temperature is decreased by 0.6˚C ~ 1.0˚C per every 100 m increase in the elevation. Snowfall occurs from EL. 5,000. Considering the elevation of the catchment area and temperature, it is supposed that snow accumulation play a major role in the hydrological cycle. During December to March, minimum temperature is below 0˚C, which needs consideration for construction period .

Table 5-6 Monthly Mean of Temperatures

Sr. No.	Month	Mean Temperature °C

		Minimum Temperature °C	Maximum Temperature °C	
1	January	1.8	14.5	8.3
2	February	3.9	16.1	10.1
3	March	7.8	20.7	14.1
4	April	12.0	26.8	19.1
5	May	16.5	32.8	24.3
6	June	20.2	36.3	27.9
7	July	22.2	34.6	27.9
8	August	21.5	33.1	26.7
9	September	17.5	31.9	24.3
10	October	11.4	28.0	19.5
11	November	5.9	22.4	14.2
12	December	2.7	16.6	9.9
Annual		**12.0**	**25.8**	**18.9**

Source: Pakistan Meteorological Department

5.3.7.2 Rainfall

Available meteorological information shows that the average annual rainfall in the project area is about 1081.5 millimeters. Complete record of average monthly precipitation for last thirty years (1981-2010) is also presented in the **Table 5-4**. general, swat district faces three rain-bearing seasons; winter rains, spring rains and summer rains.

The average annual precipitation of the project site is around 930 mm in the Project Profile (Private Power & Infrastructure Board, Ministry of Water & Power, Government of Pakistan, Jan, 2017). No observation period and location are presented in the report.

Monthly precipitation pattern in the catchment is as shown in Figure 6-8. It is shown that precipitation events concentrate from January to May and maximum precipitation occurs in March and April. The precipitation from March to April falls as snow and rainfall.

Winter rains start in December and last to the end of February. When the rainfall starts once, it remains continuous to one or two weeks. This continuous rainfall is called Jarai. The rain of this season is usually, with slow fall and small drops. In the plain, the snowfall takes place from 15th January to the end of February. But in mountainous areas, the snow period is from the beginning of December to the end of March. (In November, the snow also falls on mountains, but melts soon). Spring rains from March to May are regarded as the spring rains. In this season, the rainfall occurs in shower with thunder and lightning, and the drops are bigger. The lengthened period of the continuation of the spring rains is destructive for the muddy homes of the poor villagers. For summer rains usually, there is a gap of one dry month, June, between the rains of spring and summer. The summer rains begin in July, and end in September. These rains are not so continuous. They are in intermittent position. Sometimes the rainfall takes place suddenly with hailstones, which results in the damage to property and lives. The rain of this season falls with shower and lightning.

The maximum precipitation occurs during the monsoon season in the months of July and August whereas higher precipitation also occurs in the months of March and April.

Table 5-7 Mean Monthly Precipitation

	January	February	March	April	May	June	July	August	September	October	November	December
Precipitation / Rainfall	111	166	196	168	102	88	127	110	78	68	70	77
mm (in)	(4.4)	(6.5)	(7.7)	(6.6)	(4)	(3.5)	(5)	(4.3)	(3.1)	(2.7)	(2.8)	(3)
Humidity(%)	56%	61%	60%	59%	63%	64%	74%	77%	71%	64%	59%	55%
Rainy days (d)	9	10	11	10	10	13	17	17	12	8	6	6
avg. Sun hours (hours)	6.2	6.0	7.5	8.8	10.0	10.2	8.5	7.3	7.7	8.0	7.2	6.8

5.3.7.3 Relative Humidity

Interpretation of available meteorological data shows that the area experiences relatively high humidity. The average humidity recorded during months from August which could reach up to 87.7% while and minimum humidity was recorded from the month of June which could reach to 37.3%. The data for relative humidity is being recorded on daily basis for 00 UTC, 03 UTC and 12 UTC.

5.3.7.4 Wind Speed

Average wind speed in entire district is very erratic. According to available information, wind speed of the project area could reach up to 2.2 knots in the hotter months of the years The wind data is being recorded on daily basis for 00 UTC, 03 UTC and 12 UTC. The monthly mean for the wind speed is calculated and mentioned in Table 4.5 below for the past 30 years (1981-2010) in knots. It is observed that at 12 UTC, the wind speed is low in winter season, while in summer season, winds are blowing at a

relatively higher speed than winter. However, at 00 UTC and 03 UTC very low velocity winds are blowing during July to February annually.

5.3.7.5 Climatic Change

During the last decade, substantial research is carried out to study the effects of long-term climate change on precipitation, air temperatures, and droughts in Pakistan. Some of the main conclusions of these studies (GCISC, 200919 14F[15], Planning Commission, 20092015F[16]) are:

- between 1980 and 2005 the frequency of heatwaves (T >40 °C) has been increased in northwestern Pakistan. It is expected that there will be more frequent periods with extreme drought;
- based on predictions in scenarios of the International Panel on Climate Change (IPCC) estimates have been made by the Pakistan Meteorological Service of the increase in maximum daily temperatures, which ranges from 2.8 °C to 4.2 °C in the year 2080 for northern Pakistan;
- more heavy rainfall events during the monsoon season will occur over north western Pakistan instead of over the north-east of the country. Some model calculate 25 percent more rainfall during monsoon. As a result, areas along the western rivers of the country (Indus and Kabul) will be more vulnerable to flood episodes similar to the one experienced during 2010;

water availability might increase considerably (during monsoon or Kharif season) but not when it is required for agriculture (winter or rabi season); a shift has been observed in the rainfall pattern with monsoons starting 1-2 weeks earlier and winter rains confined towards February. The predictions of changes in precipitation, however, are much less certain than those in temperature. A general conclusion is that precipitation in the form of rainfall and snow is likely to increase in summer (2- 7 percent) and decrease (2-4 percent) in Northern Pakistan in the year 2080 (GCISC, 2009).

[15] Planning Commission 2009, Pakistan's Climate Change Policies and Actions, Task Force on Climate Change, Planning Commission, Planning and Development Division, Government of Pakistan.

[16] *GCISC (2009): Ali, G., S. Hasson, and A.M. Khan, Climate Change: Implications and Adaptation of Water Resources in Pakistan, Research Report No.GCISC-RR-13, Global Change Impact Studies Centre, Islamabad.*

Other studies (World Bank16F[17], 2005, Rees and Collins, 200417F[18]) have been concentrated on the effects of glacial melt, especially on the Hindu Kush-Karakorum or the Western part of the Himalaya. Major issues to be investigated are amongst others: the importance of the contribution of snow and glacial melt on the hydrology of the Indus; the observed changes in the extent of the glaciers; the effects of climate changes on the amount of melt-water.

From these studies, it has been concluded that glaciers in the Himalaya and Karakorum are receding faster than happens in any other part of the world. From digital terrain models and satellite observations, it might be concluded that the reduction of the thickness of ice in the Western Himalayan glaciers ranges between 0.50 to 0.90 m per year, although in some areas in the Karakorum an extension. and increase of glaciers has been reported. A recent study23 suggests that 60 percent of the discharge in the Indus catchment is fed by the melting of glaciers and snow. This is a very high percentage as compared to other major rivers originating in the Himalayas, such as Brahmaputra, Ganges and Yellow River. In a likely scenario of global warming based on IPCC predictions, the reduction of the share of melt-water in the Indus discharge has been estimated at 8.4 percent. However, this could be (over) compensated by an expected increase of precipitation in the downstream areas (in the NW of the country), which are under the influence of the monsoon.

The relation between climate change and hydrology is extremely complex. This is especially the case, since the high variability in data on climate and hydropower, requiring long time series and proper monitoring. Moreover, regional circumstances might vary considerably, especially in high mountain areas. This often leads to conflicting data. More studies and more reliable data should be collected in the coming years.

5.3.7.6 Hydropower Potential

The area drained by the Swat River and its tributary network is a part of Kohistan Himalayas and has a potential of more than 1000 MW18F[19] that can contribute 25%

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17 World Bank 2005.Pakistan's Water Economy Running Dry

18 Rees, G. and D. N. Collins (2004), An assessment of the Potential Impacts of Deglaciation on the Water Resources

of the Himalaya, Technical Report, DFID KAR Project No. R7890: Snow and Glacier Aspects of Water Resources

Management in the Himalayas (SAGAR MATHA), Centre for Ecology and Hydrology, Oxfordshire, UK

19 Assessment of hydro power potential of Swat, Kohistan Himalayas: A solution for energy shortfall in region

Mohammad Amjad Sabir, S. Shafiqur Rehman, Muhammad Umar, Amir Waseem, Muhammad Farooq, Fariduulah & Muhammad Irshad

to the total energy shortfall in the country and the same is 150% more than the shortfall experienced in the province of Khyber Pakhtunkhwa that hosts Swat Valley. Due to great relief difference acquired within a small stretch, the perennial Swat River and its tributaries become pertinent for power production as high head projects and also gain importance in irrigation as well.

5.3.8 Surface and Ground Water Hydropower and Drainage

River Swat

River Swat plays an important role in the economy of the people of the valley. It irrigates large areas of Swat, Malakand, Charsada, Mardan, Swabi and Peshawar Districts and recharge water wells and springs through seepage. The River serves as a habitat for diverse species of migratory Siberian birds and largely contributes to the fishing industry of Khyber Pakhtunkhwa. The aesthetic scenery of river attracts thousands of tourists from all over Pakistan and the world during the spring and summer seasons.

Irrigation Water

In district Swat, about 41% of the cultivated area is irrigated by canals (both Government and private), another 23% by wells (groundwater) for irrigation, while the rest is irrigated by other sources.

Flow of River Water

Swat River, second tributary of Indus River, also represents similar flow characteristics. Snowmelt runoff in upper Indus River shows contribution of 60% ~ 80% to the flow. The project site is located low part of upper Indus River, it is estimated the contribution portion of flow in river is approximately 65% ~ 70%. The snowmelt typically starts in early April and increases progressively and reaches it maximum contribution in early July. Figure 6-8 shows Swat River's flow characteristics at Kalam station. The maximum discharge occurs in June or July but precipitation is the least in a year that means the maximum discharge occurs from base flow by snow melt. From December to March, most precipitation occurs as snow in consideration of its elevation. As the air temperature is increased, snow melt flow is increased by July. It is found that the maximum flood occurs with snow melt and has very low relationship with precipitation.

It is desirable that long term flow at the project site is estimated conservatively considering the reducing snow and glacier area, and it should consider the relationship among maximum discharge, precipitation and temperature for selection of design flood.

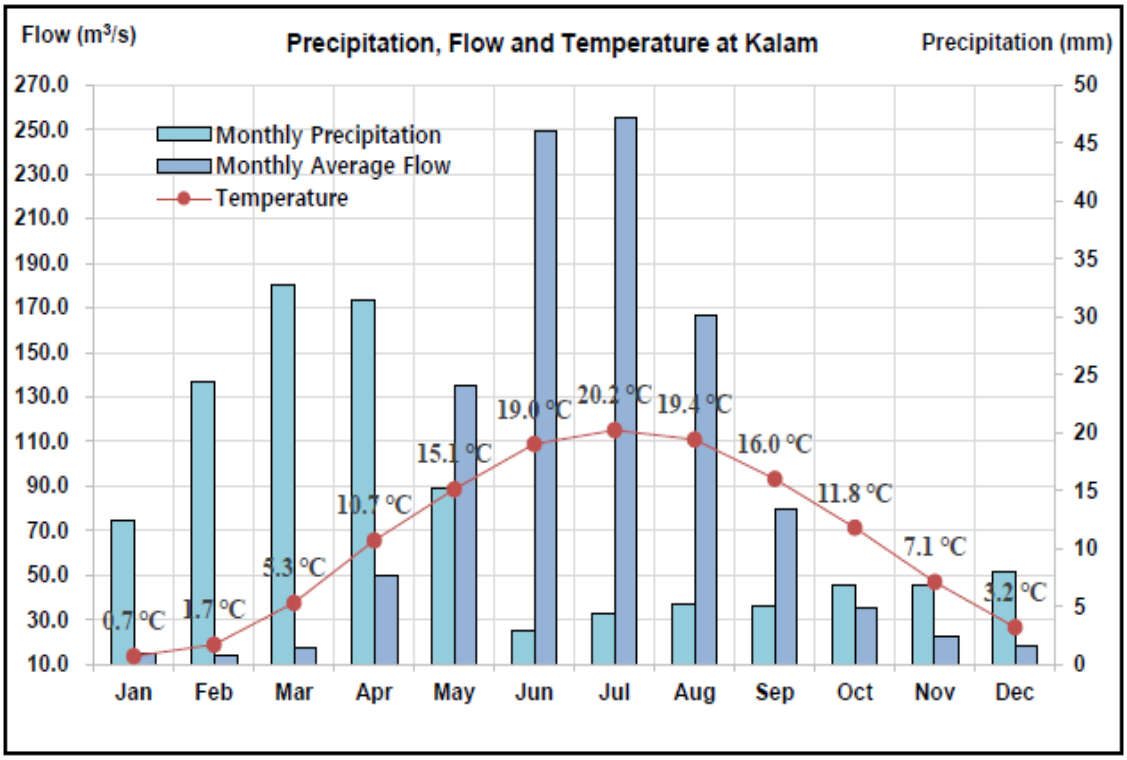


Figure 5-23: Swat River flow Characteristics

Monthly Average Flows

The monthly average flow at the weir site is estimated based on the daily average river flow. The analysis estimated the average annual river flow at the weir site and the powerhouse site as 88.4 m3/s and 95.0 m3/s, respectively. Table 6-8 and Table 6-9 show the estimated monthly average river flow.

Table 5-8: Flows at Weir Site & Tailrace Outlets

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
Weir Site													
Average Flow (m3/s)	15.4	14.1	17.8	49.7	135.6	250.2	256.4	167.7	79.8	35.6	22.9	17.9	88.4
Tailrace Outlet													
Average Flow (m3/s)	16.5	15.1	19.1	53.3	145.7	268.7	275.3	180.1	85.7	38.3	24.6	19.3	95.0

Quality of River Water

Two surface water samples were collected from Asriat Nullah near weir site and Downstream (Powerhouse Site) of Swat River. The sampling and analyses were carried out by an EPA-KP certified Environmental Laboratory in comparison to National Environmental Quality Standards to assess their quality. The data for water analysis revealed that all the parameters are in compliance with National Environmental Quality Standards-Pakistan. Report of water quality monitoring is Appendix-E at the end of this.

Canal Network

The irrigation system of KPK is entirely dependent on the Indus River for supplies of water downstream of the area. The riverine tract of the Indus River occupies a special significance in the ecology of KPK. Expansion of agriculture and subsequent industrial development led to the need for conserving water for agricultural purpose and power generation through construction of reservoirs on the Indus River and its tributaries with associated irrigation canal networks. Irrigation canals from mainly Kotri Barrage (Ghulam Muhammad Barrage, 1955) and partly from Sukkur Barrage (1932) irrigate the project area. Main canals that originate from mighty Indus River and fulfil the water requirements of the project area are Baghar, Ladhya and Jam Sakro canals.

Drainage

The drainage system in the area has not been properly developed. In urban areas sewerage pits are available while in rural open drainage is being practiced.

Groundwater Quality

As part of EIA primary data collection, water sampling at selected location was also carried out and analysis has been performed to assess the water quality of the project area. For this purpose, **twelve water samples** were taken from Shahi Muhallah near the weir site and powerhouse at the downstream site for testing purposes. Location for groundwater source is also shown in **Figure 44.** Thirty two (32) important parameters were analyzed in taken water sample and thereafter compared with NEQS Standards for Drinking Water Quality. All these parameters of water play an important role, especially in determining its quality and suitability for intended use. All values of analyzed parameters were found within the limits except Total hardness, Chlorides, Cadmium and Lead. The lab results are given in **Table 5-9**. Based upon chemical analysis test results it may be concluded that water quality is not satisfactory for drinking purposes hence causing water borne diseases. The water quality results are attached in Appendix-E.

Table 5-9 Surface water Analysis near Powerhouse

Sr. No.	Parameter	Unit	Result	NEQs Guidelines

1.	Temperature	^{O}C	13	-
2.	Ph	--	7	6.5-8.5
3.	Total Dissolved Solids (TDS)	mg/l	58	100
4.	Total Suspended Solids (TSS)	mg/l	0	-
5.	Chloride	mg/l	78	250
6.	Fluoride	mg/l	0.04	1.5
7.	Taste	Object./unobject	Unobject	Unobject
8.	Odour	Object./unobject	Unobject	Unobject
9.	Colour	TCU	0	15
10.	Iron	mg/l	0.11	0.3
11.	Sodium	mg/l	32	200
12.	Nitrate (as NO_3)	mg/l	10	50
13.	Nitrite (as No_2)	mg/l	0.13	3
14.	Ammonia	mg/l	0	1.5
15.	Hydrogen Sulphide (H_2S)	mg/l	BDL	0.05
16.	Sulphate	mg/l	31	250
17.	Lead	mg/l	BDL	0.05
18.	Total Hardness as $CaCo_3$	mg/l	36	500
19.	Turbidity	NTU	0	5
20.	Zinc	mg/l	0	3
21.	Manganese	mg/l	BDL	0.1
22.	Benzene	mg/l	BDL	10-120
23.	Aluminium	mg/l	BDL	0.2
24.	Molybdenum	mg/l	BDL	0.072
25.	Chromium	mg/l	0.01	0.050

26.	Cadmium	mg/l	0.001	0.003
27.	Boron	mg/l	0.201	0.300
28.	Barium	mg/l	BDL	0.700
29.	Antimony	mg/l	BDL	0.005
30.	Arsenic	mg/l	BDL	0.010
31.	Cyanide	mg/l	BDL	0.070
32.	Mercury	mg/l	BDL	0.001
33.	Nickel	mg/l	BDL	0.020
34.	Total Coliform	Number/100ml	0	0/100ml
35.	E.Coli	Number/100ml	0	0/100ml

Table 5-10 Surface Water Analysis near Weir Site

Sr. No.	Parameter	Unit	Result	NEQs Guidelines
1.	Temperature	^{O}C	24	-
2.	Ph	--	7.2	6.5-8.5
3.	Total Dissolved Solids (TDS)	mg/l	210	100
4.	Total Suspended Solids (TSS)	mg/l	0	-
5.	Chloride	mg/l	56	250
6.	Fluoride	mg/l	0.04	1.5
7.	Taste	Object./unobject	Unobject	Unobject
8.	Odour	Object./unobject	Unobject	Unobject
9.	Colour	TCU	0	15
10.	Iron	mg/l	0.13	0.3
11.	Sodium	mg/l	35	200
12.	Nitrate (as NO_3)	mg/l	11	50

13.	Nitrite (as No_2)	mg/l	0.13	3
14.	Ammonia	mg/l	0	1.5
15.	Hydrogen Sulphide (H_2S)	mg/l	BDL	0.05
16.	Sulphate	mg/l	38	250
17.	Lead	mg/l	BDL	0.05
18.	Total Hardness as $CaCo_3$	mg/l	124	500
19.	Turbidity	NTU	0	5
20.	Zinc	mg/l	0	3
21.	Manganese	mg/l	BDL	0.1
22.	Benzene	mg/l	BDL	10-120
23.	Aluminium	mg/l	BDL	0.2
24.	Molybdenum	mg/l	BDL	0.072
25.	Chromium	mg/l	0.01	0.050
26.	Cadmium	mg/l	0.001	0.003
27.	Boron	mg/l	0.201	0.300
28.	Barium	mg/l	BDL	0.700
29.	Antimony	mg/l	BDL	0.005
30.	Arsenic	mg/l	BDL	0.010
31.	Cyanide	mg/l	BDL	0.070
32.	Mercury	mg/l	BDL	0.001
33.	Nickel	mg/l	BDL	0.020
34.	Total Coliform	Number/100ml	0	0/100ml
35.	E.Coli	Number/100ml	0	0/100ml

More than 10 additional water sampling results are attached in Appendix-C

5.3.9 Ambient Air Quality

The ambient air quality of the project area is generally good as no significant sources of pollution are present in close vicinity. The small scale activities in the closer vicinity of the project area, vehicular emissions and movement of vehicles on dirt from roads/tracks may be considered as the major sources of air pollution in the area. The main pollutants emitted by vehicle exhaust are lead, particulate matter, carbon monoxide and nitrogen oxides. These emissions generally may affect the air quality in the vicinity of the roads. However, as traffic on the roads in the project area is high during peak tourist seasons at National Highway, city roads (Swat – Kalam Road), it is unlikely that any significant air quality concerns exist for communities living close to them. Furthermore rains lead to reduced levels of particulate pollution in the area.

To develop the baseline of ambient air quality three sample (on project site for 24 hours) was also carried out during the EIA process at Powerhouse Site, disposal area & weir site. The ambient particulate matter monitoring was carried out for assessment of PM10 & PM2.5 concentrations at project site by an EPA certified Environmental Laboratory The results of sampling location were analyzed in accordance to NEQS for ambient air quality standard parameters and are provided in **Appendix E** of this report. On the basis of the results it is concluded that background air quality of the area is good.

Vehicluar traffic and small level crush units at Kalam-Asrit Hydropower plant may be a source of dust emission but activities will be well planned/designed, and every effort will be made as recommended in this EIA to alleviate the adverse impact on environment, thus not significantly deteriorating ambient air quality.

Table 5-11 Ambient Air Quality Monitoring at Weir

Parameter	Time Duration	Unit	Method	Lowest Detection Limit	Result	NEQs
PM_{10}	24 Hours	µg/m^3	Beta Gauge Measurement Method	0.5 µg/m^3	28	150
PM2.5	24 Hours	µg/m3	Beta Gauge Measurement Method	0.5 µg/m3	10	35
CO	24 Hours	µg/m3	Non Dispersive Infrared Absorption (NDIR)	0.035 ppm	2.265	10
NO2	24 Hours	µg/m3	Reduced Pressure Chemiluminescent scence	0.2 ppb	8.26	80

SO2	24 Hours	µg/m3	UV Fluorescence (UVF)	0.4 ppb	12.36	120

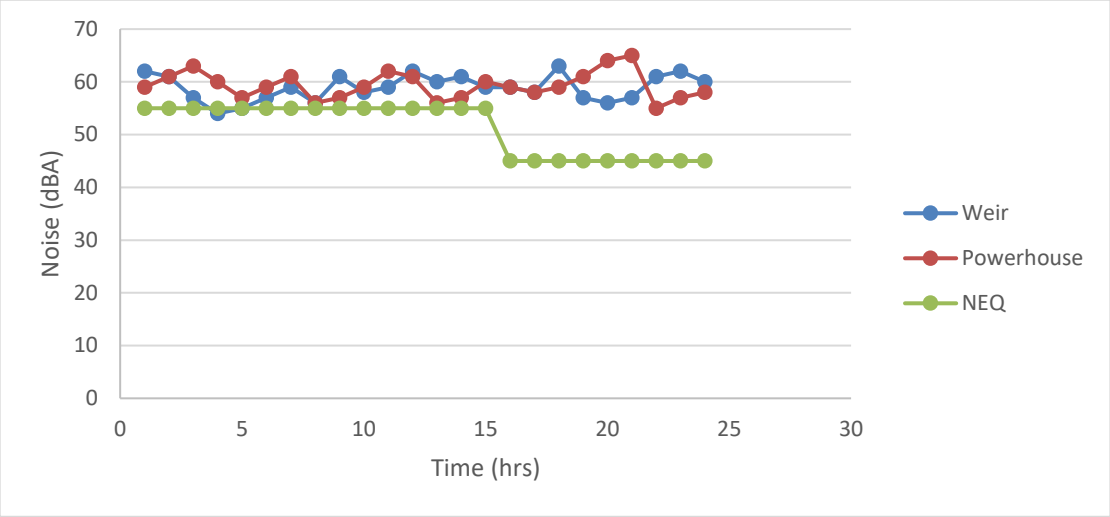
Table 5-12 Ambient Dust Monitoring at Powerhouse Site

Parameter	Time Duration	Unit	Method	Lowest Detection Limit	Result	NEQs
PM10	24 Hours	µg/m3	Beta Gauge Measurement Method	0.5 µg/m3	16	150
PM2.5	24 Hours	µg/m3	Beta Gauge Measurement Method	0.5 µg/m3	8	35
CO	24 Hours	µg/m3	Non Dispersive Infrared Absorption (NDIR)	0.035 ppm	1.65	10
NO2	24 Hours	µg/m3	Reduced Pressure Chemiluminescent scence	0.2 ppb	14.5	80
SO2	24 Hours	µg/m3	UV Fluorescence (UVF)	0.4 ppb	26.3	120

5.3.10 Noise

Traffic near the project site is consequently was moderate to high due to peak tourist season. There are no continuous major sources of noise in the project area. Intermittent sources include farm tractors, farm equipment, road traffic and other developmental activities in the nearby areas. Considering the intermittent nature of these noise sources, it can be concluded that the noise pollution in the area is low.

Figure 5-23: Noise levels at the Project Area



Ambient noise levels of the proposed project area were also monitored during the EIA baseline data establishment through Digital Sound Meter 840029 and Garmin GPS *etrex* 10 and their results are shown in the Table 5 5:. It is pertinent to mention that noise monitoring locations were randomly selected during the field visit of the project area in day time. Exact location of ambient noise sampling locations are shown in **Figure 5-23**. On the basis of the investigation it can be concluded that ambient noise level in the project area is of low level.

Table 5-13: Noise Level Monitoring Results at Powerhouse Site

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1	10:00 AM	dB(A)	59.1	63.2	61.1
2	11:00 AM		58.9	63	60.9
3	12:00 PM		58.7	62.8	60.7
4	01:00 PM		58.5	62.6	60.5
5	02:00 PM		58.2	62.3	60.2
6	03:00 PM		58	62.1	60.0
7	04:00 PM		57.8	61.9	59.8
8	05:00 PM		57.6	61.7	59.6
9	06:00 PM		54.3	59.8	57.0
10	07:00 PM		51.9	55.2	53.5
11	08:00 PM		48.7	51.6	50.1
12	09:00 PM		50.2	54.3	52.2
NEQS limit: 65 dB					

Table 5-14 Noise Level Monitoring Results at Weir Site

Sr. No.	Monitoring Time	Unit	Minimum	Maximum	Leq
1.	11:15 AM	dB(A)	60.1	62.6	61.3

2.	12:15 PM	59.9	62.4	61.1
3.	01:15 PM	59.7	62.2	60.9
4.	02:15 PM	59.5	62	60.7
5.	03:15 PM	59.3	61.7	60.5
6.	04:15 PM	59	61.5	60.2
7.	05:15 PM	58.8	61.3	60.05
8.	06:15 PM	58.6	61.1	59.8
9.	07:15 PM	58.4	60.9	59.6
10.	08:15 PM	58.2	60.7	59.4
11.	09:15 PM	58	60.4	59.2
12.	10:15PM	57.7	60.2	58.9
NEQS limit : 65 dB				

Note: All locations were randomly selected in day time within the project area.

Figure 41: Noise Sampling Locations

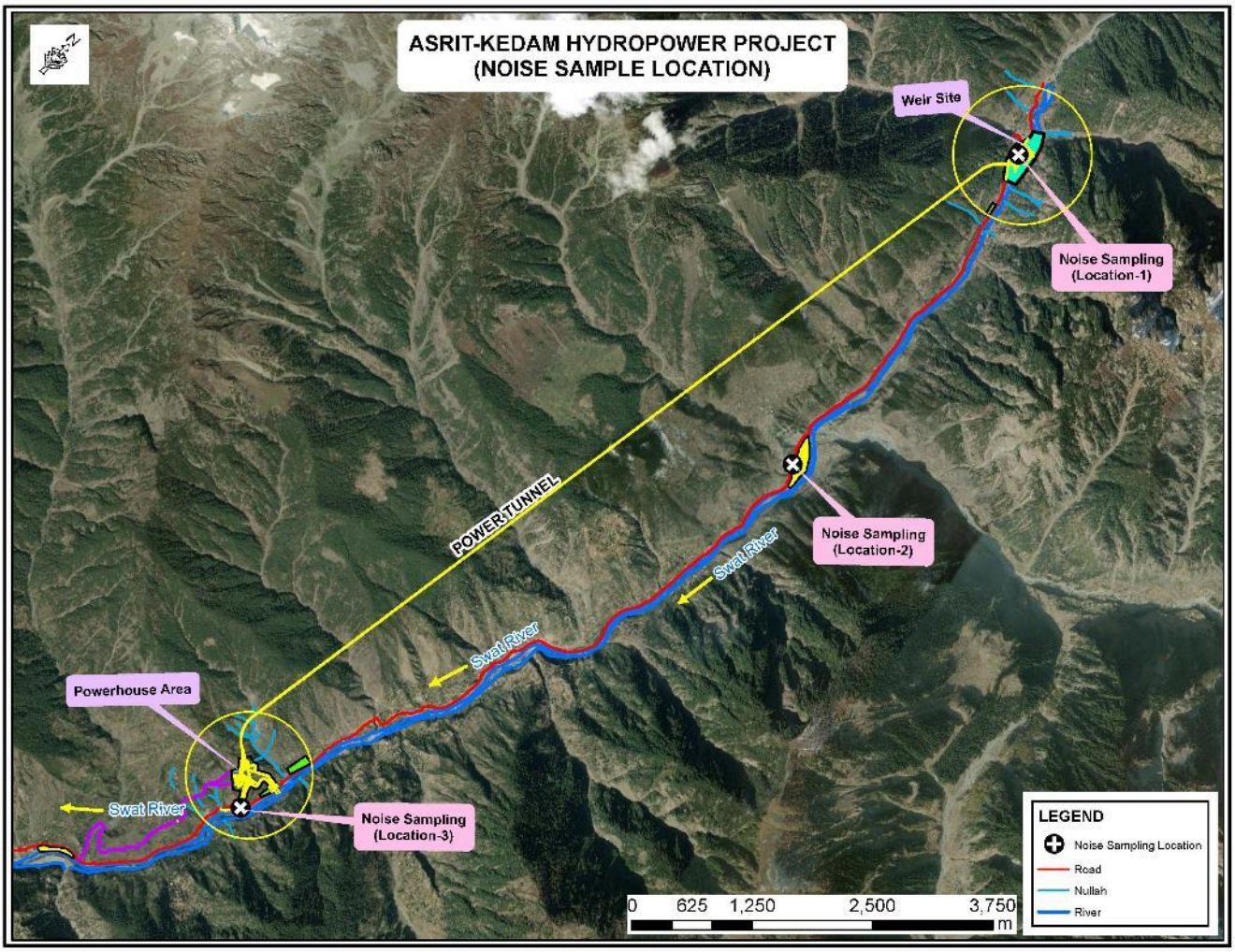


Figure 42: Air Quality Monitoring Map

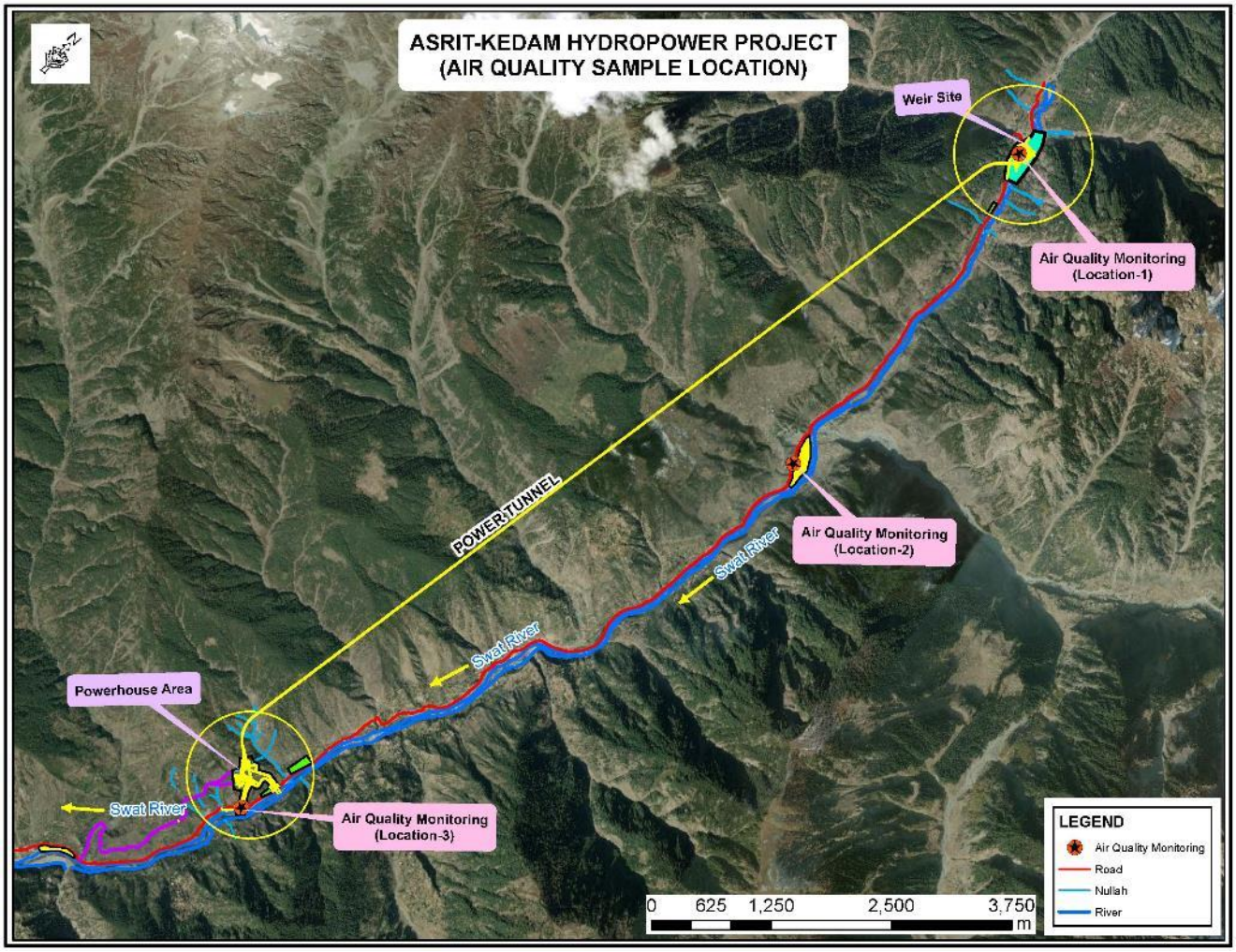
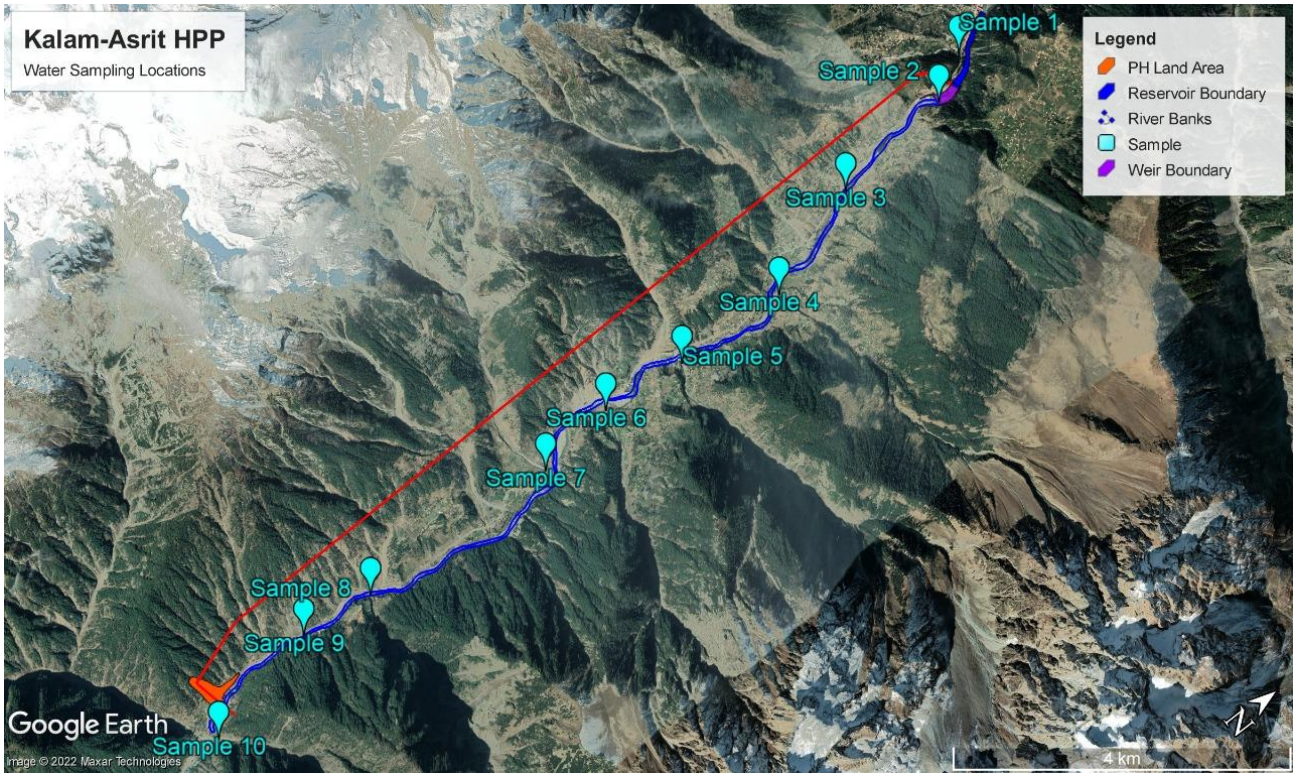


Figure 43: Water Quality Monitoring



Photographic Record: Glimpse of Physical Features in the Project Area

Photograph 5-1: A general view of Reinforcement works on N-95

Photograph 5-2: Project Proposed power house site

Photograph 5-3: A view of air quality equipment

Photograph 5-4: View of Desander Area

Photograph 5-5: View of Air quality Monitoring

Photograph 5-6: Water sample collection

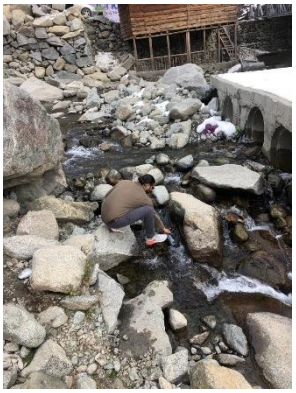
Photograph 5-7: View of sand deposits

Photograph 5-8: Ambient noise monitoring at project site

Photograph 5-9: View of C/P facilities operated along access road

Photograph 5-10: View of C/P facilities operated along access road

Photograph 5-11: View Tributaries water qualities analysis



Photograph 5-12: View Tributaries water qualities analysis

5.4 Biological Baseline Conditions

This section describes the biological environment of the project site of proposed Kalam-Asrit Hydropower Project in Swat district of KPK province.

The biological study is developed including the evaluation of vegetation and land cover classification with the field sampling of aquatic ecology, specifically fish & invertebrates. It also includes the assessment of wildlife in the region, such as large mammals, small mammals, birds, reptiles and amphibians. The field survey was carried around the project facilities to explore the status of ecological receptors on a broader spectrum.

5.4.1 Protected Areas

It is pertinent to mention that none on the declared protected areas are in the immediate vicinity of the proposed project site.

Following six areas have been declares as National Park of KPK which are far away from the Project Area and Project Area does not fall in any Protected area such as National Park, Wildlife Sanctuary or Game Reserve.

- Broghil Valley, Chitral, KPK
- Chitral Gol, Chitral, KPK
- Lulusar-Dudipatsar, Mansehra, KPK
- Manglot National Park, Nowshera, KPK
- Saiful Muluk, Mansehra, KPK
- Sheikh Badin, Dera Ismail Khan, KPK

Game reserve outside the project area include

- Bhan Valley Game Reserve (upstream -Quite away from the Weir)
- Mankial Community Game Reserve (3.5 km away from Powerhouse and 14 km away from Weir) .

5.4.2 Data Sources

This EIA is developed by using the data from both primary and secondary sources. Secondary data includes published and non-published data of the area as well as environmental assessments carried out previously in the region particularly with respect to other hydropower projects. Primary field data for current EIA was collected by a team of environmental specialist, wildlife experts and botanist in the first week of September 2020. Primary floral and faunal data was collected at different sampling locations covering representative habitats falling within the study area.

The secondary data regarding faunal species was also collected that provides a detailed insight into the biological environment of the area. These mainly include Qureshi, H., Arshad, M., & Bibi, Y. 2014, Khyber Pakhtunkhwa Biodiversity strategy & Action Plan, 2016, Kafle and Savillo 2009, Sheikh, K. M., and S. Molur. 2006, S. Rasheed, Bashir, &

Jaddon, 2020, Baig & Ahmed, 2007, Ahmad Khan 2004, Ali, A., Khattak, M. N. K., Nawaz, M. A., & Hameed, S. 2021, Shah, S. A. 2011, Choudhury 2001; Srivastava and Mohnot 2001, Ross et al. 2010, Yue et al. in press, Hearn, Ross and Macdonald unpublished data, Lorica and Heaney 2013, Grassman et al. 2005, Cheyne and Macdonald 2011, Grassman et al. 2005, Mohammad Niaz, May 4, 2009, Tehsil Disaster Management Plan TDMP, KPK, and previous environmental assessments conducted within the same or adjacent areas.

5.4.3 Methodology

The recognized survey techniques including line transect, incidental sightings and plot searches were followed for birds, ungulates, carnivores, small mammals and reptiles. Where felt necessary walking along the water courses and associated margins were also practiced for making observations using binoculars and other equipment. The survey teams ensured that the mammals, birds and other species were observed without causing any potential disturbance.

The sampling locations were randomly selected, ensuring that sufficient number of locations are used to represent each habitat type and the maximum number of species are recorded.

5.4.4 Study Team

The ecological experts team involved Dr. Anila Nisar Syed ,Ms. Mehwish (Environmental Lead), Dr. Muhammad Ali (Ecological Expert-Fisheries), Dr. Khurshid (Environmental Expert), Mr. Ahmed (International Developmental Expert), Dr. Naveed (Ecologist and Botanist), Muhammad Iftikhar (Zoologist), Mr. Mohsinullah Mohsin (Zoologist), Mr. Naeem Khan (Ecologist), Ahmar Hassan (Zoologist). 90% of ecological and environmental experts were selected for their local knowledge and developmental experience belonging to the study area.

Photographic Record: Biological Environment of Project Area

Photograph 5-13: Schizothorax plagiostomus (Snow Trout)

Photograph 5-14: Study team selecting sampling locations

Photograph 5-15: Meetings with Government Departments

Photograph 5-16: Fish sampling

Photograph 5-17: Oncorhynchus mykiss (Rainbow Trout)

Photograph 5-18: Salmo trutta fario (Brown Trout)

5.4.5 Ecological Habitats

Ecologically, the project area and AoI can be categorized into three habitats which are discussed below:

Dry Temperate Ecoregion

Ecologically, this is an important habitat. However, the proposed Hydropower project falls entirely in this habitat. in the temperate ecoregion, which mainly consists of coniferous forests that play a vital role in the economy of the area as a source of supply of timber, fuelwood, non-timber forest products (NTFPs), forage, and grazing. The main flora includes the Deodar (*Cedrus deodara*), Spruce (*Picea smithiana*), Blue Pine (*Pinus wallichiana*), and Chilghoza (*Pinus gerardiana*), *Quercus ilex, Acer caesium, Fraxinus xynthxoloides, Quercu incana* (Bunch), and *Quercus dilatata* (Zarine).

Project has areas of dry alpine and moist temperate forests coniferous forest ecosystem. About 12 bird species were noticed in this habitat, which included House Sparrow, House Crow, Raven, Chukar Partridge, Red-vented Bulbul and few other commonly observed bird species. However, majority of the species reported from the area are migrant and they are either Winter Migrant from higher elevations or Summer Migrants from lower elevations while few species are resident in the area.

Small Mammals which were found in this habitat include House Mouse, Indian Rat, Gerbil, Marmot, Squirrel, and Civet.

Common Leopard, Rhesus Macaque, Indian Crested Porcupine, Asiatic Jackal, Red Fox, Stone Marten, Yellow Throated Marten, Leopard Cat, Indian Giant Flying Squirrel, Masked Palm Civet, Indian Pika and Cape hare are the mammalian species present in the area.

There are conservation concern species which are confined to the upper reaches of the Swat Valley and slightly descend downward in Winter.

River Swat, Irrigation Network, Associate Margins & Water impoundments

The most important habitat of the project area is water impoundments and small irrigation channels, associated margins and locally termed as Nalai. The common and productive land use in the project area is agriculture, supported by a network of KPK irrigation canals. However, the project site has been observed and tested to be productive in nature. Water gather and develop during the rainy season in low laying areas along the roads, water courses and other depressions. These temporary marshes are wintering grounds for migratory birds in peak winter season. Marshes on banks of water courses are usually inundated during monsoon season.

Swat River serves as a permanent fisheries source throughout the year. Main fish fauna of these areas is represented by indigenous snow trout fishes (subfamily Schizothoracinae), and exotic trout species viz., Brown Trout (*Salmo trutta fario*) and Rainbow Trout (*Oncorhynchus mykiss*).

The abundance of different invertebrates, including insects and different palatable floral species make up the source of food for resident and migratory birds, making this habitat rich and important. This type of habitat has dense growth of hydrophytic plants.

The main floral species observed in this habitat includes *Cedrus deodara, Populas alba, Juglans regia, Malus sylvestris*, *Prunus avium,* and *Prunus armeniaca.* The Swat River and other water bodies around the mountainous areas (dhands) are habitat for mainly wintering water birds which pass through these areas. During the field visit of the project area, a few resident birds species were recorded along the river swat and associated margins.

Aquatic Habitat

River Swat originates in the Hindukush Mountains from where it is fed by the glacial waters throughout the year.

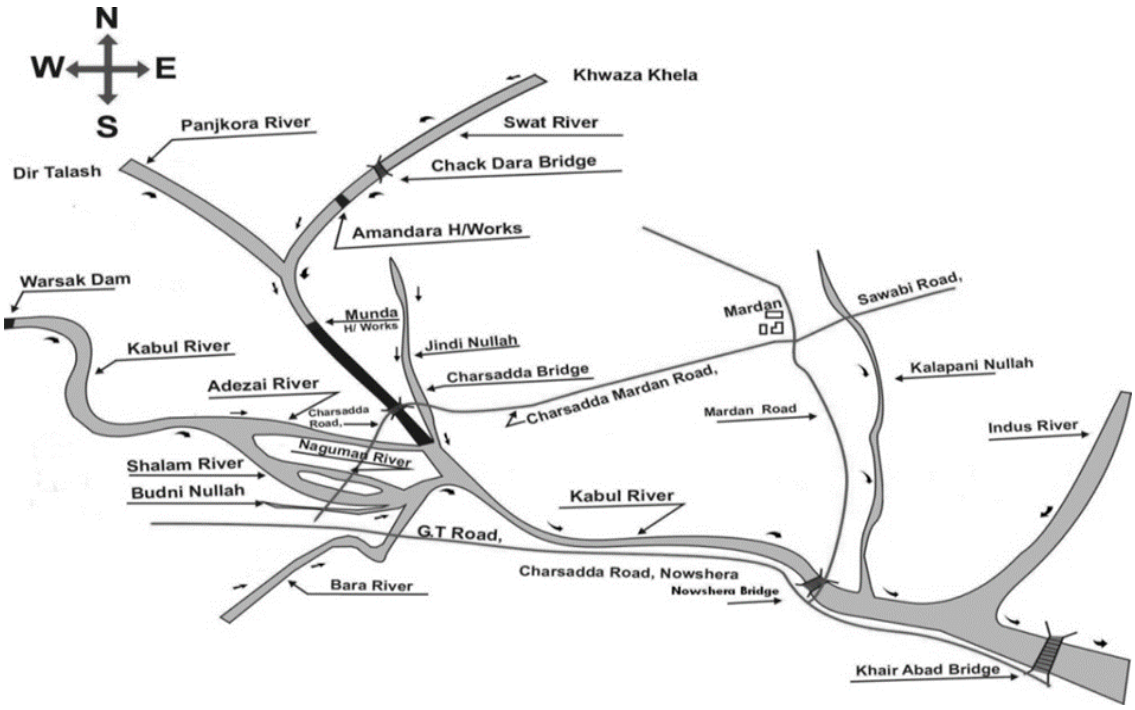


Figure 44 Map showing River Swat

The Gabral and Usho Rivers joins at Kalam making River Swat. Gabral River is formed by the Daral and Gabral Khwar as the right and left major tributaries, while Usho River is formed by the confluence of Usho and Bashingram Khwar as the major tributaries. River Swat flows through Kalam Valley with a high speed up to Madyan between two hills mostly in a gorge, receiving tributaries at Garnaye, Asrit, Kedam, Mankiyal, Daral, Chum ghari, while in lower plain areas of Swat the speeds slow down till it reaches Chackdara district Lower Dir covering a distance of about 160 km. In the way the main river receives tributaries at Madyan, Matta, Khwazakhela, Kabal, Mingora and Chackdara. In South the River again gets narrow and flows in a gorge where it joins River Panjkora at Qulangi Lower Dir and finally joins River Kabul at Nisatta near Charsadda after covering a distance of 240 km downstream. River Swat is diverted near Batkhela for irrigation and power generation purposes. The Upper Swat canal flows under Malakand hills through Benton Tunnel. In Dargai, the upper canal is divided into two branches, supplying Charsadda, Swabi and Mardan before it is used for hydropower generation at Jabban and Dargai Power Stations.

Flow Seasons

The River Swat has two flow seasons i.e., low flow season in the months of October to February and high flow season starting in the month of March and continue up to

September. Thus, the River has about 7 months high flow and 5 months low flow season. At the onset of summer, snowmelt starts therefore the water volume raises in the river. Moon Soon rains have also their role in high flow.

Natural and Modified Habitats

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

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

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

Habitat Dteremination for Aquatic and Terrestrial Habitat:

Keeping in mind the level of habitat degradation in the area caused by agricultural activities, high tourist flux and construction of many small hydropower projects, the aquatic as well as terrestrial habitat present in the Project area is classified as "modified habitats".

5.5 Flora

Generally, for forest inventory the sample plots showing characteristics of the whole forest, are selected and measurements are made on the sample plots. Plots were selected randomly on the project sites and all the trees of selected areas are considered for volume measurement. The tree height and diameter of all the trees of selected area are measured. The diameter of forest trees is measured in cm at 1.3 m (4½ feet) above the ground and is termed the "Diameter at Breast Height" (DBH). Because trees are measured with the bark and is also called the Diameter at Breast Height Over Bark (DBHOB). When measuring live trees most information is presented as over-bark dimensions.

This following formula converts the diameter in cm to the basal area in m^2.

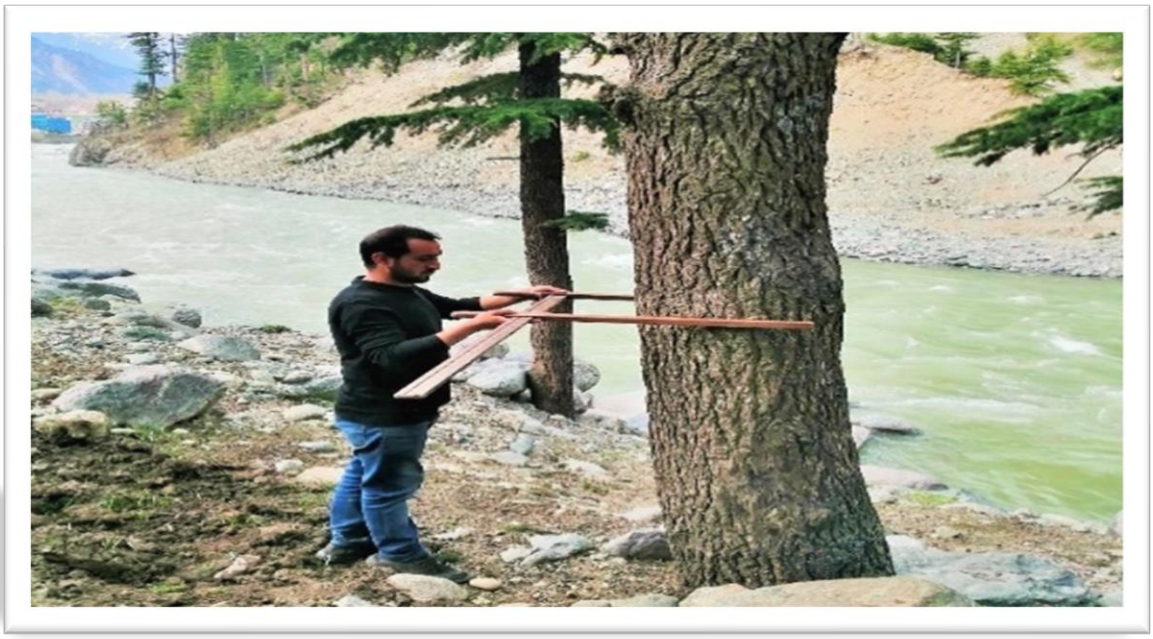
Tree Basal Area (TBA) = (DBH/200)2 x 3.142 m^2

Total tree volume: Using a measure of DBH and Height an estimation of total tree volume can be made by assuming the tree has a particular form: For example, if we assume the tree is cylindrical in shape then the following formula is appropriate:

Tree volume (m^3) = (DBH/200)2 x 3.142 x Ht (or) TBA x Ht

1 1

- Height=AB (tan α + tan ß)
- AB=Distance from observer to the tree tan α =angle of elevation
- tan ß=angle of depression



5.5.1 Tree Volume

Table 5-15: Volume of Trees in Project Area

Biological Name	Diameter (cm)	Basal Area (m2)	Avg. Height (ft)	Height (m)	Volume (m3)
Weir Site (Right Bank)					
Cedrus deodara	13	0.0133	57.31	17.47271341	0.231802
Cedrus deodara	14.3	0.0161	63.04	19.21998476	0.308528
Cedrus deodara	10.3	0.0083	45.41	13.84376524	0.115292
Cedrus deodara	17	0.0227	74.94	22.84893293	0.518362
Cedrus deodara	12.6	0.0125	55.55	16.93509146	0.211056
Cedrus deodara	11.3	0.0100	49.82	15.18782012	0.152238

Cedrus deodara	12.3	0.0119	54.22	16.531875	0.196337
Cedrus deodara	15.4	0.0186	67.89	20.69844512	0.385344
Cedrus deodara	12.2	0.0117	53.78	16.39746951	0.191587
Cedrus deodara	17	0.0227	74.94	22.84893293	0.518362
Cedrus deodara	12.5	0.0123	55.11	16.80068598	0.206071
Cedrus deodara	16.6	0.0216	73.18	22.31131098	0.482626
Cedrus deodara	16.5	0.0214	72.74	22.17690549	0.473957
Cedrus deodara	13.7	0.0147	60.40	18.41355183	0.271299
Cedrus deodara	11	0.0095	48.49	14.78460366	0.140432
Cedrus deodara	21	0.0346	92.58	28.22515244	0.977112
Cedrus deodara	11.3	0.0100	49.82	15.18782012	0.152238
Cedrus deodara	11	0.0095	48.49	14.78460366	0.140432
Cedrus deodara	18.5	0.0269	81.56	24.86501524	0.668039
Cedrus deodara	14.5	0.0165	63.92	19.48879573	0.321655
Cedrus deodara	10	0.0079	44.09	13.44054878	0.105508
Cedrus deodara	9	0.0064	39.68	12.0964939	0.076916
Cedrus deodara	21	0.0346	92.58	28.22515244	0.977112
Cedrus deodara	8.23	0.0053	36.28	11.06157165	0.058815
Cedrus deodara	9	0.0064	39.68	12.0964939	0.076916

Cedrus deodara	13	0.0133	57.31	17.47271341	0.231802
Cedrus deodara	11.5	0.0104	50.70	15.4566311	0.160465
Cedrus deodara	21	0.0346	92.58	28.22515244	0.977112
Cedrus deodara	16	0.0201	70.54	21.50487805	0.432162
Cedrus deodara	10.5	0.0087	46.29	14.11257622	0.122139
Cedrus deodara	12.5	0.0123	55.11	16.80068598	0.206071
Cedrus deodara	17	0.0227	74.94	22.84893293	0.518362
Cedrus deodara	11.5	0.0104	50.70	15.4566311	0.160465
Cedrus deodara	11	0.0095	48.49	14.78460366	0.140432
Cedrus deodara	8.5	0.0057	37.47	11.42446646	0.064795
Cedrus deodara	9.6	0.0072	42.32	12.90292683	0.093347
Cedrus deodara	10.7	0.0090	47.17	14.3813872	0.129252
Cedrus deodara	16.5	0.0214	72.74	22.17690549	0.473957
Cedrus deodara	22	0.0380	96.99	29.56920732	1.123452
Cedrus deodara	11.5	0.0104	50.70	15.4566311	0.160465
Cedrus deodara	11	0.0095	48.49	14.78460366	0.140432
Cedrus deodara	16	0.0201	70.54	21.50487805	0.432162
Cedrus deodara	10.5	0.0087	46.29	14.11257622	0.122139
Cedrus deodara	18	0.0254	79.35	24.1929878	0.615324

Cedrus deodara	8	0.0050	35.27	10.75243902	0.05402
Cedrus deodara	15	0.0177	66.13	20.16082317	0.356091
Cedrus deodara	17.5	0.0240	77.15	23.52096037	0.565459
Cedrus deodara	17	0.0227	74.94	22.84893293	0.518362
Cedrus deodara	13	0.0133	57.31	17.47271341	0.231802
Cedrus deodara	18.5	0.0269	81.56	24.86501524	0.668039
Cedrus deodara	20	0.0314	88.17	26.88109756	0.844066
Cedrus deodara	4	0.0013	17.63	5.376219512	0.006753
Cedrus deodara	5.5	0.0024	24.25	7.392301829	0.017554
Cedrus deodara	16	0.0201	70.54	21.50487805	0.432162
Cedrus deodara	12	0.0113	52.90	16.12865854	0.182318
Cedrus deodara	15	0.0177	66.13	20.16082317	0.356091
Cedrus deodara	11	0.0095	48.49	14.78460366	0.140432
Cedrus deodara	9	0.0064	39.68	12.0964939	0.076916
Cedrus deodara	12	0.0113	52.90	16.12865854	0.182318
Cedrus deodara	9	0.0064	39.68	12.0964939	0.076916
Cedrus deodara	10	0.0079	44.09	13.44054878	0.105508
Cedrus deodara	7	0.0038	30.86	9.408384146	0.036189

Weir (Left Bank)

Cedrus deodara	8.5	0.005671625	37.4	11.402	0.064670358
Cedrus deodara	3.5	0.000961625	15.4	4.695	0.004514947
Cedrus deodara	4	0.001256	17.6	5.366	0.006739512
Cedrus deodara	13	0.0132665	57.2	17.439	0.231354817
Cedrus deodara	3	0.0007065	13.2	4.024	0.002843232
Cedrus deodara	5	0.0019625	22	6.707	0.01316311
Cedrus deodara	5	0.0019625	22	6.707	0.01316311
Cedrus deodara	7	0.0038465	30.8	9.390	0.036119573
Cedrus deodara	5	0.0019625	22	6.707	0.01316311
Cedrus deodara	5	0.0019625	22	6.707	0.01316311
Cedrus deodara	4	0.001256	17.6	5.366	0.006739512
Cedrus deodara	3	0.0007065	13.2	4.024	0.002843232
Cedrus deodara	25	0.0490625	110	33.537	1.64538872
Cedrus deodara	2	0.000314	8.8	2.683	0.000842439
Cedrus deodara	2	0.000314	8.8	2.683	0.000842439
Cedrus deodara	13	0.0132665	57.2	17.439	0.231354817
Cedrus deodara	5	0.0019625	22	6.707	0.01316311
Cedrus deodara	4.5	0.001589625	19.8	6.037	0.009595907
Cedrus deodara	5.5	0.002374625	24.2	7.378	0.017520099

Cedrus deodara	5	0.0019625	22	6.707	0.01316311
Cedrus deodara	2.5	0.000490625	11	3.354	0.001645389
Cedrus deodara	3	0.0007065	13.2	4.024	0.002843232
Cedrus deodara	2.5	0.000490625	11	3.354	0.001645389
Cedrus deodara	2.5	0.000490625	11	3.354	0.001645389
Cedrus deodara	3	0.0007065	13.2	4.024	0.002843232
Cedrus deodara	9	0.0063585	39.6	12.073	0.076767256
Cedrus deodara	2.5	0.000490625	11	3.354	0.001645389
Cedrus deodara	19	0.0283385	83.6	25.488	0.722286159
Cedrus deodara	7	0.0038465	30.8	9.390	0.036119573
Cedrus deodara	8	0.005024	35.2	10.732	0.053916098
Cedrus deodara	5.5	0.002374625	24.2	7.378	0.017520099
Cedrus deodara	5	0.0019625	22	6.707	0.01316311
Cedrus deodara	3.5	0.000961625	15.4	4.695	0.004514947
Cedrus deodara	4	0.001256	17.6	5.366	0.006739512
Cedrus deodara	3.5	0.000961625	15.4	4.695	0.004514947
Cedrus deodara	6	0.002826	26.4	8.049	0.022745854
Cedrus deodara	5.5	0.002374625	24.2	7.378	0.017520099
Cedrus deodara	28	0.061544	123.2	37.561	2.311652683

Cedrus deodara	3	0.0007065	13.2	4.024	0.002843232
Cedrus deodara	14	0.015386	61.6	18.780	0.288956585
Cedrus deodara	3	0.0007065	13.2	4.024	0.002843232
Cedrus deodara	2	0.000314	8.8	2.683	0.000842439
Cedrus deodara	2	0.000314	8.8	2.683	0.000842439
Cedrus deodara	8	0.005024	35.2	10.732	0
Powerhouse					
Cedrus deodara	269.24	5.6905	82.8	25.24	143.65
Cedrus deodara	215.54	3.6469	87.26	26.60	97.02
Cedrus deodara	195.58	3.0027	98.25	29.95	89.95
Cedrus deodara	274.32	5.9072	106	32.32	190.90
Cedrus deodara	233.68	4.2866	91	27.74	118.93
Cedrus deodara	142.24	1.5882	62.5	19.05	30.26
Cedrus deodara	99.06	0.7703	46.3	14.12	10.87
Cedrus deodara	96.52	0.7313	53.7	16.37	11.97
Cedrus deodara	124.5	1.2168	51.24	15.62	19.01
Cedrus deodara	99.06	0.7703	36.1	11.01	8.48
Cedrus deodara	144.78	1.6455	72	21.95	36.12
Cedrus deodara	348	9.5067	254	77.44	736.19

Cedrus deodara	287.1	6.4705	165	50.30	325.50
Cedrus deodara	284.5	6.3538	105.7	32.23	204.76
Cedrus deodara	98	0.7539	78	23.78	17.93
Cedrus deodara	92	0.6644	65	19.82	13.17
Cedrus deodara	87	0.5942	71	21.65	12.86
Cedrus deodara	104	0.8491	112	34.15	28.99
Cedrus deodara	115	1.0382	97	29.57	30.70
Cedrus deodara	76	0.4534	72	21.95	9.95
Cedrus deodara	82	0.5278	56	17.07	9.01

The proposed project sites in Kalam comes under the compartment of Bahrain-North Forest Subdivision, which is a part of administrative infrastructure of Kalam Forest division. The reservoir site of the project covers the Kalam area, whereas at the lower part of the project where the main powerhouse is to be made is located in the Village Asrit, Bahrain.

The Study Area has a vast diversity of floral species. Ecologist and Botanist (Dr. Naveed) carried out the field survey for primary data collection in the project area. Sampling locations were selected at random intervals in the project area covering all types of existing habitats in order to identify maximum number of species. During field work for EIA, more than 40 plant species were identified within the project area.

No endemic or rare plant species were recorded during the site visit. All species have a wide range of distribution in other ecological zones of country, especially at other locations of KPK province in general and in similar habitats of Swat district in particular.

Table 5-16 provides the complete list of floral species with their known local names, family name and life form.

Table 5-16: List of Floral Species Observed/ Reported in the Project Area

	Plant Species	**Local Name**	**Family**	**Growth Form**
	Aerva javanica	*Booh*	*Amrarantaceae*	*Plant*

	Acacia nilotica	*Bubbar*	*Mimosaceae*	*Medicinal Plant*
	Alhaji maurorum	*Kandero*	*Fabaceae*	*Plant*
	Azolla pinnata	*Nagin wal*	*Salviniaceae*	*Plant*
	Aristida adscensionis	*Lumb gaah*	*Poaceae*	*Plant*
	Albizzia lebbek	*Sirin*	*Mimosaceae*	*Plant*
	Avena sativa	*Jawar*	*Poaceae*	*Plant*
	Brassica campestris	*Sarson*	*Brassicaceae*	*Plant*
	Calatropis procera	*Ak*	*Asclepdaceae*	*Plant*
	Capparis decidua	*Kirar*	*Capparidaceae*	*Plant*
	Cenchrus biflorus	*-*	*Poaceae*	*Plant*
	Cenchrus setigerus	*Mohabbat booti*	*Poaceae*	*Plant*
	Cleome brachycarpa	*Waho*	*Capparidaceae*	*Plant*
	Cressa crevice	*Oin*	*Convolvulaceae*	*Plant*
	Convolvulus arvensis	*Naro*	*Convolculaceae*	*Plant*
	Cocas nucifera	*Naryal*	*Palmae*	*Plant*
	Conocarpus lanceolatus	*Conocarpus*	*Combretaceae*	*Plant*
	Conocarpus lancifolius	*Conocarpus*	*Combretaceae*	*Plant*
	Crotalaria burhia	*-*	*Fabaceae*	*Plant*
	Cymbopogon jawarancusa	*Poi*	*Poaceae*	*Plant*
	Cynodon dactylon	*Doob gah*	*Poaceae*	*Medicinal Plant*
	Dactyloctenium aegyptium	*-*	*Poaceae*	*Plant*
	Eichornia carripes	*Nagin wal*	*Pontederiaceae*	*Plant*
	Eucalyptus citriodora	*Baid mushq*	*Myrtaceae*	*Plant*
	Heliotropium crispium	*Kharsun*	*Boraginaceae*	*Plant*

	Heliotropium europeum	*Kharsun*	*Boraginaceae*	*Plant*
	Indigofera cordifolia	*Boseri*	*Fabaceae*	*Plant*
	Ipomoea aquatica	*Jal khumbi*	*Convolvulaceae*	*Plant*
	Abies pindrow	*Chokar/Char*	*Least Concern*	*Plant*
	Achillea millefolium	*Kingha*	*Least Concern*	*Plant*
	Acorus calamus	*Skhawaja*	*Least Concern*	*Plant*
	Adiantum incisum	*Sumbal*	*Not Evaluated*	*Plant*
	Adiantum venustum	*Sumbal*	*Not Evaluated*	*Plant*
	Aesculus indica	*Jawaz*	*Not Evaluated*	*Plant*
	Ajuga bracteosa	*Panrkash*	*Not Evaluated*	*Plant*
	Berberis lycium	*Khawaray*	*Not Evaluated*	*Plant*
	Berberis vulgaris	*Kwarray*	*Least Concern*	*Medicinal Plant*
	Bergenia ciliata	*Barmia*	*Not Evaluated*	*Plant*
	Betula utilis	*Birch*	*Least Concern*	*Plant*
	Boerhavia diffusa	*Bashkhera*	*Not Evaluated*	*Plant*
	Calendula arvensis	*Charkeet*	*Not Evaluated*	*Plant*
	Caltha alba	*Makhan Path*	*Not Evaluated*	*Plant*
	Cedrela serrata	*Meem*	*Least Concern*	*Plant*
	Cedrus deodara	*Diyar*	*Least Concern*	*Plant*
	Chenopodium album	*Udharam*	*Least Concern*	*Plant*
	Chenopodium botrys	*Harawa*	*Not Evaluated*	*Plant*

	Chladophora crispata	*Jaloos*	*Not Evaluated*	*Plant*
	Cichorum intybus	*Haspa bootay*	*Not Evaluated*	*Plant*
	Clamatis gouriana	*Zealai*	*Not Evaluated*	*Plant*
	Coccinia grandis	*Kanduri*	*Not Evaluated*	*Plant*
	Colchicum luteum	*SuranjanTalkh*	*Not Evaluated*	*Plant*
	Convolvulus arvensis	*Sahargul*	*Not Evaluated*	*Plant*
	Conyza canadensis	*Malooch*	*Not Evaluated*	*Plant*
	Cuscuta reflexa	*Aamool*	*Not Evaluated*	*Plant*
	Cymbopogon stracheyi	*Raizada*	*Not Evaluated*	*Plant*
	Cynodon dactylon	*Kabal*	*Not Evaluated*	*Plant*
	Daphne mucronata	*Laighonai*	*Not Evaluated*	*Plant*
	Delphinium denudatum	*Ghojab*	*Not Evaluated*	*Plant*
	Dicanthium annulatum	*Wakha*	*Not Evaluated*	*Plant*
	Fumaria indica	*Papra*	*Not Evaluated*	*Plant*
	Geranium wallichianum	*Rattan Jook*	*Not Evaluated*	*Plant*
	Hypericum perforatum	*Shna Chai*	*Least Concern*	*Plant*
	Indigofera heterantha	*Ghoureja*	*Not Evaluated*	*Plant*
	Juniperus communis	*Juniper*	*Least Concern*	*Plant*
	Mentha longifolia	*Villanay*	*Least Concern*	*Medicinal Plant*
	Mentha spicata	*Podina*	*Least Concern*	*Plant*
	Olea ferruginea	*Khona*	*Least Concern*	*Plant*

	Bistorta amplexicaule	*Anjabar*	*Least Concern*	*Plant*
	Pinus wallichiana	*Peeuch*	*Least Concern*	*Plant*
	Podophyllum emodi	*Banasher*	*Least Concern*	*Plant*
	Polygonum barbatum	*Palpulak*	*Not Evaluated*	*Plant*
	Primula denticulata	*Zangali Surma*	*Not Evaluated*	*Plant*
	Ranunculus muricatus	*Ghat Ziargulay*	*Not Evaluated*	*Plant*
	Rosa webbiana	*Palwari*	*Not Evaluated*	*Plant*
	Salix tetrasperma	*Wala*	*Not Evaluated*	*Plant*
	Salvia lanata	*Mattar jarrai*	*Not Evaluated*	*Plant*
	Viburnum cotinifolium	*Kasarbotay*	*Not Evaluated*	*Plant*
	Withania somnifera	*Dunal*	*Not Evaluated*	*Plant*
	Xanthium strumarium	*Geskay*	*Not Evaluated*	*Plant*

Photographic Record: Biological Environment of the Project Area

Photograph 5-19: *Forest around Asrit*

Photograph 5-20: *Adiantum incisum*

Photograph 5-21: *Juniperus communis*

Photograph 5-22: *Adiantum incisum*

Photograph 5-23:*:: Juniperus communis*

5.5.2 Critical Habitat Assessment

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

Critical habitat is an area that has high biodiversity value and may include sites that are legally protected or officially proposed for protection and of high biodiversity value, including

(a) habitat of significant importance to critically endangered and/or endangered species;

(b) habitat of significant importance to endemic and/or restricted-range species;

(c) habitat supporting globally significant concentrations of migratory species and/or congregatory species

(d) highly threatened and/or unique ecosystems; and/

(e) areas associated with key evolutionary processes.

Following procedure is adopted for the critical habitat assessment:

- Prepare a list of candidate species according to IFC PS6 criteria to include in the assessment
- Use of PS6 criterias for screening of species of special concern
- Identify and define the overall area of analysis
- Obtain or calculate the global extent of occurrence (EOO), area of occupancy (AOO), population size and/or number of known sites for candidate species
- For critically endangered, endangered and vulnerable species that are wide-ranging and/or whose population distribution is not well understood, an assessment of the importance of the broader landscape based on literature review and professional judgment
- Calculate the proportion of the global or national EOO, AOO and/or population represented by these results

Ecologically Appropriate Area of Analysis:

The project identified an ecologically appropriate area of analysis to determine the presence of critical habitat for each species with regular occurrence in the project's area of influence, or ecosystem, covered by IFC PS6 criterias. The client defined the boundaries of this area taking into account the distribution of species or ecosystems (within and sometimes extending beyond the project's area of influence) and the ecological patterns, processes, features, and functions that are necessary for maintaining them. These boundaries included catchments, large rivers, or geological features. The client used this area of analysis to assess applicability of the critical habitat criteria and thresholds to determine critical habitat for the species and/or ecosystems concerned.

Critical habitats boundaries should be equivalent in scale to areas mapped for practical site-based conservation management activities. For some wide-ranging species, critical habitat may be informed by areas of aggregation, recruitment, or other specific habitat features of importance to the species. In all cases, the critical habitat should consider the distribution and connectivity of such features in the landscape/seascape and the ecological processes that support them. Where it can be shown that multiple values have largely overlapping ecological requirements and distributions, a common or aggregated area of critical habitat may be appropriate. The final area(s) of critical habitat against which project impacts will be assessed should be revised based on additional knowledge documented through field work and other assessment after the initial critical habitat assessment has been conducted.

Based on this definition, the area of analysis delimitated for this Project encompass the 1-kilometer buffer on each sides of the stretch of the Swat River from Kalam to Asrit Village including the terrestrial as well as aquatic habitat. The total area covered by the area of analysis becomes around 12 km length.

Threshold values of the Criterias Applied for Critical habitat Assessment

5.5.2.1.1 Criterion 1: Critically Endangered and Endangered Species;

- Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species).
- Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR.
- As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species.

5.5.2.1.2 Criterion 2: Endemic and Restricted-range Species:

Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a restricted range species (For terrestrial vertebrates and plants, restricted-range species are defined as those species that have an Extent of Occurrence (EOO) less than 50,000 square kilometers (km2 and for riverine species restricted range is defined as having a global range of less than or equal to 500 km linear geographic span between occupied locations).

5.5.2.1.3 Criterion 3: Migratory and Congregatory Species:

a) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle.

b) Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.

5.5.2.1.4 Criterion 4: Highly Threatened or Unique Ecosystems

a) Areas representing ≥5% of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN.

b) Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.

5.5.2.1.5 Criterion 5: Key Evolutionary Processes

There are no numerical thresholds for Criteria 5. Best available information and expert opinion is used to guide decision-making with respect to the relative "criticality" of a habitat in this case.

5.5.3 Species of Consideration in Area of Analysis for Critical Habitat Assessment:

There are around 7 species of mammals, 12 species of birds, 3 species of, 4 species of fishes and 40 species of plants belonging to 24 families reported from the area however basing on IUCN Red list, following specie are of special concern:

However ecologically appropriate area of analysis does not meet any of the following criterias qualifying for critical habitat and hence no Critical Habitat is triggered. The Project does not fulfill any of PS6 criterias.

- Habitat of significance importance to globally or nationally critically endangered or endangered species
- Habitat of significance importance to endemic and/or restricted-range species
- Habitat supporting globally significant concentrations of migratory and/or congregatory species
- Highly threatened and/or unique ecosystems
- Areas associated with key evolutionary processes

The Project does not fulfill any of these characteristics.

5.5.4 Conclusions

This section provides a summary of the aquatic and terrestrial ecological resources in the Study Area which may be of concern from Project related impacts.

- None of the terrestrial plant species reported from the study area or surroundings are globally/nationally threatened species, or protected species. However, the plant species observed at the Project Site has commercial and medicinal value and locals are dependent on these plant species along with the fruit trees present on private land. No alien or invasive plant species was observed at the Project site, so it is important that Project activities take preventative measures to avoid spread of invasive species.
- A total of six large mammalian and seven small mammalian species were observed from Project area but none of them were important from the conservation point of view. Several mammalian species of conservation importance have been reported from the wider area around the Project but not specifically from the project area. These species are restricted to high elevation alpine pastures and sub-alpine region so these species will have no impact from the Project activities.
- Of the bird species reported from the Study Area, none are of conservation importance. However, these birds are likely to face minor disturbances during the Project construction phase. It is important to ensure that Project staff and consultants do not engage in illegal hunting of the birds. Additionally, during operational phases, the T&D network will have marginal effects on the migration phenomenon.
- Of the herpetofauna species reported from the Study Area, none are endemic or included in the IUCN Red List. Project construction is likely to have a short-term impact on individual receptors and the basin wide impacts of the Project on herpetofauna is likely to be minor.

- There is no Critical Habitat in the Project site and vicinity, and both the aquatic and terrestrial habitats are considered as modified habitats.
- Of the herpetofauna species reported from the Study Area, none are endemic or included in the IUCN Red List. Project construction is likely to have a short-term impact on individual receptors but the basin wide impacts of the Project on herpetofauna is likely to be minor.
- There is no Critical Habitat in the Project site and vicinity and also both the aquatic and terrestrial habitats are considered as modified habitats.

Photographic Record: Biological Environment of the Project Area

Photograph 5-24: Study team analyzing breeding areas of fisheries

Photograph 5-25: View of aquatic sample collection

Photograph 5-26: Forest around Asrit

Photograph 5-27: Adiantum incisum

Photograph 5-28: Crow

Photograph 5-29: Crow Corvus splendens

Photograph 5-30: House Sparrow Passer domestics

Fauna

5.5.5 Aquatic Fauna (Fish)

Main fish fauna of the area is represented by indigenous snow trout fishes (subfamily Schizothoracinae such as *Schizothorax plagiostomus*), exotic trout species viz., Brown Trout (*Salmo trutta fario*) and Rainbow trout (*Oncorhynchus mykiss*).

5.5.5.1 Data Collection for Fish

Fish were caught by using hand net, rod and small gill nets by the help of local anglers during dusk and dawn times. Three fish species of commercial importance are found in the Swat River between Kalam & Asrit. These species are exotic Brown Trout (*Salmo trutta fario*), Rainbow Trout (*Onchorhynchus mykiss*) and the indigenous Snow Trout (*Schizothorax plagiostomus*).

During the fish surveys for total catch of the Brown Trout was estimated to be 50%, Rainbow Trout 3-5% and that of Snow Trout was 45%. The data was matched with the data collected by local angler Jahangir Khan of the Bahrain, Swat. According to Fisheries Department KPK and local anglers the Rainbow Trout is not much successful in open waters such as river and streams, that is why its numbers are less in the river. They either die or is preyed upon by the Brown Trout. The Brown Trout and Rainbow Trout are raised artificially in government fish hatchery in winter months starting from November to start of March and after the finger size is obtained then they are released to the Swat River. On the other hand, the Snow Trout is a natural breeder in the river and breeds in the summer season in the months of June to August. All these three species share almost identical habitat for feeding. All three species require almost same breeding physicochemical requirements except difference in spawning seasons.

The fish fauna in this area is threatened by unregulated fishing methods employed for fishing by locals (Kafle and Savillo 2009). Based on the field works and secondary data reviews, the main fish fauna found is followings:

Table 5-17: Fish in the Project Area

Biological Name of Fish	Local Name	Status
Salmo trutta	Brown Trout	Least Concern
Oncorhynchus mykiss	Rainbow Trout	Not Evaluated
Schizothorax plagiostomus	Snow Trout	Not Evaluated

5.5.5.2 Brown Trout (Salmo trutta fario)

The Brown Trout is an abundant fish of the upper reaches of the River Swat, where it shares about 90 percent of the total catch while its abundance start decreasing while moving in lower reaches. It is highly liked in the local market and has highest price in comparison to all other market fishes. Per kg price is about Rs. 2000 to 3000.

Brown Trout was introduced in Swat in about 1960 during the era of Miangual Aurangzeb the former ruler of Swat. A fish hatchery was established at Madyan Swat for its artificial breeding. The seed used to be stocked in the main river from this hatchery. The fish becomes adult after two years and breeds in natural waters. In hatcheries, it can be successfully made to spawn by stripping.

5.5.5.2.1 Habitat and Ecology

The fish is found above 3000 ft high altitudes where the water temperature seldom rises above 10 degree celsius. Such streams are with highly oxygenated and have clean water.

5.5.5.2.2 Breeding

The fish becomes sexually mature within two years when the size is about 8 inches. The breeding season starts from November, December up to February. The female lays up to 1500 eggs in one episode depending on the size of the female. Eggs are laid in slow running streams naturally by making a pit in bottom gravel bed. Males fertilize the eggs with semen or milt and hide the eggs with gravel and sand. Eggs hatch in 40 to 70 days. Low water currents of 0.5- 1.5 m/sec, pH 7.5, dissolved oxygen concentration of 8-12 ppm and gravel sizes of 50-60 mm are the optimum conditions for spawning.

5.5.5.2.3 Migration

The fish exhibit local migration and often do upward migration to shallow streams with adjoining spring waters where they make a pit in gavel and spawn in pairs. During feeding season when the water volume raises the fish descends down in deep waters.

Brown Trout has also been spread to Kaghan, Dir, Chitral and some other Northern Areas of Pakistan.

5.5.5.3 Rainbow Trout (Oncorhynchus mykiss)

5.5.5.3.1 Habitat

This fish is also found in streams above 3000 ft elevation, where the water temperature seldom rises above 10 degree Celsius. Such streams are with highly oxygenated and clean with gravel bed.

5.5.5.3.2 Breeding

Natural breeding in River swat is not successful therefore artificially raised seeds are added every year in the May, June in the river. Breeding times and intervals of both the trout's are slightly variable and dependent on water temperature and other climatic conditions.

Rearing of this fish is easier than that of brown trout. It can tolerate a higher water temperature, is less carnivorous and grows faster. Its hatching time is 33 days (Hussain, 1994). It sometimes escapes from culture and enters open waters (Hussain, 1997). Rainbow trout was first introduced in NWFP during 1928 (ADB, 1984)

5.5.5.3.3 Migration

The fish exhibit local migration and often do upward migration to shallow streams with adjoining spring waters where they make a pit in gavel and spawn in pairs. During feeding season when the water volume raises the fish descends down in deep waters.

Rainbow trout has also been spread to Kaghan, Dir, Chitral and Northern Areas

5.5.5.4 Snow Trout (Schizothorax plagiostomus)

5.5.5.4.1 Geographic Range Description

Schizothorax plagiostomus is found in Afghanistan and Pakistan to Tibet. In India often lumped under *Schizothorax richardsonii*. It is also reported from Nepal and Myanmar.

5.5.5.4.2 Habitat and Ecology

It is found in a high mountain freshwater rivers and streams with swift running water with rocky beds and spawns in gravel bed with fine pebbles in May to August.

Photographic Record: Fish Sampling and Species of the Project Area

Photograph 5-13: View of aquatic specialist performing sampling

Photograph 5-14: View of aquatic sample collection

Photograph 5-15: Study team analyzing breeding areas of fisheries

Photograph 5-16: Oncorhynchus mykiss (Rainbow Trout)

Photograph 5-17: Schizothorax plagiostomus (Snow Trout)

Photograph 5-18: Salmo trutta fario (Brown Trout)

Photograph 5-18: Brown Trout

5.5.6 Birds

During the EIA field visit, a total of 12 birds' species were recorded from the project area. As the current field visit was carried out during the month of September 2021,

the number/ diversity and frequency of avifauna from the area is quite satisfactory due to onset of migratory season. Majority of the birds recorded during current field visit are common in all stretches of District Swat. Most of the species were recorded close to agricultural fields and water courses flowing through or near the project area of current hydropower project.

Regionally, Pakistan has a rich diversity of avian habitats, from the dry alpine and moist temperate forests of the western Himalayas to the deserts of Baluchistan and Sindh. These diverse habitats are of importance to some 669 recorded bird species (Grimmett, J. Roberts, Tim Inskipp, 2008). Of the total Pakistan's bird species, 30% visit the country for a significant period of the year as long-distance migrants, 43% are either Palearctic species visiting Pakistan only for breeding and 28% are regular winter visitors, which breed mainly in trans- Himalayan northern regions (Roberts, 1992). The information about avian distribution across different habitats and Himalayan elevation zones across the region is scarce, fragmented and preliminary (Ali & Ripley, 1998).

The study area is unexplored in terms of avifauna and old documentation of the bird diversity specific to the study area exist. According to the existing records from the area, over 100 birds species are reported from the Swat Valley. Majority of the species reported from the area are migrant and they are either Winter Migrant from higher elevations or Summer Migrants from lower elevations while few species are resident in the area. Another study in the high elevation Alpine Meadows reported 46 bird species in the area (Ahmad Khan 2004). A study carried out in different ecological zones of Swat reported 21 resident and 27 migratory bird species in the area (Ahmad, H., 2015).

Among the recorded birds, Black Partridge and Grey Partridge are species of interest being game birds. Other common birds of the project area include Collared Dove, Little Brown Dove, House Crow, House Sparrow, Red-vented Bulbul, Common & Bank Myna, Little Green bee-eater, Crested Lark and White Cheeked Bulbul. Among the raptors, Black Kite, Brahminy Kite, Common Buzzard, Common Kestrel, Marsh Harrier, Tawny Eagle and White-eyed Buzzard were also recorded. More raptors may be expected during peak migration season. A more detailed bird fauna based on field work and literature reviews is in the table below. A complete list of bird species observed/reported from the area is presented in **Table 5-24**.

Table 5-18: Birds Reported in and Adjacent to the Project Area

No	*Common Name*	*Scientific Name*	*Listing*		
			IUCN Red List	*CMS Appendix*	*CITES Appendix*
1.	Chukar Partridge	Alectoris chukar	Least Concern		

2.	Common Quail	Coturnix coturnix	Least Concern	Appendix II	
3.	Koklass Pheasant	Pucrasiama crolopha	Least Concern		
4.	Himalayn Monal	Lophophorus impejanus	Least Concern		Appendix I
5.	Greylag Gooze	Anser anser	Least Concern	Appendix II	
6.	Bar-headed Gooze	Anser indicus	Least Concern		
7.	Gadwall	Anas strepera	Least Concern	Appendix II	
8.	Eurasian Wigeon	Anas penelope	Least Concern	Appendix II	
9.	Mallard	Anas platyrhynchos	Least Concern	Appendix II	
10.	Common Teal	Anas crecca	Least Concern	Appendix II	
11.	Northern Pintail	Anas acuta	Least Concern	Appendix II	
12.	Northern Shoveler	Anas clypeata	Least Concern	Appendix II	
13.	Eurasian Wryneck	Jynx torquilla	Least Concern		
14.	Himalayan Woodpecker	Dendrocopos himalayensis	Least Concern		
15.	Common Hoopoe	Upupa epops	Least Concern		
16.	Indian Roller	Coracias benghalensis	Least Concern		
17.	Eurasian Roller	Coracias garrulus	Least Concern	Appendix II	
18.	White-throated Kingfisher	Halcyon smyrnensis	Least Concern		
19.	Common Kingfisher	Alcedo atthis	Least Concern		
20.	Green Bee-eater	Merops orientalis	Least Concern		
21.	Eurasian Cuckoo	Cuculus canorus	Least Concern		
22.	Rose-ringed Parakeet	Psittacula krameri	Least Concern		Appendix II
23.	House Swift	Apus affinis	Least Concern		
24.	Common Swift	Apus apus	Least Concern		
25.	Alpine Swift	Tachymarptis melba	Least Concern		
26.	Collared Scops Owl	Otus bakkamoena	Least Concern		

27.	Spotted Owlet	Athene brama	Least Concern		
28.	Eurasian Eagle Owl	Bubo bubo	Least Concern		
29.	Tawny Owl	Strix aluco	Least Concern		
30.	Eurasian Nightjar	Caprimulgus europaeus	Least Concern		
31.	Rock Pigeon	Columba livia	Least Concern		
32.	Oriental Turtle Dove	Streptopelia orientalis	Least Concern		
33.	Eurasian Collared Dove	Streptopelia decaocto	Least Concern		
34.	Spotted Dove	Streptopelia chinensis	Least Concern		
35.	Common Moorhen	Gallinula chloropus	Least Concern		
36.	Common Coot	Fulica atra	Least Concern	Appendix II	
37.	Common Sandpiper	Actitis hypoleucos	Least Concern		
38.	Northern Lapwing	Vanellus vanellus	Near Threatened	Appendix II	
39.	Black Kite	Milvus migrans	Least Concern		
40.	Lammergier	Gypaetus barbatus	Near Threatened		
41.	Himalayan Griffon	Gyps himalayensis	Near Threatened		
42.	Eurasian Marsh Harrier	Circus aeruginosus	Near Threatened		
43.	Eurasian Sparrow-Hawk	Accipiter nisus	Least Concern		
44.	Long-legged Buzzard	Buteo rufinus	Least Concern		
45.	Booted Eagle	Hieraetus pennatus	Least Concern		
46.	Common Kestrel	Falco tinnunculus	Least Concern		
47.	Peregrine Falcon	Falco peregrinus	Least Concern		Appendix I
48.	Cattle Egret	Bubulcus ibis	Least Concern		
49.	Night Heron	Nycticorax nycticorax	Least Concern		
50.	Rufous-tailed Shrike	Lanius isabellinus	Least Concern		

51.	Long-tailed Shrike	Lanius schach	Least Concern		
52.	Black-headed Jay	Garrulus lanceolatus	Least Concern		
53.	Large-billed Crow	Corvus macrorhynchos	Least Concern		
54.	Eurasian Golden Oriole	Oriolus oriolus	Least Concern		Appendix III
55.	Black Drongo	Dicrurus macrocercus	Least Concern		
56.	Brown Dipper	Cinclus pallasii	Least Concern		
57.	Blue Rock Thrush	Monticola solitarius	Least Concern		
58.	Blue Whistling Thrush	Myophonus caeruleus	Least Concern		
59.	Eurasian Blackbird	Turdus merula	Least Concern		Appendix III
60.	Dark-throated Thrush	Turdus ruficollis	Least Concern		
61.	White-tailed Rubythroat	Luscinia pectoralis	Least Concern		
62.	Black Redstart	Phoenicurus ochruros	Least Concern		
63.	White-capped Water Redstart	Chaimarrornis leucocephalus	Least Concern		
64.	Plumbeous Water Redstart	Rhyacornis fuliginosus	Least Concern		
65.	Pied Bush Chat	Saxicola caprata	Least Concern		
66.	Common Stone Chat	Saxicola torquata	Least Concern		
67.	Pied Wheatear	Oenanthe pleschanka	Least Concern		
68.	Isabelline Wheatear	Oenanthe isabellina	Least Concern		
69.	Common Myna	Acridotheres tristis	Least Concern		
70.	Wall Creeper	Tichodroma muraria	Least Concern		
71.	Bar-tailed Tree Creeper	Certhia familiaris	Least Concern		
72.	Rufous-naped Tit	Parus rufonuchalis	Least Concern		
73.	Great Tit	Parus major	Least Concern		
74.	Pale Martin	Riparia diluta	Least Concern		

75.	Eurasian Crag Martin	Hirundo rupestris	Least Concern	
76.	Asian House Martin	Delichon dasypus	Least Concern	
77.	Barn Swallow	Hirundo rustica	Least Concern	
78.	Himalayan Bulbul	Pycnonotus leucogenys	Least Concern	
79.	Lesser Whitethroat	Sylvia curruca	Least Concern	Appendix III
80.	Common Chiffchaf	Phylloscopus collybita	Least Concern	
81.	Greenish Warbler	Phylloscopus trochiloides	Least Concern	
82.	Streaked Laughing Thrush	Garrulax lineatus	Least Concern	
83.	Crested Lark	Galerida cristata	Least Concern	Appendix III
84.	Eurasian Skylark	Alauda arvensis	Least Concern	Appendix III
85.	Indian Silverbill	Alauda gulgula	Least Concern	
86.	Common Rosefinch	Passer domesticus	Least Concern	
87.	Rock Bunting	Passer hispaniolensis	Least Concern	

Photographic Record: Biological Environment of the Project Area

Photograph 5-19: Crow

Photograph 5-31: Raven Corvus corax

Photograph 5-32: House Sparrow Passer domesticus

Photograph 5-33: Crow Corvus splendens

5.5.7 Mammals

Pakistan is home to ten of 18 known mammalian orders (Sheikh, K. M., and S. Molur. 2006). Out of 195 mammal species, 5 are endemic to Pakistan, 12 are Critically Endangered (out of them one species is endemic to Pakistan), 12 Endangered (three species endemic to Pakistan), 20 Vulnerable, 32 Near Threatened (one species endemic to Pakistan), 71 Least Concern, 38 Data Deficient, 8 Regionally Extinct and 2 are Not Evaluated. The varied and interesting mammalian fauna found in Pakistan is largely due to the country being on the transitional zone between two of the world's six major zoogeographical regions, the Palearctic and Oriental (S. Rasheed, Bashir, & Jaddon, 2020). The mammalian species present in Pakistan are represented by order Chiroptera having 50 species, followed by order Rodentia with 48, Carnivora with 35, Atriodactyla with 23, Cetartiodactyla with 20, Eulipothypha with 13, while the orders Lagomorpha, Primata, Pholidota and Perissodactyla each with 4, 3, 1 and 1 species, respectively (Baig & Ahmed, 2007).

Khyber Pakhtunkhwa province of Pakistan has nine ecological zones ranging from permanent snow field or cold deserts at higher elevation to the lower elevation foot hill plains and wetland ecosystems (Shah, S. A. 2011). These diverse ecological zones support a rich mammalian diversity with 87 species present in the whole province (Uzma Ali 2020). The Project is located in Swat district of Malakand Division of province in Pakistan and it is renowned for its natural beauty. Swat district is having dry temperate to permanent snow and cold desert ecological zones support unique mammalian species which are adapted to low temperature. The area is home to some of the ecologically important fauna including the Brown Bear, Black Bear, Grey Wolf, Lynx, Musk Deer Markhor and Ibex which are restricted to high elevation permanent snow fields/cold deserts, alpine meadows, and sub-alpine scrub forest areas (Ahmad Khan 2004, Ali, A., Khattak, M. N. K., Nawaz, M. A., & Hameed, S. 2021). These are conservation concern species which include the apex predators and umbrella species of their ecosystem which are confined to the upper reaches of the Swat Valley and slightly descend downward in Winter. Most of the large carnivores in such areas do not have a favorable conservation status. Their habitats are being reduced and local people often persecute them.

The mammalian species recorded from project area include Common Leopard, Rhesus Monkey, Asiatic Jackal, Red Fox and Leopard Cat. Other mammals like the Snow Leopard, Grey Wolf and Markhor have varied habitat adaptability and are restricted to high elevation and not present in the Project Area.

5.5.7.1 Data Collection for Large Mammals

Residents from the project areas were interviewed from different villages/localities. People were asked about their previous record of sighting of different large mammals. Status of the large mammals from the different official bodies and reports have been observed and recorded to get the actual image of diversity.

Field survey was conducted in the surroundings of Kalam-Asrit Hydropower Project Site to know the status and occurrence of different mammalian species in the area. Focus was on the proposed project areas and its buffer zones as well. Indirect species sign including the scats, pugmark, and scrape were searched in the potential habitat for the species expected to present in the area.

The main objectives of the present study were to collect information about their occurrence and absence in the area, human-wildlife conflicts, threats to different mammalian species and the probable proportion of the area occupied by each species.

The large mammalian species including the Snow Leopard, Black Bear, Grey Wolf and Markhor are restricted to high elevation and not present in the Project Area. These species are rare, nocturnal, and shy and avoid human settlements and disturbed areas. Habitat fragmentation, retaliatory killing and expansion of human settlements has badly affected these species distribution in the area. These species usually prefer high elevation areas and recent climate change has shifted these species to further higher elevation. Public perception about presence of mammals in the area shows that Snow Leopard was considered completely absent from the area and Black Bear is believed to be very rare and usually restricted to high elevation alpine pastures. Grey wolf is has faced severe persecution and now it restricted to higher elevation. Markhor population has drastically decreased in last few decades and now it can be sighted at high elevations. Markhor hunting is totally banned in the area now and according to local hunter Jahangir Khan is population is on rise again.

A complete list of mammalian species observed/reported from the area can be seen in **Table 5-25**.

Table 5-19: Mammals Observed/Reported in the Project Area

Common Name	Scientific Name	Occurrence			Listing	
		Common	Less Common	Rare	IUCN Red List	CITES Appendix

1.	Red Fox	*Vulpes vulpes*	Least Concern	Appendices III
2.	Rhesus Monkey	*Macaca mulata*	Least Concern	
3.	Asiatic Jackal	*Canis aureus*	Least Concern	Appendices III
4.	Leopard Cat	*Prionailurus bengalensis*	Least Concern	Appendices I
5.	Common Leopard	*Panthera pardus*	Vulnerable	Appendices I

Photographic Record: Biological Environment of the Project Area

Photograph 5-34: Leopard Cat

Photograph 5-35: Golden Jackal Canis aureus

Photograph 5-25: Rhesus Monkey at kalam

Photograph 5-26: Asiatic jackal

5.5.7.2 Human Wildlife Conflict

Locals in the area were asked about the Human-wildlife conflict in the area. However, there was no reliable data on livestock predation. Locals reported few incidents of predations by Asiatic Jackal and Grey Wolf at a higher altitudes. Majority (95%) of the incidence reported were the predation of poultry by Asiatic Jackal while remaining were the predation of goat and cows. Livestock were killed while grazing in the pasture outside while poultry was captured from houses and outside. There was no predation incident related to Common Leopard.

Economic Loss by Mammals due to Crop Damage

There was no incidence of crop weirage by mammals in the area which shows that these animals avoid the agricultural area and are restricted to higher elevation.

Attacks on Human

In the Project area, locals did not report any fatal or non-fatal attack by the predator on human

5.5.8 Small Mammals

According to the various reports on small mammals of Pakistan (Ahmad and Ghalib, 1979; Akhtar, 1958-60; Anthony, 1950; Baig et al, 1986; Banerji, 1955; Beg, et al., 1975, 1986; Frantz, 1973; Fulk et al., 1981; Mehmood et al., 1986; Mian, 1986; Mirza, 1969; Parrack, 1966; Roberts, 1972, 1973; Siddiqui, 1970; Thomas, 1920a,b,1923; Wagle, 1927; Walton, 1973 and Wroughton, 1911,1920) and Woods et al. (1997 a,b), there is a wide variation and availability of small mammals in the northern areas of Pakistan.

Biodiversity in the proposed area is wide in-terms of small mammals specifically with forests around. There is an abundant vegetation mixed with agriculture fields on both sides of Swat River having cold temperate and coniferous forest on the hillsides which provides enough shelter and food to the terrestrial mammalian fauna. The specific area under consideration includes species of House Mouse, Indian Rat, Gerbil, Weasels, Marmot, Squirrel, and specie of Civet.

Data Collection for Small Mammals

Secondary data was collected from the locals in the area about the presence of different small mammals species in the area. Besides this, species signs like burrows, footprint, droppings and road kills were also noted to report the small mammalian species in the area.

A complete list of mammalian species observed/reported from the area can be seen in **Table 5-26**.

Table 5-20: Small Mammals Observed/Reported in the Project Area

	Common Name	Scientific Name	Occurrence			Listing	
			Common	Less Common	Rare	IUCN Status	CITES Appendix
1.	House Mouse	Mus musculus	Yes			Least Concern	
2.	Indian Giant Flying Squirrel	Petaurista philippensis		Yes		Least Concern	
3.	Asian Palm Civet	Asian Palm Civet		Yes		Least Concern	Appendices III
4.	Indian Bush Rat	Golunda ellioti		Yes		Least Concern	
5.	Masked Palm Civet	Paguma larvata		Yes		Least Concern	Appendices III
6.	Himalayan Marmot	Marmota caudata		Yes		Least Concern	Appendices III
7.	Kashmir Flying squirrel	Hylopetes fimbriatus			Yes	Least Concern	
8.	Indian Gray Mongoose	Herpestes edwardsii		Yes		Least Concern	
9.	Small Indian Mongoose	Herpestes auropunctatus		Yes		Least Concern	
10	Himalayan Pika	Ochotona roylei		Yes		Least Concern	
11	White-toothed Shrew	Crocidura suaveolens	Yes			Least Concern	
12	Himalayan Rat	Rattus turkestanicus		Yes		Least Concern	
13	Himalayan Wood Mouse	Apodemus rusiges		Yes		Least Concern	

Photographic Record: Biological Environment of the Project Area

Photograph 5-27: Indian Bush Rat

Photograph 5-28: Wooly Flying Squirrel

5.5.9 Reptiles

Most of the herpetological studies carried out in Pakistan are either old or mainly restricted to the Sindh and Balochistan provinces of Pakistan (Murray, 1884; Boulenger, 1920; Smith, 1933, 1935, 1943; Minton, 1966; Mertens, 1969). The other subsequent and relatively recent studies include Dubois and Khan, 1979; Khan, 1985, 1991, 1993a, 1993b; Khan and Baig, 1988, 1992; Baig, 1988, 1996.

The available studies on the herpetology of the proposed Project area and surrounding areas in District Swat as described by Muhammad Sharif, 1999, include species of geckos which readily invade buildings and settlements. Lizard species are found in orchards and bushes, while Skinks are frequently found on grass fields.

5.5.9.1 Data Collection for Herpetofauna

The project area comprises different types of habitats and terrains including forests, cultivated lands and wild lands. Different direct and indirect methods were applied to study various groups of herpetofauna in the Study Area. Field visit was carried out during September 2021 to record the sightings and data. Interviews with residents were also done, which are valuable not only for identifying the potential sites in the study area but also a good source of primary data about the already existing wildlife of an area.

During the EIA field visit a total of 3 reptiles were recorded/observed from the project area. As the field visit was carried out during the month of September during winter season, still a satisfactory number of reptiles were recorded.

Most of the species are commonly observed in such habitats and even in close proximity of human habitations. The common reptiles of project area include, Bengal Monitor Lizard *Varanus bengalenis*, Spiny-tailed Lizard *Saara hardwickii*, and Leopard Gecko *Eublepharis macularius* along with species of frogs and snakes.

According to a preliminary review of literature, no crocodilians and tortoises found in the study area. Most of the species were observed directly whereas some were detected through indirect evidence like tracks, burrows, molts which was confirmed after interviewing several residents including farmers, hunters, and teachers.

A complete list of reptilian species observed/reported from the area is presented in **Table 5-27**.

Table 5-21: Reptiles Observed/Reported in the Project Area

	Common Name	Scientific Name	Listing	
			IUCN	CITES
1.	Bronze Grass Skink	*Mabuya macularia*	Not Evaluated	
2.	Checkered Keelback	*Xenochrophis piscator*	Not Evaluated	Appendices III
3.	Rat Snake	*Ptyas mucosus*	Not Evaluated	Appendices II
4.	Eastern Diadem Snake	*Spalerosophis diadema*	Least Concern	
5.	Leopard Gecko	*Eublepharis macularius*	Least Concern	
6.	Garden Lizard	*Calotes versicolor*	Least Concern	
7.	Glossy Bellied Racer	*Coluber ventromaculatus*	Least Concern	
8.	Bengal Monitor Lizard	*Varanus bengalensis*	Near Threatened	Appendices I
9.	Indian Sand Boa	*Eryx johnii johnii*	Near Threatened	
10	Pakistan Ribbon Snake	*Psammophis leithii*	Not Evaluated	
11	Saw scaled Viper	*Echis carinatus pyramidum*	Least Concern	
12	KPK Sand Gecko	*Crossobamon orientalis*	Not Evaluated	
13	Spotted Indian House Gecko	*Hemidactylus brookii brookii*	Least Concern	
14	Yellow Bellied House Gecko	*Hemidactylus flaviviridis*	Not Evaluated	

5.5.9.2 Macro invertebrate fauna

The invertebrate species recorded included species of planaria, leech, Caddis Fly, May Fly, Stone Fly, Dragon Fly, Weires Fly, Water Strider, chironomous, water beetles and water scorpions. phytoplankton, diatoms, algae, zooplanktons i.e. rotifers and cyclops mostly at bottom rocks and stones. They therefore benthivorous in nature.

Table 5-28 provides the complete list of macro and micro-invertebrate fauna and flora collected from sampling sites from River Swat at Kalam and Asrit.

Table 5-22: Invertebrate collected from River Swat at Kalam and Asrit

Common Name	Scientific Name	Status in Project Area	IUCN Red List
Planaria	*Planaria torva*	Spotted	Least Concern
Leech	*Hirudinea*	Spotted	Least Concern
Caddis Fly	*Trichoptera*	Not Spotted	Least Concern
May Fly	*Ephemeroptera*	Spotted	Least Concern
Stone Fly	*Plecoptera*	Spotted	Least Concern
Dragon Fly	*Anisoptera*	Spotted	Least Concern
Weirsel Fly	*Zygoptera*	Spotted	Least Concern
Water Strider	*Gerridae*	Not Spotted	Least Concern
Chironomus	*Chironomus riparius*	Not Spotted	Least Concern
Water Beetle	*Dytiscidae*	Not Spotted	Least Concern
Water Scorpion	*Nepidae*	Spotted	Least Concern
Rotifers		Spotted	Least Concern
Diatoms		Not Spotted	

5.6 Socio-Economic Baseline Data

District Swat is in one of the oldest regions of Civilization. The history of Swat valley goes back to around 2000 years ago. It was known as Udyana and later the name was changed to Suvastu. The valley was a very peaceful area for living until the 11th century.

The valley was a major centre of early Buddhism under the ancient kingdom of Gandhara, and was a major centre of Gandharan Buddhism, with pockets of Buddhism persisting in the valley until the 10th century, after which the area became largely Muslim.Until 1969, Swat was part of the Yusafzai State of Swat, a self-governing princely state that was inherited by Pakistan following its independence from British

rule. The region was seized by the Tehrik-i-Taliban in late-2007 until Pakistani control was re-established in mid-2009.

The Yousafzai State of Swat was a kingdom established in 1849 by the Muslim saint Akhund Abdul Gaffur, more commonly known as Saidu Baba, that was ruled by chiefs known as Akhunds. It was then recognized as a princely state in alliance with the British Indian Empire between 1926 and 1947, after which the Akhwand acceded to the newly independent state of Pakistan. Swat continued to exist as an autonomous region until it was dissolved in 1969 and incorporated into Khyber Pakhtunkhwa Province (formerly called NWFP).

5.6.1 Methodology

This section describes the socioeconomic and cultural environment of the project area. It presents information on the project area's location and its tribal distribution, describes the generic characteristics of communities inhibiting the project area, and discusses the health, economy, lifestyle, and the use of resources by the local community. Community wellbeing, as understood by the local people has also been explained to provide a backdrop against which to analyze the socioeconomic and cultural environment of the community. To collect the baseline information of the local community primary and secondary data collection techniques were used.

5.6.2 Field Survey Data Collection

Primary data was collected through individual interviews, focus group discussion and consultations with project Affected Persons (APs) and project Displace Persons (DPs) local community, while secondary data was collected from the published documents.

- Interview methods – individual household/DP were interviewed.
- Group discussions – Focus group discussions/ scoping sessions were conducted with all DPs and the general population.
- Participatory rapid appraisal methods (PRA) – PRA tools and techniques were used for conducting the impact location profile and public consultations.

The baseline information was collected by using the following techniques: Households' Survey, Key Informant Survey, Public Consultation, Observation, and Photographs

5.6.3 Data Collection Tools

Household Surveys

A Socio-economic survey of project affected households (whose land and the house will be permanently acquired) was carried out. The pre-tested questionnaire was applied by a trained team of enumerators to solicit information from project affected families. Households' survey was conducted for all of those families living near the

project area. The questionnaire has been designed to cover demographic characteristics, basic health conditions, income and expenditure, water and energy-related issues, attitude towards resettlement and expectations from the project etc.

Key Informant Surveys

Key informant survey was employed during the field visit to gather information on socio-economic and cultural activities. The checklist was designed to collect information on basic demographic and migration patterns, food sufficiency and cropping patterns, the existence of user's group/committees, public facilities and infrastructure, labour force availability, the existence of archaeological and religious sites etc

Group Discussions

A group discussion was organized to give special attention to issues concerning specific target groups such as women, children and farmers. Local people, leaders, teachers and key persons were also included in the discussion

Direct Field Observations

The field observation of the project site was made by the team of sociologist and other staffs to collect the baseline information of the project area and to identify the potential environmental impact and the pertinent issues. During the field visit, the team met local stakeholders and discussed with some key persons. Meetings were mainly focused on issues likely to arise due to the implementation of the project, the existing environment of the project area and views/concerns of stakeholders

5.6.4 Population Characteristics of the project area

The population of Swat District is 2,309,570 as per 2017 census, making it the third-largest district of Khyber Pakhtunkhwa after Peshawar and Mardan District. Swat is populated mostly by ethnic Pashtuns and Gujjar and Kohistani communities. The language spoken in the valley is Pashto, with a minority of Torwali and Kalami Kohistani speakers in the Swat Kohistan region of Upper Swat. According to 2017 census of Pakistan, Pashto is the main language and spoken by 73.55% of the population in the province of Khyber Pakhtunkhwa, while Kohistani, Kalami and Torwali is constituted to the 15.11% of total population which are also spoken by a fraction of population.

Table 5-23: Demographic Details of District Swat as per Census 2017

S No.	Tehsil	Population 2017	No. of Households
1.	Babuzai	599,040	74,015

2.	BariKot	184,000	22,782
3.	Behrain	248,474	29,975
4.	Charbagh	126,115	15,315
5.	Kabal	420,374	47,943
6.	Khawazakhela	265,571	31,965
7.	Matta	465,996	52,625
	Total	**2,309,570**	**274,620**

5.6.5 Conflict and Social Tension

Along with the formal justice system in Swat, there is a strong system of informal justice or Alternate Dispute Resolution (ADR) under the centuries' long Pakhtoon code of life. Most of the people refer their cases to this informal system or Jirga. The Jirga plays very active for conflict resolution in the area. The Jirga has been adapted as a source of ADR in Swat called Dispute Resolution Councils (DRC). There is one DRC working at every police station level under the government umbrella. This is a trained group of some 18-21 elders from the local area and work with the police station to solve disputes and day to day problems/ conflicts of people at local level .

Jirga	• It is the historical source of conflict resolution in the Pakhtoon Society. People mostly rely on Jirgas to sort out their problems at the local level • Local disputes, honor issues, water, Jungle, hills, mines and other resources are distributed through local Jirgas
Dispute Resolution Council (DRC)	• Established and working in Mingora, Rahimabad, Kanju, Kabal, Mata and Kalakot Police Stations. • Every DRC has a membership from 18-21. They are mainly retired persons/ elders from the local community
Khpalo Khwendo Jirga (Sisters Council) established in March 2012	• 500 trained women activists, spread over the whole Swat district, engage themselves in Conflict resolution as per the requirement in their relevant area. They mostly work on women related issues • Main Jirga comprises of 25 members headed by Tabassum Adnan, a local activists, social workers and advocate for women rights in Swat.

5.6.6 Settlements

There are 04 villages in project area, from which there are specifically 13 settlements from the weir site (Pushmal Village) and 5 from the powerhouse sites (Asrit Village)

are being affected due to project. Other villages are not to be affected significantly. The following table shows the villages name that are linked with project areas.

Sr. No.	Name Village
1.	Dadul Karandoki Village
2.	Pushmal Village
3.	Ariyan Bagla Village
4.	Asrit Village

Table 5-24: Average Household Size

Settlement	No. of Households	Total Population	Male Population	Female Population	Average Household Size
Dadul Karandoki	140	1350	539	561	9.60
Muhallad Shaid Bagh, Pushmal	17	105	53	52	6.17
Ariyana Bagla	100	700	371	329	7.00
Asrit	60	350	150	200	5.8

5.6.7 Caste and Ethnicity

Two ethnic group commonly found in Project area are Pathan tribes and the Kohistanis the other casts are darra khel, ulak hel, gujjar, khande wal, torwali, nalilar, jafler, akhwanzadgan ,yousafzai khan akhail, totak hail, dora khail, katan khail, jaqar khail, mian khel and Kashmiri.

5.6.8 Religious

The area is mostly Muslim populated area. People are very much concerned about castes and beliefs, visiting shrines is very common among them.

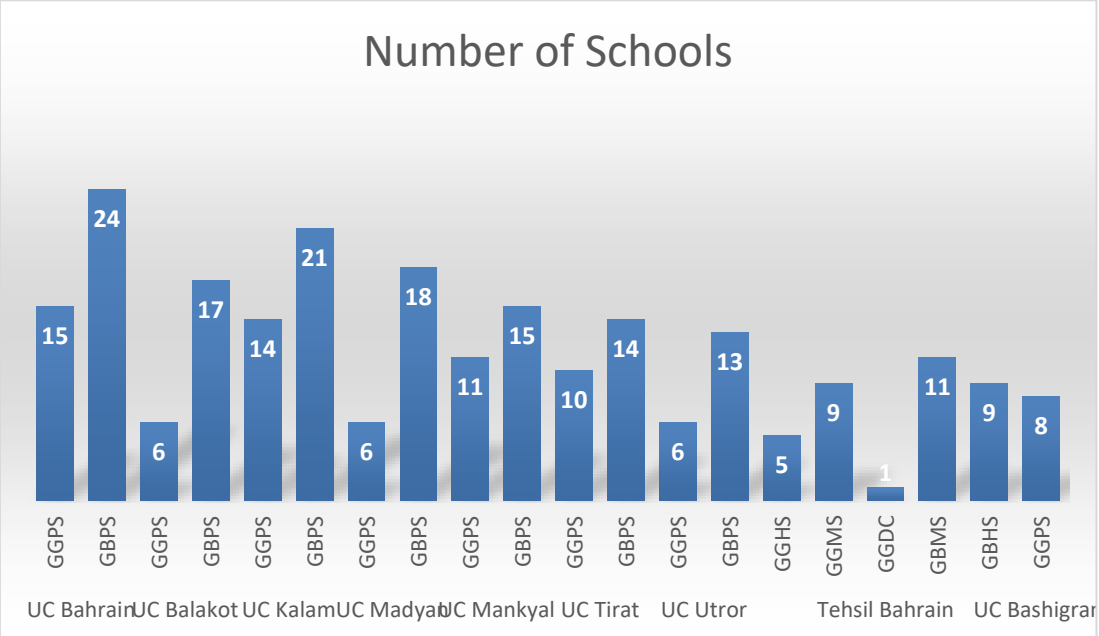
5.6.9 Language

The language spoken in the project area is Pashto and Kalami Kohistani with a minority of Torwali speakers. According to 2017 census, Pashto is the main language and spoken by 90. % of the population while Kohistani and other languages is spoken by10%.

5.6.10 Education

Schools suffer from lack of proper infrastructure, clean drinking water facilities, lack of playgrounds etc. Most importantly, there is a dearth of good teachers. Female students are discouraged from attaining higher education. There are very few teachers who are capable of teaching disciplines like Mathematics and Physics. Poverty is a great barrier for individuals in attaining education. There are only 02 School and 02 Madrasa in project area.

Bellow figure Shows the overall education facilities situation in Tehsil Behrain



5.6.11 Occupation and Employment

Major economic activity in the project area is working for different agriculture and cultivation. A few numbers of people also work in the nearby city.

5.6.12 Agriculture and Livestock

Agriculture and Livestock include farms, ranches, dairies, feedlots, egg production facilities, broiler facilities, poultry hatcheries, apiaries. Village-wise Livestock in the project area is mentioned in the following table

Animals	Dadul Karandoki	Shaid Bagh-Pashmal	Ariyana Bagla	Asrit
Cows	60	55	200	180
Goat	50	1	60	20
Sheep	10	60		12
Donkey	5			2
Buffalo	4	5		
Horse	3			3
Poultry	50		400	200

5.6.13 Health Facilities in the Region

There are no hospitals only one dispensary is working in the project and for surrounding area. Community of the project area strongly demand for the medical facility during conduction socioeconomic questionnaire. For the medical treatment, people have to visit a dispensary/medical clinic in Bahrain, Madyan or Kalam.

However, there are some health facilities available at tehsil level, located in Bahrain which are mentioned below,

Name of Hospital / BHU / Dispensary in Bahrain	**Numbers**
Civil Hospital Madian	1
BHU Tirath	1
BHU Chail	1
BHU Bahrain	1
BHU Laikot	1
Civil Dispensary Chamghari	1

5.6.14 Communication

People of the area is connected with down country relative and friends through Local PTCL and Mobile network.

PTCL and Zong Mobile network is available in the project area. This is one of the major issues of people living nearby

5.6.15 Transportation, Travelling and Accessibility

Majority of the people living in the project are having access to Jeep, fueling coach, and Cars to visit the market in Kalam or Bahrain. Survey results shown that on overall basis in the project area, 84.12% male members responded regarding their regular travelling/ mobility per month and the range of travelling cost/ month worked out to be Rs.1,500 to Rs. 3,000. In case of females 15.88% female respondents responded for travel per month and the travelling cost/ month worked out to be Rs.1,500 to 3,000 The details are given in table below.

Households' Mobility and Travelling Cost.

Male /Female	No. of HHs Travelled/ Month	No. of Visit/ Month		Cost of travelling/ month (Rs.)	
		(min)	(max)	(min)	(max)
Male Members	84.12% (53 Nos.)	18	30	1,500	3,000
Female Members	15.88% (10 Nos.)	3.2	4.8	1,500	3,000

Generally, people travelled in nearby villages or town for getting medical treatments, domestic needs, education, business, sports activities, recreation and social gatherings.

5.6.16 Electricity

The facilities like electric polls and transformers are installed but there is some load shading about 18 hours per day. The need for electricity is fulfilled by the current micro-hydel established within the project area. Those micro-hydel were developed by the locals and the social organizations.

5.6.17 Water Supply and Sanitation

All households have access to drinking water at their houses which is supplied through a local Chashma (Spring). The water is supplied through plastic pipes to their homes. The water from different Nullahas used for domestic purposes e.g. washing purposes. Most of the households do not possess proper sewerage system and almost 99% of the toilets are flushed into the river.

5.6.18 Cropping Pattern

The cropping pattern refers to the area sown under various crops during winter and summer season. The major kharif (summer) crop is (Wheat 85% & vegetables and potatoes 15%). The cropping pattern in the project area is given in Table below.

Table 5-25: Crop Pattern

Kharif Crops (Summer: April-Sept)	
Wheat	Vegetables
85%	15%

5.6.19 Historical, Religious and Archeological Sites

Nearby community is mainly a Muslim populated area. Majority of the inhabitant believe in shrines (peers), different inhabitants have different peers and there were few who have developed a firm trust towards these peers. Apart from general mosques there is a Kalam Masjid which is famous for its unique wooden structure and is constructed with pure timber and according to locals, this masjid is about 400-year-old Masjid.

The overall social arrangements on the project sites were based around different clans (baradari) and tribes majorly constituting Pathans and Kohistani, along with that darra khel, ulak hel, gujjar, khande wal, torwali, nalilar,jafler, akhwanzadgan, yousafzai khan akhail, totak hail, dora khail, katan khail, jaqar khail, mian khel and Kashmiri are also living in the different regions of the project areas. The language spoken in the Project valley is Pashto, with a minority of Torwali, Kalami, Kohistani, Gujri and Khandian speakers.

The area is Muslim populated area, however, people are very much concerned about castes and beliefs, visiting shrines is very common among them. Following are the religious / historical sites present at the Project sites.

Table 5-26: Religious Sites at Project Area

S. No.	Site Location	Site Component	Number of Religious / Historical Facility
1	Upstream of Pushmal Village	Weir	3
2	Aryanai Bagla	Adit	1
3	Asrit	Powerhouse	2

5.6.20 Income Profile of The Area

The assessment of annual household income is one of the important indicators to measure the well-being/ livelihood of the household. In the field survey, the major sources of income included: income from farming, labour, government service, private service, and business

Major Occupations of Households in the project area are define as follows:

Farming	Govt. Service	Private Service	Business	Labor	Livestock	Others
39%	2 %	11%	16%	9%	20%	3%

5.6.21 Average Annual Income

The settlements and their respective incomes may vary from one site to the other. However, the data for the average annual income of the different households on the reservoir site was found to be Rs. 480,000/-, and the average annual income on the powerhouse site was recorded Rs. 160,400/-, which is higher than the national average per capita income of Rs. 1504/month.

5.6.22 Average Household Expenditures

Annual expenditure and pattern of expenditure provides an indication for assessing standard of living of a household. The expenditure on food items include cereals, pulses, flour, sugar, cooking oil/ ghee, milk etc., while the non-food items include education, medical treatment, clothes, shoes, cosmetics, utilities, social and other. Total average annual household expenditure on both food and non-food items is estimated as Rs. 305,942. On the whole, the proportion of expenditure incurred on food and non-food items is 73.9% and 26.1% respectively as the survey results are given in Table below.

Annual Expenditure on Food and Non- Food Items

Total Expenditure on Food & Non Food Items (Rs/ Annum)	Food Expenditure %	Non-Food Expenditure %
305,942	73.9	26.1

5.7 Gender Analysis

As in most rural parts of Pakistan, the socioeconomic wellbeing of women in the project area is moderate. This section describes the roles and responsibilities of women in the project area and the AoI. Their access and control over resources such as health, education and means of livelihood are also addressed.

Information regarding the status of women in the project area was obtained through interaction with female members of the community by gender specialist, as strict purdah (seclusion from outsiders and they do not interact with men outside their immediate family circle) was observed in the project area.

a. Societal Role and Authority

Women don't carry authority roles and are usually directed by males. During consultations, it was found that most decisions are taken by both men and women at the household level. However, the decision for women to work outside their home is not taken by the women themselves but by the men. This also indicates restricted mobility of women outside the village. It has been observed that the role of women in decision making was not much significant like the marriage of children, sale and purchase of property, sale and purchase of animals, decisions regarding the schooling of children and to attend social activities. Women shared that women's participation in decision making is more encouraged and common in educated families and younger generation. Educated couples believe in sharing and taking joint decisions. Traditionally, man is seen as the authority figure and the source of all codes of conduct, even when deciding in the matters related to health and education. As majority of the families carry forward traditions, combine family systems prevail as was done by their ancestors.

b. Dress and Footwear

Generally, women wear *shalwar kameez*. Women also wear jewelry including necklace (*locriyia*), earnings (*walian*), bangles (*kangri*).

c. Purdah and Social Mobility

Women generally observe purdah from men and any outsiders within the project specific communities. The purdah restrictions are more stringent for young girls and women. The restrictions on mobility are strict for young women. Married & elderly women are free to attend marriages, death and birth ceremonies, bring water from nearby villages and can go to markets with male members of the family. A married woman has to seek permission for a social visit from her husband or mother in law and is usually accompanied by her husband or sister in law. Unmarried girls mostly remain secluded within their houses and also have to observe purdah from males.

d. Project Impacts on Women's Mobility and Access

The women occasionally travel outside their villages, mostly for visiting doctors, shopping and social events. Very few girls travel for education or to access vocational facilities located in the urban centres. Women were concerned that, during the project implementation, their travel time and privacy as well as their social networking may be affected. There were number of women involved in agriculture/ farming activities in the field, and only a few number of women working outside their houses/ villages.

In this context, a proper mitigation measures need to adopt to avoid/ or minimize their disturbances, although these disturbances will be temporary. It is not likely there will be significant mobility issues for women during the proposed sub-project implementation, since a nominal number of women were working in farm fields and out of their houses/villages

e. Decision Making

Decision making is in the hands of male members of the family for e.g. control over the household budget. A male member's decision cannot be challenged by a female. The routine household purchases are also mainly carried out by male members for which they visit the nearest town or city, weekly or as required. Women's decisions are not sought in marriage.

f. Daily and Seasonal Workload

The project area is located in the Swat Basin, where livelihood is more dependent on agriculture and tourism.

Daily workload includes household chores and supporting male members in livestock and agriculture related activities of tourism. A single household mostly comprise of more than one woman and hence, the workload is distributed and shared. Mostly laborious work requiring strength is done by adult women and chores are carried by younger females. The distribution of work and workload is influenced by age and health of individuals.

Around the project area, women participate in livestock activities which are localized to their homes, for other activities such as grazing, males take the responsibility. Women also contribute in agricultural activities which include seeding, land preparation and harvesting. In crop seasons almost all females of the household work in the cultivation areas, except for a few who stays at home for chores i.e. meal preparation and looking after children.

g. Preferences in Marriage

Marriages are mostly endogamous (i.e. marriages within the family). The paternal cousins are given preference, usually the will of girl is not sought. In some cases, parents decide their daughter's fate even before she is born. Engagement or *mangni* is held before marriage which symbolically represents the fixation of marriage. Usually, the females are engaged at a very early age . Mostly, girls are married at an early age, thinking it is easier for the girls to adjust to their husband's life style. Within the project AoI similar trends in marriages were observed.

h. Handicraft

Along with household chores women pass their free time by making different handicrafts Foremost among these are the woollen blankets, commonly known as 'Sharai'. These are intended for men and are worn all over the valley for escaping the severity of the winter season. 'Jollagen' or weavers are primarily engaged in making these. The blankets weigh around four kilos and are produced in Dewlai, Kala Kalay, Salampur, Puran and Ghurband. Similar to the blankets are the shawls made for women, created from woollen sheets. Cotton is mixed with the wool to add some texture to the fabric and the ends are fringed exquisitely. 'Lamsay' or rugs are made using the fleece from local livestock, which is then spun using a wooden instrument. The spun fleece is then laid out on a straw mat and sprinkled with water and dye in astonishing shades of pink, black and crimson. Then, the straw mat is rolled and tread upon.

The embroidery of Swat is especially captivating and is an ancient and revered art, inherited from the artisans of Gandhara. Women are usually engaged in this art as they spend a large portion of their day indoors, so it also serves as a pastime for them. Even young girls can often be seen with needles in their hands. The embroidered work of Nekpikheil is especially stunning and can be classified into three broad areas consisting of silken thread work, cotton thread work and golden lace work. The silk work is hardest and most time consuming as the threads of warp and woof of the cloth have to be counted and the embroidery carried out according to calculations. Bed coverings, table cloths, pillows, shirts and caps are created using this technique

Aside from garments, Swati craftsmen make 'Panrae', which are old fashioned leather shoes, embellished with gold lace. However, this craft is becoming archaic. 'Bachookay' are braids for hair, made with strips of silk and cotton woven together and

ornamented at the end with beads and tinkling bells. Interestingly, Swatis locally produce many of the items used in their daily lives and beauty is an important eleme

5.8 Limitation of Study

The project area is male dominant society. Access to women is very difficult and most of female have limited information regarding to their land and other gender issues. Even the female has no permission to attend any type of social meeting and independently visit to health facilities.

5.9 Archaeological or Cultural Sites

In fact, Swat is home to a good number of United Nations World Heritage sites. These sites are protected by the UN Educational, Scientific and Cultural Organization (UNESCO).

When it comes to politics, Swat district is majorly influenced by Pakistan People's Party followed by Pakistan Muslim League (N) and currently Pakistan Tehreek Insaaf.

During the EIA study by the qualified archaeologist, no surface archaeological site was identified in the project study area during the fieldwork for the EIA however, the Proponent will ensure that mitigation measures suggested in the EIA are being adhered with to avoid contravene with any provisions of the Act. Local graveyard was observed outside the community not within the project construction area. Proponent will ensure change find procedure is in place prior to construction activities.

5.10 Cultural and Historical Heritage

A fairly large number of Buddhist sites preserving stupas, monasteries, viharas, settlements, caves, rock-carvings and inscriptions are scattered all over the Swat Valley. This heritage of immense interest may be seen both in plains and in the hilly tracts. Fa-Hein, who came to Swat in 4th century A.D, wrote about 6000 monasteries in the valley. The report of Sung-Yun, who visited the enchanting valley in the 6th century A.D, saw 6000 images in the sacred monastery of Talo (Butkara). The most famous of all the Chinese pilgrims, Hsuan-Tsang who graced the valley by his presence in the 7th century A.D, mentioned 1400 monasteries in Swat, which eloquently confirmed the extensive remains of the Buddhist period.

Even today over 400 Buddhist stupas and monasteries may still be seen in ruins in Swat covering an area of about 160 square km.

The Buddhists built mostly their stupas and monasteries higher on the hills with the aim that agricultural economy may not suffer and also to provide a sort of protection and security to them from the invaders..

5.10.1 Sights of Swat

Swat Valley include Kalam, Mahodand Lake, Malam Jabba, Takht-i-Bahi, Saidu Sharif, Ushu Forest, Mingora and Buddha Stupas as major sight-seeing destinations.

5.11 Summary of Socio-Economic Consultations (Community Opinion)

During the socioeconomic survey, question was asked about the possible positive impacts of the proposed project as well as anticipated concerns of the respondents associated with the construction of the hydropower project. The views of the respondents were as following;

5.12 Positive Impacts

- Most of the respondents showed their consent about the positivity of the project and assumed that due to the construction of this Kalam-Asrit hydropower project cheap electricity will be available for them;

- Construction of the Kalam-Asrit Hydropower Project will generate job opportunism for them.
- Respondents were of the view that proposed Project will open the new doors for development of the area.
- There will be increase tourism in the area which leads the socio-economic uplift in the area.
- They were of the view that they will be new job opportunities for the local people during construction period of the proposed hydropower.
- With the development of new tourism sites, the business opportunities will create for the local people and their existing business will also flourish.
- Property rates will also increase.

5.13 Anticipated Concerns

- Respondents were of the view that the compensation for their affected land due to construction of this hydropower project and structures should be given as per replacement value. It was made sure that they will get fair compensation for affected land and assets at market based replacement cost.
- They showed a fear that the government will not purchase their leftover land as that particular land (if nominal left) will not remain in their use.
- Local women mobility will be restricted because of construction activities especially during construction of the access road;
- Dust and noise should manage during construction activities.
- Respondents demanded that the supply of public utilities will remain continue during construction phase.
- The educated youth is jobless, hence jobs should be provided to these male and females during project execution.
- Privacy of the local people should not be disturbed

6 Stakeholders Engagement

During the EIA of Kalam-Asrit HPP Project, Stakeholder engagement and consultation were conducted as a tool for the purpose of communication, taken to include; information dissemination, exchanging views, soliciting feedback and suggestions on issues pertaining to the project, plan future actions, initiate a needs assessment and identify areas of concern.

6.1 Financial Institutions Requirements for Stakeholders Consultation and Disclosure of Information

The project lenders and government regulatory body's emphasis on the disclosure of information and consultations with the stakeholders has been increasing over period. The Project lenders requirements that are applicable fall under the umbrella of IFC PS and ADB Social Safeguards. A brief explanation of the requirements of public disclosure and stakeholder's consultations applicable to the project are provided below. The PS1 establishes the importance of integrated assessment to identify the social and environmental impacts, risks, and opportunities in the project's area of influence. PS1 requires Social and Environmental Assessment and Management Systems for managing social and environmental performance throughout the life cycle of this Project and runs through all subsequent PSs. Community engagement or stakeholder engagement is one of the seven elements of PS1. The specific requirements of the stakeholder engagement are summarized

below.

Table 6-1: Overview of Financial requirements specific to Project

Financial Institution/ Regulator Body	*Reference of Regulation*	*Requirements*
IFC	**PS-1`**	■ Proponent to undertake with their affected communities a process of community engagement, which must be free of external manipulation, interference, or coercion and intimidation. ■ Furthermore, in situations where the affected community is subject to various risks or adverse impacts from a project, the proponent must undertake a process of consultation so as to provide the affected communities with an opportunity to express their views on the project risks, impacts and mitigation measures, as well as

		allow the proponent to consider and respond to them. ■ Informed Participation: In case of project with significant adverse impacts on affected communities, the consultation process must ensure that free, prior and informed consultation with affected communities occur and that processes exist to facilitate participation by those affected. ■ Apart from the consultation process the Proponent's, must establish a Grievance Redressal Mechanism, which will allow the affected communities concerns and grievances about the Hydropower Project Owners environmental and social performance to be received and allow for steps to be taken to resolve the same;

6.2 Regulatory Requirements

Public consultation is mandated under national environmental law. The Pak-EPA, under Regulation 6 of the IEE-EIA Regulations 2000, has issued a set of guidelines of general applicability and sectoral guidelines indicating specific assessment requirements. The subject has been covered under Regulation 11 Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2021. These guidelines have been adopted by the KPK-EPA for use in its jurisdiction. This includes Guidelines for Public Consultation, 1997 (the 'Guidelines'), that are summarized below:

Objectives of Public Involvement: 'To inform stakeholders about the proposed project, to provide an opportunity for those otherwise unrepresented to present their views and values, providing better transparency and accountability in decision making, creating a sense of ownership with the stakeholders'.

- **Stakeholders:** 'People who may be directly or indirectly affected by a proposal will clearly be the focus of public involvement. Those who are directly affected may be project beneficiaries, those likely to be adversely affected, or other stakeholders. The identification of those indirectly affected is more difficult, and to some extent it will be a subjective judgment. For this reason, it is a good practice to have a very wide definition of who should be involved and to include any person or group who thinks that they have an interest. Sometimes it may be necessary to consult with a representative from a particular interest group. In such cases the choice of representative should be left to the group itself. Consultation should include not only those likely to be affected, positively or negatively, by the outcome of a proposal, but should also include those who can affect the outcome of a proposal'.

- **Mechanism:** 'Provides sufficient relevant information in a form that is easily understood by non-experts (without being simplistic or insulting), allow sufficient time for stakeholders to read, discuss, consider the information and its implications and to present their views, responses should be provided to issues and problems raised or comments made by stakeholders, selection of venues and timings of events should encourage maximum attendance'.

- **Timing and Frequency:** Planning for the public consultation program needs to begin at a very early stage; ideally it should commence at the screening stage of the proposal and continue throughout the EIA process.

- **Consultation Tools:** Some specific consultation tools that can be used for conducting consultations include; focus group meetings, needs assessment, semi-structured interviews; village meetings and workshops.

- **Important Considerations:** 'The development of a public involvement program would typically involve consideration of the following issues; objectives of the proposal and the study; identification of stakeholders; identification of appropriate techniques to consult with the stakeholders; identification of approaches to ensure feedback to involved stakeholders; and mechanisms to ensure stakeholders' considerations are considered'.

6.3 Objectives of Engagement and Consultation

Engagement and consultations with stakeholders leads to an overall understanding of the project on the part of the communities and also gives the proponent a clearer understanding of the stakeholder's perspective. Effective stakeholders' engagement and consultation can add substantial value to the EIA process. The information gained through engagement and consultation on the stakeholders' concerns, interests and their ability to influence decision-making helps to identify key cause of environmental and social concerns.

This can be used to evaluate direct and indirect environmental and social impacts and assess short term and long-term resource use implications. The input from local communities and affected stakeholders can help evaluating alternatives and strengthen the management planning by incorporating local inputs and know-how. These factors contribute towards improved project implementation sensitized to the human environment of the area. The objectives of stakeholders' engagement and consultations were to:

- Promote better understanding of the proposed operation through explaining its objectives and potential positive and negative impacts particularly on the local communities;
- Identify and address the concerns of all interested and affected stakeholders;
- Provide a mechanism to resolve issues identified by communities, before project plans are finalized and development begins, thereby, avoiding public outcry and resentment; and

- Instill trust between various stakeholders and the proponent to promote cooperation.
- In addition to above, also to assess and address some specific issues relating to:
    - Disruption of settlements, infrastructure, graveyard, shrine, earnings of people, who get benefits from the river, etc.
    - Depletion of the river bed for part of the year in the stretch between the weir and the powerhouse when the flows are diverted through the power tunnel.
    - Social concerns of the population settled on the high benches near both the portals of the power tunnel and the powerhouse that is not directly disrupted by the project.

6.4 Consultations during Implementation Stage of resettlement plan

Land Acquisition & Resettlement Plan (LARP) will be implemented with due consultation and consent of the APs. The representative of the implementing agency together with Social and Resettlement Experts will publish brochures, posters, leaflets, etc. explaining the impacts of the proposed project, compensation policies for APs, resettlement options/strategies for households, and tentative implementation schedule of the project. Furthermore, steps will be taken to keep the affected people informed about the land acquisition plan, compensation policies and payments, resettlement plans and strategies and to ensure that the APs and other stakeholders will be involved in making decisions concerning their relocation and implementation of the RP. APs will also be involved in the grievance redressal committees (GRC) to review and resolve, “out of court,” any dispute concerning compensation and other resettlement benefits.

This consultation will be very important and constitute a continuous process to develop a better understanding and participation of the stakeholders especially at the implementation stage. In each section of the weir being constructed, an interaction with the affectees will ensure its uninterrupted continuity and give a sense of ownership of the entire project developmental work. This information sharing will cover the following aspects:

a) Entitlement package applicable to the various types of affectees having their land and land based assets.

b) Tenants and laborers working at the farms, and cultivators having contractual arrangements under the lease agreements either formal or informal.

c) Difficulties being experienced by the affectees in the processing of their compensation cases.

d) Type of arrangements made towards rehabilitation and restoration of their livelihood.

e) Health, safety and environmental issues related with the project implementation stage.

f) Application submission procedure for the affected land and assets.

g) Kind of compensation for affectees.

h) Compensation to be paid to the family head or his representative.

i) One window operation for the purpose of early payment / resettlement.

j) Rented houses / shops, etc. and payment procedure.

Holding of regular meetings on given dates and places will ensure their availability and sharing the information, and to arrive at some conclusions in taking further steps to facilitate the project implementation, and address the concerns of the affectees in a mutually acceptable way. These meetings will facilitate two way communications i.e. from the project authorities to the affectees and vice versa. During this consultation, any problem as and when raised by the affectees, will be evaluated on its merit and some mitigation measures will be devised to either solve the issue or reduce its impacts to minimize the nature and extent of the problem. All such findings and solutions of the emerging situation in the project area will be discussed, as required, to facilitate the implementation of the project.

These meetings and interactions will also ensure the involvement and employment of the affectees in the project work by the contractors, against the opportunities available in accordance with the capability of the affectees, as feasible.

6.4.1 Community Stakeholders

During the field survey for this study, meetings were held with the communities residing within and around the project area and its surroundings. Kalam-Asrit villages headmen were particularly sought after for consultations. The objective of these meetings was to explore and record their views and concerns for inclusion in project design at the planning phase and subsequently to implement during the construction, installation, operational and decommissioning phases of the Hydropower plant project.

Table 6-2 Summary of Public Consultation

Sr. No.	Detail	Village /Settlement	No. of Participants
1	Consultative Meeting Resettlement Data Collection	Dadul Karoundoki	6
2	Consultative Meeting Resettlement Data Collection	Shaidbagh,	4
3	Consultative Meeting	Ariyane Bagla	16

4	Consultative Meeting Resettlement Data Collection	Asrit	4
	Consultative Meeting	Pushmal	10

Points Discussed

- Project components, activities and impacts.
- Needs, priorities and reactions of the affected people regarding the proposed project.
- Downstream environmental water requirements.
- Ensuring the participation of the PAPs in the resettlement planning
- Grievances redressal procedures.
- Entitlement Matrix development for affectees of the project.
- Evaluation criteria of the buildings.
- Basis for determining the rates of the land, houses, and other infrastructure.
- Compensation framework for the project affectees.
- Compensation criteria to be followed for the payment to the affectees.
- Role of affectees in implementation of the project.
- Social Issues.

6.4.2 Institutional Stakeholders

In the same vein, meetings were held with community and members of local and provincial government. All the stakeholders were briefed regarding the proposed project activities planned by Kalam-Asrit Hydropower project in Swat District of KPK province. Their concerns and suggestions were recorded in detail which are reproduced in this chapter. The consultation process was designed to be consistent with the relevant national legislation and the IFC PS1 on social and environmental sustainability. The institutional stakeholders consulted for the project included relevant government agencies, NGOs and private sector. The list of stakeholders consulted is shown in Table 6-6:

Table 6-3: List of Official Participants in the Meeting Held at Bahrain on April

Name	*Designation*	*Department*
Shoukat Ali	Field Assistant Agriculture (Extension)	Agriculture
Shah Aslam Khan	Range Forest Officer	Forest
Hayat Khan	SHO	Police - Security
Nawaz Ali	Fisheries watcher	Fishery

Saeed-ur-rehman	Forester	Forest

Table 6-4: List of Official Participants in the Second Meeting

Name	*Designation*	*Department*
Syed Khadim Shah	Sub divisional Education Officer (SDEO) (Additional charge) , Assistant SDEO (ASDEO)	Education
M Tariq Sir	Assistant SDEO (ASDEO)	Education
Mian Maqbool Ahmed	EPI technician Vaccination	Health
M Zubair	Incharge at BHU Bahrain	Health
Dr. Ghulam Subhani	DHO - Mingora	Health

Table 6-5: List of Stakeholders Consulted during EIA

No.	Name	Organization/Department	Designation
1.	Mr. Ajaz Ahmad	Wildlife dept, Swat, KPK	Divisional Forest and Wildlife Officer
2.	Mr. M. Saddique	Forest dept, Swat, KPK	DFO Madyan
3.	Ms. Naila Anjum	KPK Environmental Protection Agency (KPK EPA)	Assistant Director, Swat Division
4.	Mr. Muhammad Uzair	Agriculture Extension Department (KPK EPA)	Director
5.	Mr. Asad Ullah	Revenue dept, Swat, KPK	Tehsildar, Bahrain
6.	Mr. Hadayat Ullah	Tehsil Office, KPK	Assistant Commissioner
7.	Mr. Ajaz Ahmad	Forest Department of KPK	Divisional Forest and Wildlife Officer
8.	Mr. Ajaz Ahmad	Wildlife dept, Swat, KPK	Divisional Forest and Wildlife Officer

Table 6-6: List of Institutional Stakeholders during EIA

Stakeholders	*Date Consulted*
Government and Related	
Wildlife department (KPK)	September 01, 2021
KPK Environmental Protection Agency (KPK), Peshawar	September 01, 2021
KPK Environmental Protection Agency (KPK EPA), Swat	September 20, 2021

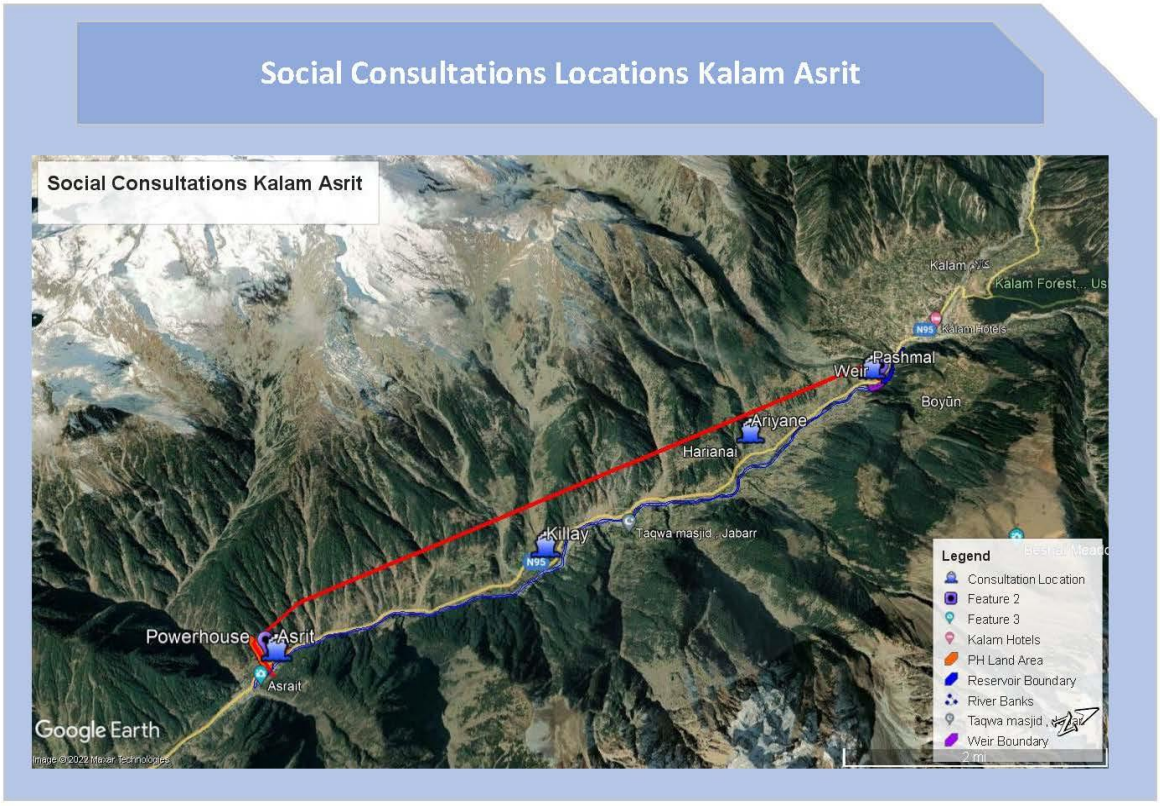
Stakeholders	Date Consulted
Agriculture Extension Department, Mingora	September 17, 2021
District Forest Department, Behrain	September 20, 2021
KPK Forest Department Mingora(KPK)	September 17, 2021
Assistant Commissioner, Bahrain (KPK)	September 20, 2021
Tehsildar, Bahrain (KPK)	September 20, 2021
Revenue Staff (Gurdawar and Relevant Patwari)	September 21, 2021

6.5 Community Consultations

6.5.1 Consultation Team

An EIA specialist (*environmental specialist)* directed the team, which included of stakeholder consultation experts and female/ sociologist and gender specialist that were familiar with the area and the local languages.

Figure 45: EIA Consultant Consultations Locations



6.5.2 Community Consultation Methodology

Community consultations were carried out in the project area through formal and informal meetings, focus group discussions and in-depth interviews especially covering issues related to 'gender'. The consultation exercise was conducted in and around Asrit and Kalam identified villages. The sociologist/gender expert, assisted by *environmental specialist* initiated the sessions by giving a brief, simple and non-technical description of the project providing an overview of all likely positive and negative impacts. This was followed by an open discussion in which all participants were encouraged to voice their concerns and opinions. Feedback obtained from the stakeholders was documented and all issues and suggestions raised were recorded in detail. Through this process the consultant reached out to a wide segment of the population of the area, whereby actively involving all stakeholders in the decision-making process.

All information was imparted to the communities and other stakeholders in such a manner that their expectations were not unnecessarily or unrealistically raised in order to avoid any future conflict involving local public, leaders or administrators.

Formal and informal community consultations and focused group discussions were carried out in almost all visited villages during the field survey for EIA. These meetings were conducted by a Pashto-speaking sociologist and gender specialist.

6.5.3 Community's Concerns & Reservations

All community members with whom meetings were held were open to the idea of development in the project area. No adverse concerns were raised, neither were there any objections to the project concept. Most people welcomed the idea of project activities sensing a relative boom in the localized economy particularly employments and provision of better civic amenities in the area. They envisaged the project activities a short-term as well as long term benefit for the communities residing in the area. However, the communities raised some legitimate concerns. The main concerns common to most communities are listed below:

- Local villagers shall be given priority during employment process for various project-related activities; especially local unemployed educated people shall also be given preference for technical jobs;
- Health facilities in the area are inadequate and need major reforms. Proponent in liaison with the related government departments should ensure that, provision of standardized and accessible health facilities to the marginalized communities of the area;
- Provision of educational facilities should be ensured to the children of the residing communities to equip and fight the emerging challenges of the 21st century;
- Access routes (road network) and means should be improved among communities away from the NH95;
- Local cultural norms should be respected;
- Communities' water resources shall not be over-exploited during project execution; and
- Safety and security of the local communities should also be given due consideration during the proposed project activities.

6.6 Other Stakeholders

In addition to holding consultation meetings with communities, meetings with members of local & provincial government and NGOs were also deemed essential. All the stakeholders were given maximum project information verbally and by sharing project area maps. Their concerns and suggestions were noted which have been reproduced below. A complete list of these stakeholders consulted is provided in **Table 6-3, 6-4, 6-5, 6-6**. Proceedings of the meetings with Board of Revenue, Swat (Revenue Officer, Bahrain), KPK Environmental Protection Agency (Deputy Director Technical in Peshawar and Regional In charge in KPK), KPK Forest Department (DFO, Madain), Local Landlord (Kalam-Asrit), Social Welfare Department (Social Welfare Officer, Bahrain) and KPK Health Department (Health Officer, Kalam-Asrit). The remaining meetings which were conducted consisted primarily of information collection and dissemination.

6.6.1 Board of Revenue, Swat

The survey team visited on September 01, 2021 Board of Revenue office to meet with Mr. Asad Ullah, Revenue Officer. Details of proposed project activities and the prospective area was briefed to Mr. Asad Ullah with the help of project area maps. Mr. Asad Ullah briefed that, the area is remote and not easily accessible to general public. He further added that, being a major stakeholder, it is our responsibility to maintain the land records and as the land has been already purchased for the purpose board will ensure that no land issues arise during the execution of the project activities. On behalf of Board of Revenue, Mr. Asad Ullah showed his reservations and suggestion regarding the proposed Hydropower plant project in Kalam-Asrit of Swat District, which are discussed as follows:

- To minimize the project's social adverse impacts on the existing communities, every effort should be made to uplift the social indicators of the area;
- The compensation for crops and other assets should be according to the current market rates as government rates are generally low.
- The compensation should be made to the affectees prior to the commencement of the civil works.
- As the local communities are completely dependent on agriculture and tourism, hence, these sources of income should be protected by adopting appropriate mitigation measures;
- Health & education system including infrastructure of the area needs to be improved by taking major reforms and taking all stakeholders onboard; and
- Locals should be given preference in employment process to help these marginalized communities

6.6.2 KPK Environmental Protection Agency (KPK EPA), Swat

A formal consultation was also held with Ms. Naila Anjum (Assistant Director, Tech) dated September 20, 2021, to discuss the environmental issues related to the

proposed project activities. During meeting, AZMEC team briefed regarding the proposed project, its location and environmental issues pertaining to the proposed project. Ms. Naila Anjum appreciated the idea and expressed interest in the briefing and provided his following valuable suggestions:

- All applicable laws, treaties, and regulations etc. (local & international) shall be complied during the proposed project execution in addition to best industrial guidelines ensuring no or least harm on the physical, biological and socioeconomic environment of the area.
- The methodology adopted to collect baseline data on floral and faunal attributes should be described in detail in the EIA report.
- Mitigation measures should be suggested in accordance with all possible aspects and their possible impacts; and
- Regional KPK EPA office based in Peshawar should also be taken onboard before execution of the proposed project activities.

Applicable environmental assessment guidelines for carrying out a detailed impact assessment are also crucial.

6.6.3 KPK Environmental Protection Agency (KPK EPA), Peshawar

The Proponent management paid a customary visit dated 6th September 2021 to meet Dr. Malik Amjad (Director General, KPK EPA) at his Peshawar office EPA's Representatives were informed about the proposed project activities and their anticipated environmental and impacts which may arise during the execution of the activities. All officials expressed much interest in briefing and provided valuable suggestions which are reproduced here:

- Baseline surveys including socio-economic, biological, and physical surveys should be done properly, especially the primary surveys should be done on comprehensive basis so that the issues can be identified properly, and their mitigations can be finalized.
- EIA should provide the commitment of the company for large scale tree plantation including tree plantation plan, tree species to be planted, identification of areas for planting, number of trees to be planted and timelines
- A waste and soil disposal plan should be provided as part of EIA including the allocation and identification of waste disposal sites, acquisition of these sites and design of these areas.
- CSR Plan should be prepared by the Proponent for the social benefits of the area.
- Local administration and other concerned stakeholders should also be taken onboard before, during and after the proposed project activities particularly Land Revenue Department; and

- The Proponent need to ensure No Objection Certificate (NOC) from Forest Department (if portion of the project land falls in the forest area), and NOC from wildlife department and fisheries department.

6.6.4 KPK Forest Department, Bahrain

A formal consultation meeting was held dated September 20, 2021, with Mr. M. Saddique to share the project related environmental issues and their potential impacts. Details of proposed activities and the prospective area were briefed to Mr. Sadique with the help of maps. Mr. M. Saddique was well versed about the developmental activities and presented his opinion openly. Furthermore, he confirmed that there is no reserved or protected forest area in and around the proposed project site in Swat District however, he expressed few certain concerns regarding the proposed project activities which are discussed as follows:

- A brief description regarding the major trees and floral species along the tunnel route, access road and in and around the weir and powerhouse.
- During the uprooting of the tree's presence of joint team of Forest Department, PEDO, Consultant Ecologist and Contractor Environmentalist must present at site.
- It is strongly recommended that the portion of financial resources as Corporate Social Responsibility (CSR) should be allocated for the sustainability of the biodiversity in the Project Area.
- The Contractor should reduce tree cutting during construction.
- Required data in the form of rates of trees, harvesting charges and Per CFT rates for standing volume was provided by the concerned office.
- It is suggested that the proper enumeration of tress during construction phases to compensate Forest Department Bahrain and local communities will be ensured according to law of land.
- Hydropower potential in the northern areas and evacuation of power from these projects was also discussed during the consultation.
- Forest department cooperation is available for any information and guidance regarding the proposed 238 MW Kalam Asrit Hydropower Project.

6.6.5 KPK Wildlife Department (WD), Swat

A formal consultation was also carried outdated September 01, 2021, with Conservator KPK Wildlife Department, Mr. Ajaz Ahmad for sake of identification and verification of wildlife protected area, to ascertain the existing faunal scenarios and potential environmental issues may arise related to the proposed project activities. Details of proposed activities and the prospective area was briefed to Mr. Ajaz Ahmad with the help of maps. Project specific reservations and suggestions were provided to the AZMEC team for the conservation, protection and management of habitats and wildlife of the area. Key points suggested by the Mr. Ajaz Ahmad, during the consultation meeting are listed as under:

- Wildlife Department was Contacted to ensure avoidance/mitigation Ban and Mankial Game Reserves, which are on higher altitudes and would not be affected
- Where construction is to be carried out in vicinity of protected forests and wildlife areas, the contractor will be required to provide awareness and training to ensure no hunting, poaching, impacts on vegetation and wildlife.

Mr. Ajaz Ahmad further emphasized on abidance of all applicable laws and regulations during the proposed project execution. In addition, best industrial guidelines shall be practiced ensuring no or least harm to the existing environmental conditions of the area.

The project area doesn't current include any work in the concern area highlighted by the Wildlife department.

6.6.6 Agriculture Extension Department, Mingora (Swat)

A formal consultation was also carried outdated September 17, 2021, with Director, Agriculture Extension Department, Mingora. Mr. Muhammad Uzair presented the following concerns and discussion on below topics was carried out.

- Brief discussion was carried out with the concerned department regarding purpose of visit and data requirements.
- Agriculture of the area including major crops, cropping pattern and growing seasons the proposed hydropower project AoI was also discussed.
- People have small holding of lands cultivated for the domestic consumption, try to avoid their agriculture land at maximum level during design.
- There must be provision of alternate jobs or livelihood development for affectees losing their agricultural land if it is only source of livelihood.
- Information regarding cropping pattern, yield and intensities were provided for the Project area.
- The project is appreciable in view of the prevailing electricity shortage.
- Compensation should be paid to the effected persons at current market rates and impacts of proposed project should be addressed in the EIA Report.
- The project is in national interest and should be executed. Ensure minimum loss of agriculture land.

6.6.7 Assistant Commissioner, Bahrain

A formal consultation was also carried outdated September 20, 2021 with Assistant Commissioner, Bahrain Mr. Hidayatullah have following observations regarding the proposed project;

- Under the national law, matters relating to land use and ownership are provincial subjects, and for the purposes of this project, the respective Revenue Department, KP are empowered to carry out the acquisition of private land or built-up property for public purposes. To depute land acquisition collectors (LACs) and other revenue staff who will be responsible for handling matters related to acquisition of land and the disbursement of compensation, the proponent must lodge applications with KP government.
- The proponent will provide logistical support and assist in preparing the documents necessary for notification. It will also need to liaise with the departments of agriculture, horticulture, and forestry to evaluate affected vegetation resources, such as trees and crops etc., for compensation purposes. Where public buildings/infrastructures are involved, the proponent will approach the relevant departments for valuation of the affected building or infrastructure before removing the facilities.
- Ownership status, khasra maps were collected by Social Specialist. Official rates of different types of lands were also collected.
- Likewise, the Proponent will liaise with other relevant departments/agencies for relocation of public facilities such as electricity and telephone poles, public water supply schemes, public buildings, etc.
- Although being beneficial, the project must fulfil and cater the safety measures considerable for protecting the nearby community, especially the pupils in the nearby schools.
- The current electricity demand in the country makes it necessary for the mega power projects to be executed.
- Environment and Resettlement Studies, Impact Assessment Processes under the local and international laws, were also discussed thoroughly during the meetings. Participation of the PAPs in the resettlement planning, Grievance's redress procedures, entitlement matrix, compensation of loss of business etc. were also discussed in detail.
- Local government assured their full moral and other support for the project.
- As the overall project seems beneficial for the country and its development, the representative of government have no concern against this project
- A joint visit to study area was scheduled with revenue team to verify status of impact areas, on next day i-e 21-09-2021.

6.6.8 Other meetings

Meetings were also held particularly with villages' heads to disseminate information regarding the proposed development activities. None of the stakeholders consulted during the consultation process showed any uneasiness or apprehensions about the proposed project. Important recommendation from villages' heads and local elders are as under:

- The local cultural norms should be respected.
- Locals should be preferred for employment.
- Roads, schools and health centers should be improved/developed; and
- The proponent should initiate comprehensive community development work in the project area.

6.7 Focus Group Meetings

During the survey all affected villages were visited and a brief verbal summary of the project was provided in local language. Feedback from villagers including men and women were collected separately. The objective of the survey was more to identify their concerns with respect to project construction and operational activities. In this stakeholder engagement, villages beyond the 1 km radius of the project site were also included. The scope of this stakeholders' engagement was to identify any aspect of project construction and operation which may have been overlooked during Environmental and Social Aspect Identification and Impact Assessment and to validate those aspects and impacts which have been identified and addressed in Environmental and Management Plan. Due to distances between the villages and lack of transportation facility, instead of conducting collective FGDs with all the villages at same time, each village was visited separately, and a group of village representatives was invited to attend the stakeholders' engagement meeting.

Discussion topics were put forward by the organizer and all the meeting participants were encouraged to share their concerns/issues for each discussion point. Different topics were brought under discussion including current sources of livelihood, current employment, local conflicts and tensions, environmental and social impacts from existing neighboring projects, cultural sensitivity, community perception of neighboring Hydropower project under construction and expectations from Proponent. and vulnerable groups were discussed during the stakeholders' engagement meetings.

The feedback from each participant group was documented for each topic and is summarized in below table for each visited village.

Table 6-7: Concerns of the Local Community

Sr. No.	Concerns Raised	Response by the Consultant	Responsibility
1.	Appropriate compensation should be provided to anyone who are losing their land/property due to the reservoir/weir or any project component.	Comprehensive Land Acquisition and Resettlement Plan has been developed for the resettlement of the affected people.	**KA POWER/PMU**
2.	Livelihood of the community shall be improved e.g. safe drinking water, education etc.	Proponent will contribute to the community through Corporate Social	

		Responsibility (CSR) keeping in mind the developments mentioned by the community.	
3.	People's homes are very important to them as they have been living since decades and hold value in terms of family ties.	People will be properly compensated for loss of houses and other assets. A comprehensive Resettlement Action Plan (RAP) has been developed.	**KA POWER/PMU**
4.	Land acquisition should be minimized. Those affected should be properly compensated. This should be done for all assets, not just land.	A comprehensive Resettlement Action Plan (RAP) has been developed for the resettlement of affected people. This includes compensation for loss of assets.	**KA POWER/PMU**
5.	Spring may dry due to construction activities especially in tunnel area.	If any local's water supply is affected, the Project will provide alternative supply. This is included in the budget of the EMP in Section 9, Environmental Management Plan.	**KA POWER/PMU**
6.	Increased traffic especially during construction will result in air and noise pollution	Ambient air quality monitoring has been carried out to establish baseline levels. Strict measures will be adopted to make sure that the air and noise poolution is not created during the construction. Impacts due to traffic are considered as part of the ESIA and mitigations for impacts due to increased traffic are provided in Environmental Management Plan	**KA POWER/PMU**
7.	Construction of the tunnel may result in instability and increase in landslides.	If there is any damage to community assets due to landslide caused by the tunnel construction, compensation will be provided.	**KA POWER/PMU**
8.	A few people said that their skilled children should be given employment opportunities during the construction and operation stage of the proposed project.	Noted down and it is the responsibility of the contractors that unskilled job opportunities should be provided to the locals.	**KA POWER/PMU/ Contractor**

9.	How the rates of crops and average yields will be determined.	The average yields and rate of crops will be market reflective and will be finalized with the involvement of relevant government departments.	**KA POWER/PMU/ Contractor**
10.	APs also demanded that KA should bound the contractor to hire the relevant skilled and un-skilled labour/ workers from the APs to compensate them during the interim period.	The contractor will be mandated to give priority in the hiring of skilled and unskilled workers from the APs as per their abilities to compensate their income loss during the construction phase.	**KA POWER/PMU/ Contractor**
11.	How compensation of the affected structures will be paid.	The cost of the affected structures will be assessed based on its construction category and type of material used. For compensation purpose, cash will be paid equivalent to replacement value of the affected structure.	**KA POWER/PMU/ Contractor**
12.	During the construction of the access road, try to use minimum land so that crop damage can be reduced.	During the construction stage, maximum effort will be made to avoid the productive cultivated land.	**KA POWER/PMU/ Contractor**
13.	How the affected trees will be compensated.	The APs were explained that the non-fruit trees will be assessed on the type and volume of wood of the trees and its utility in the open market. While fruit trees will be compensated according to the type, present age and productive life span of the trees. In addition, affectees will be allowed to take the trees to be cut with them.	**KA POWER/PMU/ Contractor**
14.	Due to movement of heavy machinery during the construction phase, movement of the locals will be restricted.	The contractor will be made bound that the movement of heavy machinery should not disturb the activities of the local people.	**KA POWER/PMU/ Contractor**
15.	Will there be any complaint system in the proposed project during construction?	There will be formal GRM at the PMU level and grievances redress committee will be formed, if APs have any	**KA POWER/PMU**

		complaints, they can register their complaints formally.	
16.	Will the poor people be paid any additional compensation, in addition to the standard compensation of the loss of crops?	In case of being vulnerable or severely affected, APs will be entitled for additional crop compensation.	**KA POWER/PMU/ Contractor**
17.	How much distance will be from weir to powerhouse?	It depends on the design of the tunnel; however, it will be approx. 10.5 KM.	**KA POWER/PMU/ Contractor**
18.	If the contractor damages the access road or any other asset falling within the access road, will that be compensated.	All type of loss or damages of crops, trees and structures occurred due to developing the access roads by the contractor will be compensated fully.	**KA POWER/PMU/ Contractor**
19.	Another suggestion by the APs of this project that new market should be developed and provided the shops of the affected people or assisted to develop an alternative site for business, prior to the start of the construction activities.	Compensation of the affected structures will be provided as per policy.	
20.	Before the start of construction activities, the community consultation should be done with the locals and especially PAPs.	Community consultation will be carried out during the construction stage	**KA POWER/PMU/ Contractor**
21.	The contractor should hire the local labour, so that chances of conflicts with the locals may be reduced or avoided.	Contractor will be made bound through the contract documents to hire the labour from the local villages.	**KA POWER/PMU/ Contractor**
22.	Vocation training / educations needs to be provided to local women, so that they could support their families by supplementing their household income;	Noted down	**KA POWER/PMU/ Contractor**
23.	Locals' roads should not be damaged by the construction and if damage than contractor should rehabilitate.	The contractor will be bound to rehabilitate the affected roads and tracks to their original position or better at the completion of the construction activities.	**KA POWER/PMU/ Contractor**
24.	Contractor should be bound to set up their camps away from the settlements.	Noted down	**KA POWER/PMU/ Contractor**
25.	Contractor should respect the privacy of local women.	Contractor should bound not to involve any unethical activity.	**KA POWER/PMU/ Contractor**

26.	Contractor should be bound to rehabilitate the damaged village roads / farm roads and water courses.	It should be part of the agreement that contractor will rehabilitate the damaged infrastructure	**KA POWER/PMU/ Contractor**
27.	The contractor should not use private land for parking of construction machinery and vehicles. For this proper permission from the landowner should be obtained and he should be paid rent.	Noted	**KA POWER/PMU/ Contractor**
28.	Contractor should not dump the construction materials in the private fields.	Noted	**KA POWER/PMU/ Contractor**
29.	Contractor should adopt measures to minimize dust, smoke and noise pollution, and to control oil spillages from the construction machinery.	Noted	**KA POWER/PMU/ Contractor**
30.	Government should arrange awareness campaign from time to time for the safety of the installations and public information.	Noted	**KA POWER/PMU/ Contractor**
31.	Development projects are generally delayed due to litigation. Government should prefer to settle the disputes at the spot through some proper arrangement, to avoid litigation.	Noted	**KA POWER/PMU/ Contractor**
32.	Compensation to the affected people should be fair, prompt and transparent.	Noted	**KA POWER/PMU/ Contractor**

6.8 Corporate Social Responsibility

CSR is defined as organizations position and activities with reference to perceived stakeholders or at the least societal responsibilities (Brown & Dacin, 1997). To understand the precise definition of CSR and its importance for the companies, one needs to understand their stakeholders' needs and ambitions while formulating their CSR strategies (Welford, 2005). Their involvement will show the organizations legitimacy and will also provide the organization with an opportunity to work in a balanced way between private and public benefits (Hess & Warren, 2008). To sum it up, CSR is an idea that must be placed in a relevant context. Literature review reveals that in Pakistan many NGOs (as stakeholders) are taking responsibility by working together with organizations on CSR issues. However, companies are yet to involve the stakeholders in their strategic processes related to CSR (Khan, 2006; SECP, 2005). The Securities and Exchange Commission of Pakistan (SECP), a government regulatory authority, presented a survey-based report on CSR in 2005. According to

this report companies in Pakistan are focused mainly on philanthropic work and legal compliance. Focus is limited on initial policy developmental stages of CSR. Companies' plans are short term and efforts are more situational and not a part of a continuous strategic process. CSR activities strengthen the bond among employees as well. Corporate Social Responsibility (CSR) also goes a long way in building a positive image of the brand and the brand becomes a "common man's brand". People start believing in the brand and nothing can help more than customers trusting the brand. Positive word of mouth eventually helps to generate more revenues for the organization. As per law things should be grown if the company wanted to get an approach to work on professional ground and get good understanding with the local community. Below are some suggestions proposed for the company for the activities done under CSR:

1 Promotion and attaining sustainability in the tourism sector by planning and devising a tourism management plan to facilitate the rising tourism in the area with initiatives such as planning and selection of tourist sites around hydropower project, provision of land to affectees near tourist hot spots within project premises for improving their domestic economics.

2 Vocational centers should be opened for women to promote women skills in handicraft and empower then economically which will enhance the tourism area.

3 Improve the current educational infrastructure in partnership with NGOs within project premises so students get educated and combat the challenges of 21st century

4 Medical camps should be initiated to give relief to the surrounding villages of proposed project site.

5 Mostly women are active and working in agriculture and livestock activities, so the activities must consider the cultural norms and issues related to gender.

6 Employment provision for the locals to eradicate poverty.

7 Skill trainings for the women in their specific fields like Traditional Birth Attendants and Health.

8 Improving the waste management settings in collaboration with the local district government.

6.8.1 Key Findings and Issues

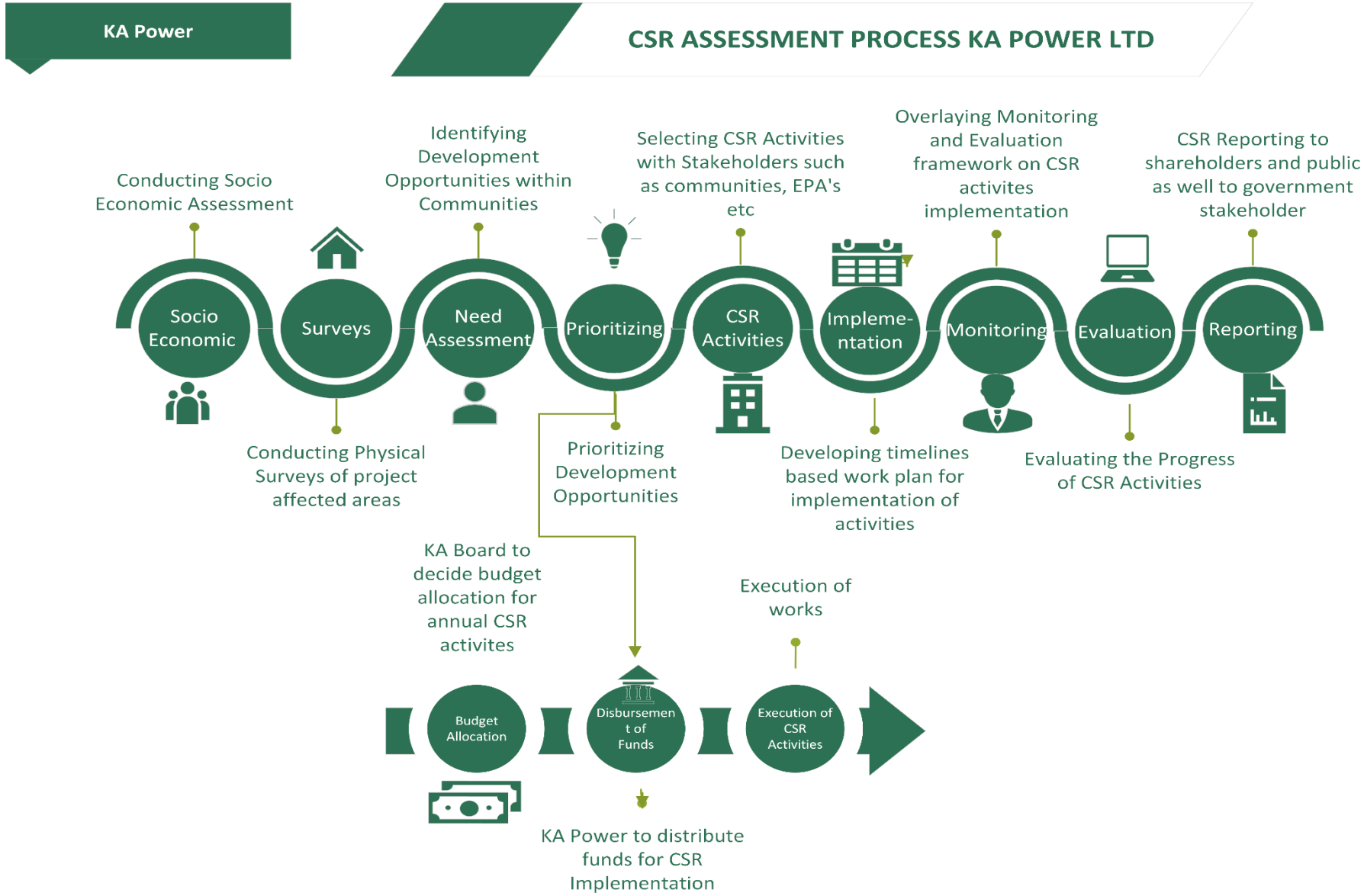
- Most of the communities and to some extent the local influential people are not concerned over the environmental or social issues. They are mostly interested in getting maximum benefits in terms of employment, local market boom especially with tourism and property prices and community development programs;
- People have hopes that the company would employ locals during its operations;

- The biggest aspiration of the locals is getting one thing i.e. 'employment'; and promotion of tourism sector for employment opportunities.
- People have hopes that the company would develop and improve the infrastructure in terms of schools and better health facilities in the area.

For the purpose of project cost the budget will be divided in two parts i.e., Community Investment Program (CIP) & Corporate Social Responsibility (CSR). Most IPPs in the country divide total budget in these two heads. However, the Proponent will finalize CSR programs before start of construction activities based on consultation with affected community and line departments and will share with stakeholders before finalization.

CSR IMPLEMENTATION STRATEGY

- To implement the CSR in transparent & effective manner, a CSR management committee will be constituted with representation from all relevant stakeholders.
- Proposed members of CSR committee are team members of KOAK Power (admin, finance, PD, technical representatives), EPC Contractor (if it agrees to share the expense) and minor representation from community.
- Selection of projects for CSR, budget approval, procurement and monitoring will be done through CSR Management Committee.
- Collaboration with counter department of the provincial government will be made by the CSR Management Committee ensure effective implementation and acknowledgement


KA Power
CSR ASSESSMENT PROCESS KA POWER LTD
Conducting Socio Economic Assessment
Identifying Development Opportunities within Communities
Selecting CSR Activities with Stakeholders such as communities, EPA's etc
Overlaying Monitoring and Evaluation framework on CSR activites implementation
CSR Reporting to shareholders and public as well to government stakeholder
Socio Economic
Surveys
Need Assessment
Prioritizing
CSR Activities
Impleme-ntation
Monitoring
Evaluation
Reporting
Conducting Physical Surveys of project affected areas
Prioritizing Development Opportunities
Developing timelines based work plan for implementation of activities
Evaluating the Progress of CSR Activities
KA Board to decide budget allocation for annual CSR activites
Execution of works
Budget Allocation
Disbursement of Funds
Execution of CSR Activities
KA Power to distribute funds for CSR Implementation

Photographs: Stakeholders Consultation Record

6.9 Consultation beyond the EIA Process

The Proponent is committed towards the stakeholders' engagement process throughout the lifecycle of the Project. In this regard E&S team of the Proponent along with Project management will continue community engagement activities throughout the life of the Hydropower Project operations. Visits will be undertaken in all the communities at least twice a year, depending on the number of concerns raised under each consultation. Ongoing community engagement activities relevant to the EIA include:

- Ongoing reporting on progress on the implementation of environmental and social management measures identified during the EIA process and recording of comments on the effectiveness of these measures.
- Updating communities about new project developments and recording comments on these; and,
- Ongoing operation of the grievance redress mechanism (SEP **Section 7**).

Table 6-8: List of Stakeholders and their Relevance for the EIA and the Project

Stakeholder Group.	*Stakeholders*	*Engagement Method*	*Frequency*
Regulatory Institutions	❖ KPK Environmental Protection Agency (KPK EPA), Peshawar ❖ KPK Environmental Protection Agency (KPK EPA), Swat	❖ Face-to-face ❖ meetings. ❖ Periodic reports	❖ Annually or earlier, if required
Government Institutions	❖ KPK Forest Department, Bahrain ❖ KPK Forest Department, Bahrain ❖ Board of Revenue, Swat	❖ Face-to-face ❖ meetings. ❖ Periodic reports	❖ Annually or earlier, if required
Non-Governmental Organizations and Civil Society Organizations	❖ There are several NGOs ❖ operating in KPK. ❖ The NGOs working on protection and management of ❖ wildlife and natural resources and gender-based issues are: ❖ Sarhad Rural Support Program (SRSP). ❖ Idara Barai Taleem-o-Taraqi (IBT)	❖ Notification and availability of information on website ❖ Invitation to ❖ public events	❖ As and when the ❖ information is ❖ available or the ❖ meeting is held

Communities within a 1km buffer	❖ Communities within the buffer of project	❖ Meetings with the communities ❖ Group meetings	At least twice every year

7 Potential Environmental and Social Impacts and Mitigations

This section of the EIA report identifies and evaluates the potential environmental and social impacts of the proposed Kalam-Asrit Hydropower project on the physical, biological, social and socioeconomic environment within the area of operation as well as AoI. The environmental consequences of the construction of hydropower project (Dams) are numerous and varied, and include direct impacts on the biological, chemical, and physical properties of the rivers and riparian's (or "stream-side") environment. The construction of weirs, in general, has both beneficial and adverse impacts on different physical, biological socioeconomic and cultural parameters in relation to water and land, and the existing ecosystem balance.

The construction of 238 MW Kalam-Asrit HPP will also have some impacts on such parameters, which need to be identified. For this purpose, a checklist in accordance with the EPA a guidelines has been prepared. This checklist provides the significance of different parameters due to environmental impacts/issues of the project. The likely impacts were assessed for all activities during the construction, installation, operation and decommissioning phases of the proposed project development.

The identification and assessment of environmental impacts were based on American Society for Testing of Materials (ASTM), World Bank Environmental Assessment Sourcebook, ISO 14001/14004 guidelines IFC PSs and lenders' requirements which include the following steps:

- Identification of major activities of the project during the establishment of the proposed Hydropower generating plant;
- Identification of all the potential environmental aspects (hazards or sources of potential impacts) associated with each component of the activity; and
- Assessment of significance of identified environmental impacts.

Based on the above steps, major activities during the proposed project were identified. The associated environmental and social aspects were identified based on the project description. All potential impacts from the proposed project have been evaluated as part of the assessment process – effluent, ambient air quality, noise, surface and groundwater, geology, ecology and socioeconomics as per IFC PS. Project specific Environmental and Social Management Plan (EMP) is provided in **Volume II** of this EIA report.

7.1 Impacts Associated with Proposed Project Activities

A detailed screening process of proposed project activities in different phases of project cycle was carried out for identification of adverse environmental and social impacts by preparation of environmental assessment checklist in line with EPA KPK

requirements and guidelines. The whole project was divided broad phases which may pose environmental and social impacts:

- Construction phase
- Operational and maintenance phase
- Decommissioning phase

7.1.1 Impacted Areas

The area of direct influence of the project starts from the upper limits of the catchment of the reservoir and extends to the downstream of the weir axis. It, therefore, includes the watershed and river valley below the weir and the powerhouse area along with existing and new access roads. Although there are direct environmental impacts like dust, erosion, borrow and disposal problems, etc. associated with the construction of the weir, yet the greatest impact is due to the impoundment of water, flooding of land from the reservoir and alteration of water flow downstream. These effects have direct impacts on soil, vegetation, wildlife, land, fisheries, and climate, especially on the socioeconomic conditions of the human beings of the project area.

The indirect effects, which at times may be worse than the direct effects include those associated with the building, maintenance and functioning of the project due to the access roads, construction camps, power transmission lines, development of agricultural, industrial, or municipal activities made possible by the implementation of the project.

7.2 Methodology

The EIA experts involved during the study has adopted general methodology used for impact assessment which is described the coming section.

It describes the process of impact identification and definition, significance rating, the mitigation, management and good practice measures based on the EIA's conducted in Pakistan renewable energy sector based on International Financing such as IFC/ADB.

7.2.1 Identification of Potential Impacts

In the first step, potential impacts of the project are identified by desktop screening exercise, professional judgment, published literature on environmental and social impacts of similar projects and standard national/international environmental guidelines. Another critical step in identifying potential impacts is, discussion with the Proponent., consultation with stakeholders **(Section-6)** and communities to identify their concerns and reservations. Stakeholder consultation was also carried out to identify the concerns of primary and secondary stakeholders.

The main aspects associated with potential environmental and social impacts are as follow:

- Geomorphology and soil

- Water resources (aquifer and surface water quality);
- Project wastes
- Air quality
- Noise
- Greenhouse Gases (GHG) emissions and ozone depleting substances
- Ecology (including flora and fauna)
- Vehicles movement
- Socioeconomic conditions (Macroeconomic impacts, Livelihood and well-being, Cultural heritage, Community and Social Network, Indigenous people, Land acquisition, Aesthetics and tourism, Traffic and road, Occupational health and safety)
- Occupational and community health safety
- Land acquisition and resettlement
- Ecological flows

7.2.2 Impacts Classification

The potential environmental and social impacts are classified according to the type of potential receptors. The following receptor categories were used:

- Community (people, their social and cultural values, aspirations, and archaeological sensitivity).
- Land and soil (land and soil resources).
- Air quality (ambient air quality and GHG emissions).
- Water resources (aquifer and surface water resources)
- Ecosystem (vegetation, wildlife, and biodiversity) and
- Socioeconomic Environment (Macroeconomic impacts, Livelihood and well-being, Cultural heritage, Community and Social Network, Indigenous people, Land acquisition, Aesthetics and tourism, Traffic and road, Community health and safety)
- Occupational health safety (OHS related construction safety issues (including floods, earthquakes) during construction works.
- Land acquisition and resettlement impacts on the directly displaced communities.

7.2.3 Impact Scoping Matrix

Impact scoping matrix mentioned in table below is developed on the basis of following consideration:

- Outcome of the present baseline conditions and the changes in environmental and social parameters which are likely to be affected due to the proposed project related activities;
- Any impact by which applicable environmental or social standards such as the National Environmental Quality Standards (NEQS) or international

environmental guidelines such as the International Finance Corporation (IFC) and WHO environmental guidelines applicable to the project will be breached;

- Any high risk of permanent, irreversible and significant change to environmental conditions due to the particular project activity; and
- Any concern related to aspects/potential impacts by the community.

Table 7-1 Impact scoping matrix

Project Phase	Environmental Impact	Social Impacts
Construction activities involving access road to site, site survey, soil investigation, site clearing, excavation, earthwork, headworks, waterway, powerhouse, tailrace, mobilization/ demobilization of equipment & labor	▪ Water resource depletion ▪ Landscape disturbance ▪ Soil erosion, removal of topsoil, contamination/ spillage ▪ Waste generation from construction activities exerting pressure on existing facilities ▪ Hazardous and non-hazardous waste generation ▪ Vehicles and equipment exhaust emissions ▪ Noise pollution Impacts on ecology and biodiversity	▪ Traffic disturbance, uneasiness, and road accident ▪ Employment conflicts ▪ Increased pressure on existing health facilities ▪ Employment opportunities Grievances related to wages etc.
Operational activities involving vehicles operation, maintenance activities and base campsite's & related operations	▪ Land and soil contamination ▪ Hazardous and non-hazardous material usage and storage ▪ Vehicles and machinery exhaust emissions Noise from operation	▪ Dust generation from vehicular movement Employment opportunities

7.2.4 Impact Assessment

The method defines three levels of consequence (or severity) and likelihood (or probability of occurrence) of any impact i.e.

- High
- Medium
- Low

A standard risk-based approach has been used in which the significance of an Environment and Social impact is determined on the basis of the level of consequence and likelihood of the impact e.g. an Environment and Social impact of medium severity is assigned a low significance if the likelihood of occurrence of the impact is low and high significance if the likelihood of occurrence is high or almost certain. The definition of consequence and likelihood is illustrated in table below:

Level	Consequence (Severity of Impact)	Likelihood
High	Serious/catastrophic damage to local and regional environmental and social issues. Direct E&S legislative requirements of KPK EPA, IFC and Corporate requirement. Serious threat to corporate reputation/profitability/ability to do business due to social and environment issues and conflicts.	High likelihood of occurrence during lifetime of operation regular/continuous part of operations
Medium	Measurable weightage to the environment and social. Subject to potential future legislation. Potential to affect reputation/cost. Implication/reduced efficiency such as social conflicts resulting in strikes at Regional and local level.	Moderate possibility of occurrence during lifetime of construction such as local strikes on job opportunities. Periodic/occasional part of operations
Low	Negligible weightage to the environment and social values around the hydropower project setting. No risk to Proponent business portfolio due to environment and social issues.	Unlikely to occur during lifetime of operation

Environment and Social Impact significant matrix is provided in table below:

Consequence	**Likelihood**		
	High	Medium	Low
High	High	High	Medium
Medium	High	Medium	Low

Low	Medium	Low	Low

The prediction of Environment and Social impacts also includes the duration of impacts (in terms of long, medium and short term), nature of social or environmental impact and geographical location of the impact as well as reversibility of the impact. Environment and Social Impact assessment criteria for the above mention parameters are illustrated in table below:

Impact Characteristics	**Categories**
Nature of the Environment and Social impact	Direct – The environmental or social parameter is directly changed by the project such as direct use of ground water, relocation of access road etc. Indirect – The environmental or social parameter changes because of change in another parameter. E.g., spills which impact soils indirectly.
Duration of the Environment and Social impact	Short term – Lasting only till the duration of the project activity such as noise from the construction activities, relocation of access roads. Medium term – Lasting for a period of few months to a year after the project activity before naturally reverting to the original condition such as contamination of soil or water by fuels or oil, rehabilitation of vegetation loss. Long term – Lasting for a period much greater than medium term impacts before naturally reverting to the original condition such as loss of soil due to soil erosion.
Geographical location of the Environment and Social impact	Local – Within the area of project i.e., operational site and access road. Regional – Within the boundaries of the project area/region at district or provincial level. National – Within the boundaries of the country.

- Identification of the mitigation measures – If it is determined that the predicted impact is significant, suitable and effective mitigation measures will be identified for the impact.
- Evaluation of the residual impact – Incorporation of the suggested mitigation measures reduces the adverse impact of the project and brings it within the acceptable limit. This step refers to the identification of the anticipated remaining impacts after mitigation measures have been applied i.e. the residual impacts.
- Identification of the monitoring requirements – The last step in the assessment process is the identification of the monitoring requirements. The scope and frequency of the monitoring depends on the residual

impacts. The purpose of monitoring is to confirm that the impact is within the predicted limits and to provide timely information if unacceptable impact is taking place.

An Environmental Management Plan (EMP) Volume II has been developed with identification of monitoring requirements. **Table ES -1 and Table ES-3** summarizes the assessment of environmental and social impacts of proposed project activities with their significance. The table is structured according to the main issues and effects resulting from the proposed project activities across the following project phases:

- Construction Phase – This involves all activities for the construction of the Hydro power plant.
- Operation & Maintenance Phase – This refers to the Hydro power plant operation & maintenance processes.
- Decommissioning Phase – This refers the Hydro power plant decommissioning/restoration activities (if required).

7.2.5 Residual impact

Residual Environment and Social impacts that remain after mitigation measures, including those incorporated into the project's base case design in addition to those developed as part of the base design.

The residual Environment and Social impacts assessment identifies which project activities are likely to result in a semi-permanent to permanent change in the natural (i.e. physical & biological) and/or socioeconomic environments. The significance of this change has also been assessed.

7.3 Impact Assessment for Proposed Project (All Phases)

In this section, environmental and social issues associated with the construction, installation, operational and restoration phases of proposed project are identified, and their impacts are examined as per the categories mentioned in section 7.9 of this chapter. These impacts are broadly examined under following categories:

- Impacts on physical environment including soil, water, noise and air etc.;
- Impacts on biological environment including flora and fauna; and
- Impacts on socioeconomic, cultural and archaeological environment.

7.4 Impacts on Physical Environment

7.4.1 Land & Resettlement Impact

Total of 256.7 Kanal of land will be required for permanent acquisition. Out of which 231.25 Kanal is privately owned land and remaining 25.45 Kanal is government owned land. Out of 571.15 Kanal, 314.45 Kanal is the temporary acquisition. This land is totally owned by government and consist of cultivable and waste land.

The land ownership record shows that the project will impact on 314.45 kanal of cultivable land. Through the record of land department, out of 256.7 Kanal, 25.45 Kanal

is government owned and remaining 231.25 Kanal is owned by individuals. Among 339.9Kanal (314.45 Kanal is temporary required) of government land, 30 Kanal is under the possession of forest department.

Details of permanently and temporary acquisition of land is given in Table below

Table 7-2 Acquisition of Land & Resettlement

Sr. No.	Item	Unit	Area
1.	**Permanent Land**	**Kanal**	**256.7**
	Reservoir	Kanal	47.6
	Weir	Kanal	30.2
	Disposal - I	Kanal	8.85
	Disposal - II	Kanal	1.9
	Disposal - III	Kanal	25.55
	Powerhouse	Kanal	142.6
2.	Temporary Land	Kanal	314.45
3.	Disposal - III	Kanal	8.95
4.	Disposal - IV	Kanal	111.65
5.	Disposal - V	Kanal	37.9
6.	Disposal - VI	Kanal	60.95
7.	Powerhouse	Kanal	45
	Worker camp	Kanal	50

The socioeconomic profile of the project affected families was collected through interviews and questionnaire method. 7 households would be affected at weir site, Muhallah Shaid Bagh and 4 are located at powerhouse area i.e. Asrit. The total population of the affected households is 73, detail consultation meetings @100% of the households were conducted with affected households. Number of affected households and population due to construction of the project is shown below:.

Table 7-3 Impact on Houses & Population

Village Name	Affected Households	Affected Population
Muhallad Shaid Bagh, Pushmal (Weir Site)	7	44
Asrit (Powerhouse Area)	4	29
Total	11	73

Details of land and other impacts are shown in figures below.

Figure 46: Impact on Land – Powerhouse

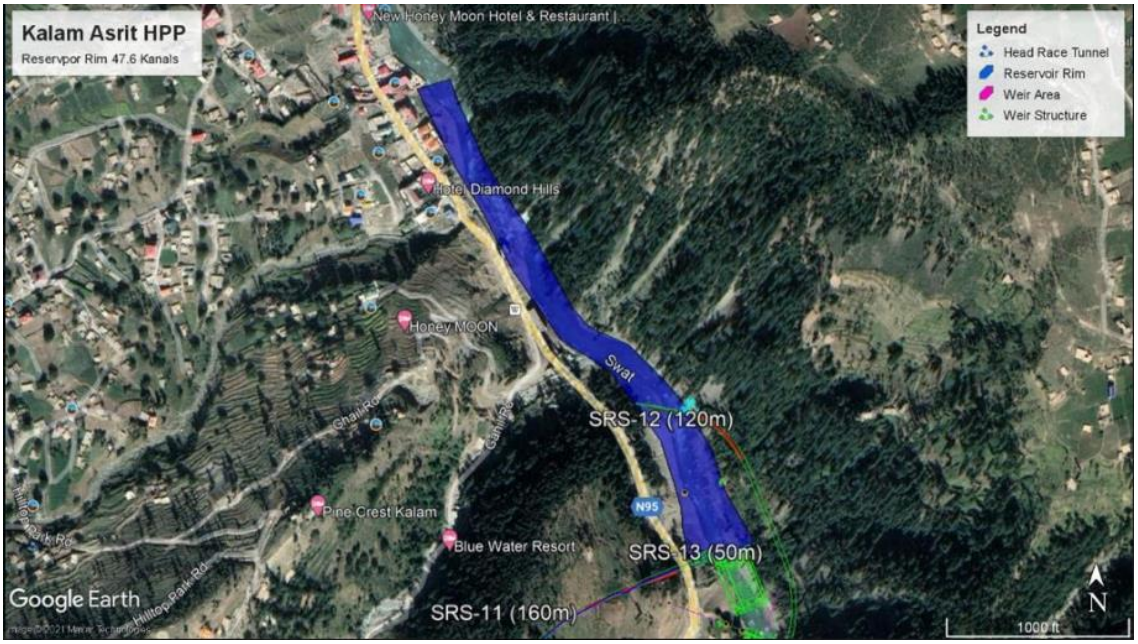


Figure 47: Impact on Land – Weir & Reservoir

Impact 01 & 02: Temporary & Permanent Land Acquisition and Resettlement						
Applicable Project Phase			*Construction and Operations*			
Initial Impact Rating	Nature	Duration	Geographical Scale	Severity	Likelihood	Significance
	Direct	Short Term	Local	Medium	Low	Medium
Mitigation Measures:						

1. A comprehensive Land Acquisition and Resettlement Plan is developed and annexed (Volume III) with this EIA report.

Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short Term	Local	Low	Low	Low

Recommendation: It is recommended that local market competitive prices of land are provided to the owners as well as LARP is implemented.

7.4.2 Soil and Water Contamination

Impact 03: Assuming that the area is a mountainous region/stony with soil, it is anticipated that during construction & operation phases spills to soil can occur.

Applicable Project Phase *Construction and Operation*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Indirect	Short	Local	Medium	Medium	Medium

Mitigation Measures: The proposed mitigation measures to reduce the impacts on soils during the proposed construction activity of the project are given below:

1. A spill prevention and response plan will be prepared by the contractors to control any inadvertent leakage or spillage. Spill response measures shall be implemented (as necessary e.g., containment basins) to contain and clean up any contaminated soil.
2. Construction of bunds around relevant work and storage areas. Bunds in areas of hazardous chemical storage (including temporary storage) should be lined to contain accidental spillage and minimize the potential for migration to the underlying soils.
3. On-site maintenance of construction vehicles and equipment will only be carried out at designated points.
4. Regular inspections will be carried out to detect leakages in construction vehicles and equipment.
5. The bottom of any septic tank will be constructed at least 100 meters away from springs and water bores
6. Any spilled chemical shall be immediately collected and disposed of in accordance with Spill Prevention and Response Plan and MSDS; and
7. Contractors should ensure that a spill kit and adequate PPEs are available at the site for emergency cleanup activities in case of any chemical/oil spillage.
8. Record of spills and volume of removed contaminated soil will be maintained.
9. Collect runoff from maintenance workshops using impervious channels and pass-through oil water separators (OWS) before final disposal. Properly dispose of the sludge and oil collected at the OWS.

10. Build separate impervious pits (with concrete walls and proper shed) at the construction sites for temporary handling and storage of contaminated soil and water if encountered during construction such as sludge from OWS.
11. Keep all fuel storage tanks and lubricating oil drums in secondary containment impervious pits with impervious shed walls.
12. Avoid on-site maintenance of construction vehicles and equipment, as far as possible.
13. Store fuels and lubricants in covered and dyked areas, underlain with impervious lining.
14. Spill control kits (shovels, plastic bags, and absorbent materials) will be available near fuel and oil storage areas, vehicle parking, and vehicle maintenance areas as well as at construction sites.
15. Remove contaminated soil from the site and dispose of in a manner to ensure the protection of water sources.
16. Construct the bottom of any soak pit or septic tank at least 100 m away from springs and water bores.
17. Maintain records of spills and volume of removed contaminated soil.
18. Maintain a record of remedial measures taken.
19. Use silt traps to prevent contamination of river and streams.
20. Mechanical works and shops, secondary containment (>110% of volume) for storage and use of paints and other hazardous materials should be done over impermeable surfaces.
21. Incorporate the above measures in the Construction Site Environmental Management Plan

Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Indirect	Short	Local	Low	Low	Low

Recommendation: The bottom of any septic tank shall be at reasonable distance above the groundwater table. The distance can be reduced, based on the soil properties, if it is established that distance will not result in contamination of groundwater.

Assuming that the area is a mountainous region/stony with soil, it is anticipated that during construction & operation phases, impacts of spills' likelihood to soil will be medium, with a medium consequence, yielding low impact significance. Through implanting project specific spill response procedures and proper storage and handling of any chemicals on site, the impact probability will be reduced

Assuming that spill response plans would be in place by the operational contractor/s, it is anticipated that during operational and decommissioning phase impacts of spill

likelihood to soil will be low, with a low consequence, yielding medium impact significance. Therefore, for operational phase likelihood of impact is low, with a low consequence, yielding overall low impact significance.

7.4.3 Disposal Areas and Excavated Waste Material

Waste material will be generated during the excavation of different components of the project. In this project, a tunnel of over 10 km is to be constructed. The muck produced by excavation of the tunnel is a major spoil. Moreover, all other excavation works generally generate spoils and these types of spoils consist of debris, stone dust, waste rock, etc., which need to be disposed of.

Impact 04: Pollution due to solid waste from the construction activities and municipal waste from construction camps.

Applicable Project Phase *Construction and Operation*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Indirect	Short term	Local	Medium	Medium	Medium

Mitigation Measures: The proposed mitigation measures to reduce the impacts on soils during the proposed construction activity of the project are given below:

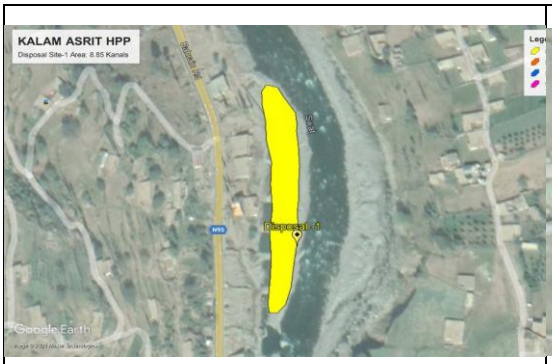
1. A spoil disposal plan will be developed by contractor as a part of SSMP.
2. Slope protection of the disposal area are important and must be ensured by Contractor to control any sediment erosion and flow.
3. Solid waste collection points will be developed in the labor camps and construction areas by the contractor.
4. A system of collection, segregation, storage, and transportation should be in place to transfer the solid waste to the waste disposal sites. The solid waste so deposited in the waste site and will be covered with earth after each filling to avoid unpleasant conditions for the surrounding area people
5. Solid waste generated during the construction phase will consist primarily of surplus concrete and cement, rejected components and materials, metal cuttings, packing crates and domestic garbage, etc., which will contaminate the soil, groundwater, surface water and the air quality
6. The muck produced by drilling of approx..10 km long headrace tunnel is a major construction waste spoil. Land is selected at different places near the edits of the tunnel, where this spoil material can be disposed of. (See figure48) After disposal, the area will be levelled properly and can be used as residential or commercial land. The land can later also be utilized for agriculture after putting a layer of soil on it or used for construction of hotels/camp hotels in the summer season.
7. Adopt slope stabilization measures such as adequate vertical and horizontal drains, drainage along roadsides, cross drainage and retaining walls.

8. Monitor slope movements around excavation work areas.
9. Salvage, store, and reuse all topsoil at all construction sites.

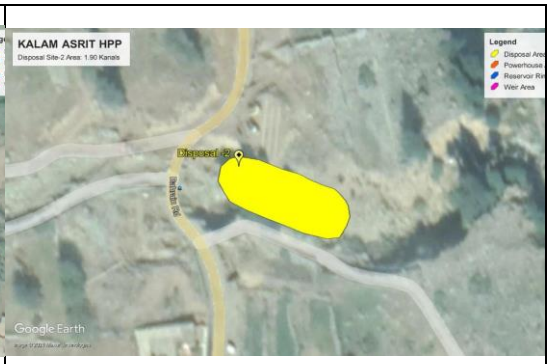
Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Indirect	Short term	Local	Low	Low	Low

Recommendation: The bottom of any septic tank shall be at reasonable distance above the groundwater table. The distance can be reduced, based on the soil properties, if it is established that distance will not result in contamination of groundwater.

Slope stabilization of spoil tips are very important and must be ensured with proper designing of spoil areas.

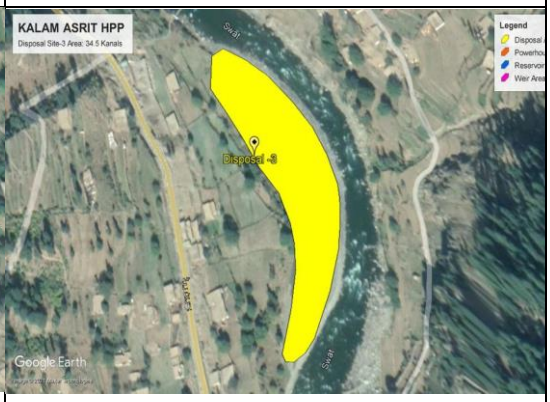


View of disposal area #1



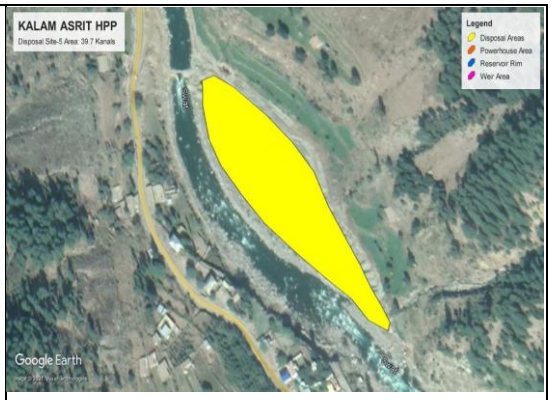
View of disposal area #2

View of disposal area #4



View of disposal area #3

View of disposal area #6



View of disposal area #5

Figure 48: View of Waste Disposal Areas

7.4.4 Water Resources

Potential Sources

Water, within the project area and its surroundings is relatively abundant resource (River Swat).

On priority the water for proposed project activities will be obtained from local contractors (In case available) or River Swat. Proponent in addition to local Contractors may adopt obtaining water from water wells keeping in view the conservation aspects to best comply with compliance of the aspect. Therefore, water for proposed project activities can be obtained from existing water wells in the areas close to the project area with the help of local community members. The aquifer yield will be calculated for ensuring that the available capacity at the local tube well (safe yield minus local demand) is at least 50% greater than the project demand. Discharge from the tube well will be regularly monitored to monitor any changes in the yield of the well. With regards to water usage, it should be recognized that groundwater is a communal resource. To share the groundwater in the project area with the local communities, Proponent must ensure that its construction and operational activities must not exploit the resource in an unsustainable manner and that local communities are compensated for the use of the communal resource.

Therefore, for water abstraction compensation payment will be done to the local well owner at the market price of the quantity of water obtained ensuring no overexploitation. Proposed construction, operation and decommissioning activities of Hydropower plant could affect the area's water resources in two ways:

- Reduction from use/overuse for locals
- Contamination

7.4.4.1 Reduction from use/overuse for locals

Impact 05: Construction and Decommissioning activities by use of tanker water may pose quantitative impact on local water resources of the project area. The effect on

local wells can be significant enough to cause any localized depletion of aquifers or effects on local water requirement only in case water acquired from the local wells however the EPC Contractor priority will be local Contractors.

Applicable Project Phase *Construction and Decommissioning*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Medium	Local	Medium	Medium	Medium

Mitigation Measures: The mitigation measures described below will ensure that the project area's groundwater resources are not significantly affected by activities. of hydropower project and the measures are given below:

1. The water extraction will be kept at minimum.
2. The quantity of water used will be kept to the minimum required by taking prudent water conservation measures on site.
3. A complete record of water consumption during all operations will be maintained.
4. Care will be taken while moving heavy machinery to avoid damage or blockage of natural waterways and channels.
5. Water required for construction activity may be obtained from available local water supply Contractors on first priority.
6. In case water is acquired from local community water wells, the water from a local well will only be used after ensuring that the available capacity at the tube well (safe yield minus local demand) is at least 50% greater than the project demand. Discharge from the tube well will be regularly monitored to monitor any changes in the yield of the wells. If a single well fails to meet this requirement, water will be obtained from multiple wells such that each well meets the abovementioned requirement.
7. Water conservation strategies will be developed to avoid over consumption or depletion of water resource in the project area.
8. Contractor will develop a Water Sourcing and Abstraction Plan.
9. Develop and implement water conservation techniques through the EPC contractor.
10. Keep clear access routes of the community to water sources so that their water requirements are not compromised.
11. Exercise care while moving heavy machinery to avoid damage or blockage of natural waterways and channels.
12. Maintain records of water usage in all Project activities.
13. Incorporate the above measures in the Construction Site Environmental Management Plan.

Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short	Local	Low	Low	Low

The use of tanker water will not pose any quantitative impact on local water resources of the project area. Groundwater can be used from existing wells with the permission of local well owners/community and EPA. To ensure that effect on local wells will not be significant enough to cause any localized depletion of aquifers or effects on local water requirement, the local water wells will only be used after ensuring that they have the excess capacity to supply the water requirement and water levels/discharges will be monitored to ensure that any effects remain negligible.

Assuming that Water Sourcing and Abstraction Plan under the EIA would be in place by the operational contractor's, it is anticipated that during operational phase impacts of water depletion will be low, with a low consequence, yielding low impact significance. Therefore, for operational phase likelihood of impact is low, with a low consequence, yielding overall low impact significance.

7.4.4.2 Surface Water Depletion

Impact 06: Construction, operation and decommissioning activity the Surface water quality may deplete if water abstraction is not carried out properly during various phases of the project activities.

Applicable Project Phase *Construction, Operation and Decommissioning*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Medium	Local	High	Medium	High

Mitigation Measures: The mitigation measures described below will ensure that the project area's surface resources are not significantly affected by activities of hydro power plant:

1. Water from water bodies e.g., irrigation canals will not be used for the project.
2. Water from River Swat only for construction activities will be used (Subject to evaluation after Testing requirements).
3. Water conservation measures discussed in 7.4.4.1 will be adopted to reduce overuse of water resource.

Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short term	Local	Low	Low	Low

7.4.4.3 Contamination of Surface Water

Impact 07: Construction and decommissioning activity may cause the Surface water

quality to deteriorate if waste disposal is not carried out properly and mixed with surface runoff during rain which leads to contamination of water resources in the vicinity.

Applicable Project Phase *Construction, Operation and Decommissioning*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Medium term	Local	Medium	Medium	Medium

Mitigation Measures: The mitigation measures described below will ensure that the project area's surface resources contamination is not done by activities of hydro power project:

1. Sumps will remain covered all the time and measures will be taken to prevent rainwater entry;
2. Septic tanks will be designed so that runoff does not flow into them;
3. Fuels tanks will be checked on regular basis for leaks and all such leaks will be plugged immediately.
4. Contractor will develop and implement a Water Quality Management Plan.
5. Contractor will develop and implement a Hazardous Material Management Plan.
6. A project specific spill contingency plan will be developed and implemented;
7. Contractor will develop and implement a Waste Management Plan.
8. At the time of restoration, septic tanks will be backfilled;
9. Fuels and lubricants will be stored in areas with impervious floors and bunds that can contain spills;
10. Prepare and implement a Spill Prevention and Response Plan and inducted to the staff for any incident of a spill.
11. All fuel tanks will be properly marked to highlight their contents and will be checked for their integrity; and
12. Septic treatment facility will be developed at each camp and construction site to manage waste generated on-site.
13. Provide and use spill prevention trays at refueling locations.
14. Collect runoff from maintenance workshops using impervious channels and pass through oil water separators (OWS) before final disposal. Properly dispose of the sludge and oil collected at the OWS.
15. Keep all fuel storage tanks and lubricating oil drums in secondary containment impervious pits with impervious shed walls.

16. Avoid on-site maintenance of construction vehicles and equipment, as far as possible.
17. Regularly inspect construction vehicles and equipment to detect leakages.
18. Store fuels and lubricants in covered and dyked areas, underlain with impervious lining.
19. Spill control kits (shovels, plastic bags, and absorbent materials) will be available near fuel and oil storage areas, vehicle parking, and vehicle maintenance areas as well as at construction sites.
20. Remove contaminated soil from the site and dispose of in a manner to ensure the protection of water sources.
21. Construct the bottom of any soak pit or septic tank at least 100 m away from springs and water bores.
22. Maintain records of spills and volume of removed contaminated soil.
23. Maintain a record of remedial measures taken.
24. Use silt traps to prevent contamination of river and streams.
25. Mechanical works and shops, secondary containment (>110% of volume) for storage and use of paints and other hazardous materials should be done over impermeable surfaces.
26. Incorporate the above measures in the Construction Site Environmental Management Plan

	Nature	Duration	Scale	Consequence	Probability	Significance
Residual Impact Rating	Direct	Short term	Local	Low	Low	Low

Surface water quality may deteriorate if waste disposal is not carried out properly and mixed with surface runoff during rain which leads to contamination of water resources in the vicinity. Potential sources of impact may include:

- Domestic effluent (i.e., grey and black waters).
- Sediments from altered land surface (construction site and new tracks); and
- Spilled fuel, oil, and other chemicals.

Black water from the construction site will go into an impermeable septic tank. The impermeable septic tank will prevent untreated sewage from polluting surface water. Therefore, impact of domestic effluent is assessed to be of low importance.

There is a chance of release of fuel, oil and chemical by leakage or spill during project activities from loading/unloading and transfer operations which may lead to groundwater contamination. From a management perspective, these have been categorized as minor, moderate or major and must be dealt according to their impact severity. Improper waste management practices can deteriorate the environmental conditions of the project area due to leachate formation causing surface and groundwater contamination, especially in rainy season.

Based on above-mentioned assessment, for impacts on water resources, it is anticipated that during construction & decommissioning phase impacts likelihood to contamination will be medium, with a medium consequence, yielding medium impact significance.

However, for operational phase, likelihood to contamination impact is considered negligible in case mitigation measures are taken to prepare proper septic and sewerage system. Therefore, no mitigation measures will be needed during the operation phase in that case.

7.4.5 Air Quality

In the project area, there is no industry and traffic volume is also low, but during summer months the volume of traffic increases manifold due to the visit of the national and international tourists. During the field survey, it was observed on site that air polluting elements were generally not present and except for summer vehicular pollution the ambient air was of good quality.

Kalam-Asrit HPP construction will require sizable machinery that will include dozers, dumpers, excavators, trucks, cranes, stone crushing plants, transportation vehicles and drilling plant, etc. The likely pollutants expected are:

a. Particulate matter from the moving vehicular traffic and operating plants and equipment;

b. Sulphur dioxide (SOx), H2S, CO and NOx from the exhaust of vehicular and operating plants.

c. Particulate matter (PM10) and discarded stone dust (fugitive dust) from the crushing plants.

d. Quarry material (stone dust) particulate matter and other air pollutants.

Moderate quantity of explosives will be used for excavation of tunnels and rock chambers and for construction of the main structure and the road. Tunnels excavation will use Tunnel Boring Machine as primary mode of excavation. Apart from noise produced by blasting and drilling operations a lot of noise and dust will be produced by excavation equipment, other machinery, concrete mixing, and traffic from trucks and vehicles. The village in the AoI are close to the project and the disposal areas. These

villages will be exposed to moderate noise levels from the project. The V-shape of the valley will reinforce the noise levels. Noise of explosions and ground vibrations will be common during excavations. At low to medium levels, ground vibrations and air blasts can result in community annoyance. At higher levels this could lead even to structural damage on buildings. These impacts have been assessed as Moderate Adverse.

a. ***Potential Sources***

Environmental aspects of proposed project activities related to air quality are:

- Excavation, clearing and levelling work during construction, operation, and decommissioning phases; and
- Use of generators and vehicles during the whole project lifetime.
- Blasting activities

Likely impacts of these aspects/activities include:

- Dust emissions.
- Gaseous emissions from the generators and vehicles; and
- Vapor intrusions from the spilled oil.
- Air quality impacts on community of project communities.

b. ***Impact Assessment***

7.4.5.1 Dust, Gaseous and vapor emission

Impact 08: Ambient air quality may get deteriorate during the construction and operation phase of Hydropower project phases and may have negative impact on the community health and safety.

Applicable Project Phase *Construction and Operation*

	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
Initial Impact Rating	Indirect	Medium Term	Local	Low	Medium	Low

Mitigation Measures: The proposed mitigation measures will improve the air quality impact and ensure that they remain within acceptable limits of hydro power project are given below:

1. Contractor will Develop and implement an Air Pollution Control Plan as a part of Site Specific Management Plan (SSMP)
2. All generators, equipment and vehicles used during the whole project life cycle will be properly tuned and maintained in good working condition in order to minimize exhaust emissions. handling of vehicles and machinery will also be ensured;

3. All project vehicles, equipment and generators will be checked regularly to ensure that engines are in sound working condition and are not emitting excessive smoke;

Fugitive Dust and Suspended Particulate Matter

1. Unnecessary handling of dusty materials will be avoided such as minimizing drop heights when loaders dump soils into trucks with spraying of ground and covering the trucks transporting dusty materials;
2. Dust emissions during construction activities will be minimized by good management practices such as locating stock piles of construction sand out of the wind direction, keeping the height of the stock piles to a minimum, keeping earthwork areas weir etc.; and
3. Imposing speed limits and encouraging more efficient journey management will reduce the dust emissions produced by vehicular traffic.
4. The Contractor will ensure to minimize disturbance to, or movement of, soil and vegetation.
5. Water will be sprayed daily on all exposed surfaces sufficient to suppress emissions of dust. The frequency of spraying will be increased as necessary but controlled such that the surface remains just moist at all times, particularly when wind is blowing towards any nearby sensitive receptors. Dust emission from soil and aggregate storage stockpiles used for road construction will be reduced by appropriate measures.
    a. Covering the pile with tarpaulin or thick plastic sheets when not in use and at the end of the working day;
    b. Erecting windshields / walls on three sides of the piles such that the walls project 0.5 m above the top of the pile and,
    c. Keeping the material moist by spraying of water at appropriate intervals to prevent emissions
6. The construction vehicles will maintain a speed limit of 20 km/h or less on all unpaved areas within the construction route. Speed limit signposts will be erected in highly visible positions along the access road and within the route and maintained for the duration of the construction. Speed bumps will be constructed near all sensitive receptors such as schools where there is a risk that vehicles may exceed the speed limit.
7. Construction materials will be transported to the route and around the route in trucks securely covered with tarpaulins or equivalent to prevent dust emission during transportation
8. Regularly maintain vehicles and equipment to keep a check on emissions.

9. Ensure that smoke from internal combustion engines is not visible for more than ten seconds.
10. Use new and low emission equipment and vehicles to the extent possible.
11. Purchase best quality fuel and lubes and where possible use lead free oil and lubes.
12. Sprinkle water on all unsealed roads used by Project vehicles that are within 200 m of any settlement.
13. Cover loads and long-term piles of friable material to reduce fugitive dust emission.
14. Reduce traffic speeds on all unpaved surfaces to 30 km/hr or less to avoid dust emissions from vehicular movement.
15. Absolute prohibition on soil or mud accumulation on public roads. Public and Project access roads should be frequently cleaned and visually inspected daily to prevent any soil or mud accumulation.
16. Install wheel washers where vehicle exit onto the paved road from unpaved and prior to each trip.

Fugitive Dust Emissions from Quarry Areas:

1. Avoid earth stripping or moving in periods of dry and windy weather.
2. Carry out dust generating activities where maximum protection can be obtained through topography or in areas where prevailing winds will blow dust away from sensitive areas/uses.
3. Suspend dust generating when wind speed exceeds 20 km/hr in areas within 500 m of any settlement.
4. Sprinkle water on conveyors/conveyor transfer points, stockpiles, and roads.
5. Cover fine dry loads or spray water on loads prior to exiting the site, and if necessary regular cleaning of public roads in the vicinity of the entrance.

Fugitive Dust Emissions from Concrete Batching Plant:

6. Suspend earthwork operation when wind speed exceeds 20 km/hr in areas within 500 m of any settlement.
7. Perform weighing and mixing process in a fully enclosed environment.
8. Install dust collectors to the mixers to avoid dust emissions.
9. Ensure that bunkers and conveyors are sited in the leeward direction to minimize the effects of the wind.

10. Consider the natural wind barriers such as trees and landforms to help control the emission of dust from the batching plant.

Fugitive Dust Emissions from Aggregate Production and Handling System:

1. Suspend operation when wind speed exceeds 20 km/hr in areas within 500 m of any settlement.
2. Consider prevailing wind direction to ensure that aggregate handling systems located in the leeward direction to minimize the effects of the wind.
3. Sprinkle water on all exposed surfaces, particularly those close and up-wind of settlements.

Wind-Blown Dust from Exposed Surfaces such as bare lands, stockpiles, and waste dumping sites:

1. Cover all exposed surfaces, particularly those close and up-wind of settlements.
2. Suspend all grading operations on a Project when winds exceed 20 km/hr.
3. Minimize disturbance to, or movement of, soil and vegetation.
4. Sprinkle water on all exposed surfaces, particularly those close and up-wind of settlements.
5. Retain as much natural vegetation as possible.
6. Cover on-site dirt piles or other stockpiled areas.
7. Install windbreaks and employ water and/or soil stabilizers to reduce wind-blown dust emissions.
8. Adequately wet, cover with plastic, or provide with wind shield all stockpiles to reduce dust emission

	Nature	Duration	Scale	Consequence	Probability	Significance
Residual Impact Rating	Indirect	Short Term	Local	Low	Low	Low

Vehicular and generator exhaust emissions generally emit particulate matters in the form of smoke, carbon dioxide (CO2), oxides of nitrogen (NOX), Sulphur dioxide (SO2), carbon monoxide (CO) and volatile organic compounds (VOCs). CO2 is the principal greenhouse gas (GHG) among these pollutants. The environmental impacts of stated pollutants are summarized as following:

- Particulate matter – May cause lungs/respiratory, visibility/haze problem, creation of smog etc.
- Carbon dioxide (CO2) – A GHG that is believed to contribute to climate change.

- Carbon monoxide (CO) – Enhances low level ozone production, indirectly contributing to climate change.
- Oxides of nitrogen (NOx) – Contributes to acid deposition (e.g. acid rain). May also enhance ground ozone when mixed with VOCs in sunlight level.
- Sulphur dioxide (SO2) – A toxic gas which contributes to acid deposition (e.g. acid rain).

Improper tuning of generators and vehicles may lead to deteriorate the air quality of project area. The Contractor should monitor all emission sources during project activities visually through regular and strict basis. Moreover, it is envisaged that due to the natural ventilation, emissions will disperse quickly with the prevalent wind currents. Very low emissions are expected to be released during the operational phase, due to the fact that Hydropower projects do not release any greenhouse gases or toxic pollutants during their operation, as a result, no impacts on ambient air quality are anticipated during the operational or maintenance phase.

It is worth mentioning that Hydropower projects have very low air emissions of air pollutants during operations as compared to fossil fuel power generation facilities, since Hydropower plants do not involve combustion processes.

Based on the above discussion, local degradation of the air quality during construction and decommissioning phase impacts likelihood is considered to be low with low consequence, resulting in an overall low impact significance.

Whereas, for operation phase this impact is considered negligible therefore, no mitigation measures are needed during the operational phase.

7.4.6 Project Wastes

Proposed project activities will generate different types of waste. This includes domestic wastes, glass, metals, concrete waste, spilled chemicals and oil, medical waste, grey and black water generated from domestic activities. Hazardous waste in small quantities which includes absorbent material, batteries, tires, metal drums, empty chemical containers and waste oil from machinery lubricants etc.

The offices, residential colonies and contractor camps at the peak time of construction are estimated to produce about 500 kg of solid waste per day (0.3 kg/capita/day). A large part of this waste is bio- degradable. In addition small quantities of hazardous waste will also be generated mainly from the vehicle maintenance activities (liquid fuels; lubricants, hydraulic oils; chemicals, such as anti-freeze; contaminated soil; spillage control materials used to absorb oil and chemical spillages; machine/engine filter cartridges; oily rags, spent filters, contaminated soil, etc.). It is imperative that such waste is responsibly disposed to avoid adverse environmental, human health and aesthetic impacts

Improper waste management practices will favor waste accumulation in nearby environment and may deteriorate aesthetical and environmental conditions of the project site and requires serious consideration.

Likely impacts of improper waste management generated from project activities can include:

- Surface and aquifer pollution.
- Soils and water contamination.
- Odor problem.
- Health hazards; and
- Aesthetic issues

Impact Assessment

7.4.6.1 Surface and aquifer pollution;

Impact 09: Improper waste management practices will favor waste accumulation in nearby environment and may deteriorate environmental conditions such as surface and aquifer pollution of the project site and requires serious consideration construction and operation phase of project.

Applicable Project Phase *Construction Operation and Decommissioning*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Medium	Local	Medium	Medium	Medium *

Mitigation Measures: The proposed mitigation measures will further improve the surface and aquifer impact and ensure that of hydro power plant:

1. Solid waste disposal should be through waste contractor. The contractor shall establish regular intervals for waste collection and disposal as per contractor's waste management procedures in compliance with local legislations and any additional binding by the authorities or lenders;
2. The recyclable waste should be sent to waste contractors/vendor or any other recycling facility for recycling purposes;
3. Waste management activities should be monitored by Company's site HSE representative. Waste management at site, contractor's activity, waste recycling and treatment/recycling facilities to be audited periodically;
4. A waste management plan with waste tracking sheet and register should be developed before the start of the project activities and implemented accordingly.

-* Medium scale impact prediction due to hydropower project site at district level considered as tourist site.

Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short	Local	Low	Low	Low

All the waste generated during construction, operations and decommissioning will be disposed of through implementation of an effective waste management plan.

During project all waste generated at site will be managed as per Contractor's Waste Management procedures.

Waste generation during the construction and operation phase is considered part of daily operations therefore, it is not considered to have any significant impacts to the environment or health of personnel present on site given that the number of personnel on site during operations will be minimal (approx. 100-120 persons). Therefore, the impact likelihood is assessed as medium, with a medium consequence, yielding medium impact significance.

7.4.6.2 Soils and water contamination;

Impact 10: During Construction and decommissioning activity the Surface water quality may impact soils and water contamination if waste disposal is not carried out properly and mixed with surface runoff during rain which leads to contamination of water resources in the vicinity

Applicable Project Phase *Construction, Operation and Decommissioning*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Medium	Local	Medium	Medium	Medium

Mitigation Measures: The mitigation measures described below will ensure that the project area's surface resources are not significantly affected by activities of Kalam-Asrit hydropower activities:

1. Septic tanks will be confined with a buffer area in order to stop any entrance or its exposure to outer environment;
2. Septic tanks should be constructed and designed to accommodate domestic sewage and wastewater generated from maintenance and cleaning activities i.e. black and grey water;
3. Sumps will remain covered all the time and measures will be taken to prevent rainwater entry;
4. Septic tanks will be designed so that runoff does not flow into them;
5. At the time of restoration, septic tanks will be backfilled;
6. Fuels and lubricants will be stored in areas with impervious floors and bunds that can contain spills;
7. All fuel tanks will be properly marked to highlight their contents and will be checked for their integrity; and
8. Fuels tanks will be checked on regular basis for leaks and all such leaks will be plugged immediately.

9. Solid residue from the septic tanks should be dispose of through waste contractor;
10. All chemicals and fuels will be stored in bunded areas;
11. Spill response kit should be available at chemical and fuel storage areas. In addition to this, ensure the availability of shovels, plastic bags and absorbent material for the spill management;
12. A project specific spill contingency plan will be developed and implemented;
13. At the time of restoration, septic tanks should be dismantled and backfilled with at least 1 m of topsoil cover keeping in view surrounding ground level;

Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short	Local	Low	Low	Low

All the waste generated during construction, operations and decommissioning will be disposed of through implementation of an effective waste management plan.

- Wastewater (Grey and Black Water) – Black water from the campsite and wastewater generated from maintenance and cleaning activities will go into an impermeable septic tank. Therefore, impact of domestic effluent is assessed to be of low importance.
- Recyclable and Non-Recyclable Wastes – Recyclable/reusable waste such as paper, card board, textiles, glass, plastics, tin and aluminum cans etc. will be sold to recycling vender (recyclable/reusable waste contractor). Non-recyclable waste will be stored separately and sent to contractor for appropriate disposal. Leftover food waste can be buried onsite, if appropriate or sent to approved waste contractor (KPK EPA).

Domestic wastewater generated at site will be collected in septic tanks. These shall be transported to the nearest approved municipal wastewater treatment facility, and solid wastes shall be disposed of in a secured area for trash. The impact likelihood is medium, and consequence is medium therefore, the impact significance is assessed as medium.

7.4.6.3 Odor problem, Health hazards; and Aesthetic issues

Impact 11: Improper waste management practices will favor waste accumulation in nearby environment and may deteriorate Odor problem, Health hazards; and Aesthetic issues of the project site and requires serious consideration construction and operation phase of Hydropower PV project phases.

Applicable Project Phase	*Construction, Installation, Operation and Decommissioning*					
Initial Impact	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance

Rating	Direct	Medium	Local	Medium	Medium	Medium
Mitigation Measures: The proposed mitigation measures will improve odor problem, Health hazards; and Aesthetic issues: 1. Ensuring all the mitigation measures suggested in Section 7.4.5 and 7.4.5.1. 2. Medical waste should be sent to an approved incineration facility; and 3. Non-recyclable debris and domestic garbage should be stored separately and sent to nearest domestic contractor for final disposal;						
Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short	Local	Low	Low	Low

During the construction phase visual impact will be local and Medium. The activities during construction that will affect the aesthetics of the area include excavation, stacking of material onto stockpiles and dumping at the waste disposal areas. Access roads, will necessitate the clearing of shrubs for their construction. The waste water generated during the construction and operation phases can have aesthetic bad impact in addition to the foul odor at the work areas, which could result in the irritation and discomfort among the workforce.

The impact likelihood is medium, and consequence is medium therefore, the impact significance is assessed as medium which after the implementation of mitigation measures will be reduced to low categories.

7.4.7 Noise Pollution

In the project area, no source of noise pollution was identified in the field except the occasional sounds of vehicular traffic and River Swat flow. As indicated by noise monitoring in the project area, generally the noise levels were within the NEQS.

Potential sources of noise during construction and decommissioning phases will include noise from operation of construction machinery and equipment for the construction activities including excavation and demolition work, site preparation work, foundations and concrete placement, erection of metal structures, installation of mechanical and electrical equipment and building maintenance or repair work. The maximum disturbance may occur along the roads and project site. Generally, different types of vehicles like, 4x4 pickups, cranes, lifter, loader, cars, mobile welding plants etc. are used during the various project components. Likely impacts of these activities can include:

- Local community
- exposed personal disturbance; and
- Migration of wildlife from the area.

Impact Assessment

7.4.7.1 Local community and exposed personal disturbance

Impact 12: Several noise generating activities such as noise of traffic from access roads and camp facilities, earthworks, blasting haulage activities, excavation, backfilling and O&M activities requires consideration during construction and operation phase of project.

Applicable Project Phase *Construction, Operation*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Short	Local	High	Medium	High

Mitigation Measures: The proposed mitigation measures will reduce noise issues by the Contractor staff during construction phase of Hydropower Project must ensure the mitigations given below are met:

Construction Corridor Mitigations;

1. Proper engineering control will be applied to noise producing sources like generator (canopy, muffler and enclosure will be installed/provided to reduce the noise impact on the surroundings and nearby social receptors);
2. It will be ensured that generators, vehicles and other potentially noisy equipment used are in good working condition;
3. Noise from generators, vehicles and other equipment and machinery will be kept to the minimum through regular maintenance;
4. The use of horns by project vehicles will be minimized. The use of pressure horns will not be allowed;
5. All onsite personnel will use required personal protective equipment (PPE) in high noise areas that will be clearly marked;
6. The contractor shall limit idling of engines when not in use to reduce its contribution to noise emissions.
7. A complaint registering, tracking and redressal mechanism will be implemented.
8. Close liaison with the community and regular monitoring of the noise levels in the community are key to successfully implementation of the above mitigation measures. Specifically: The communities will be informed of all major construction activities at three days in advance. Noise control measures will be discussed with the community through informal and formal meetings
9. Reduce workers' exposure to high noise levels by keeping moving workers away from the noise source; restricting access to areas; rotating workers performing noisy tasks, and shutting down noisy equipment when not needed.
10. Provide baffles and specialized mufflers, and acoustic enclosures to the plant and equipment.

11. Design and built acoustic barriers if needed. Vegetated buffer zones can also be planted to mitigate noise from operations using suitably selected native plantings local to the area.
12. Move static plant and equipment as far as possible from sensitive boundaries, as work allows. A distance of four times further away lowers the noise by 12 dBA. A reduction of 10 dBA will sound half as loud.

Noise from Traffic:

1. Install residential class mufflers and silencers to the mobile plants such as excavators, front-end loaders, and other diesel-engine equipment as applicable.
2. Construct paved Project access roads and locate where the gradient is low.
3. Implement special noise reduction measures, such as erecting purpose-built acoustic barriers, restricting opening hours and maintaining transport vehicle.
4. Prepare and implement a Traffic Management Plan including, timing of traffic through communities, route planning to avoid sensitive locations, etc.

Noise from On-Site Plant Operations and Equipment:

1. Select plant equipment appropriately that required minimal mitigation.
2. Install mufflers and silencers on the equipment and provide acoustical enclosures.
3. Modify the equipment or the work area to make it quieter by substituting existing equipment with quieter equipment; retro-fitting existing equipment with damaging materials, mufflers, or enclosures; erecting barriers; and maintenance.
4. Shift to a quieter construction process for example pile driving is very loud as compared to boring which is a much quieter way to do the same work.
5. Combine noisy operations to occur in the same time period. The total noise level produced will not be significantly greater than the level produced if the operations were performed separately.
6. Maintain and monitor plant and equipment regularly.
7. Move static plant and equipment as far as possible from sensitive boundaries, as work allows. A distance of four times further away lowers the noise by 12 dBA. A reduction of 10 dBA will sound half as loud.
8. Provide baffles and specialized mufflers, and acoustic enclosures to the plant and equipment.
9. Design and built acoustic barriers if needed. Vegetated buffer zones can also be planted to mitigate noise from operations using suitably selected native plantings local to the area.

10. Reduce workers' exposure to high noise levels by keeping moving workers away from the noise source; restricting access to areas; rotating workers performing noisy tasks, and shutting down noisy equipment when not needed.

11. Use earplugs to reduce workers' exposure to high noise levels.

Noise generated from the blasting in quarry areas:

1. Use vibratory piling instead of impact piling.
2. House conveyor belts and crushing/screening equipment to provide acoustic screening.
3. Ensure that the noise-reduction equipment fitted to machinery is used and maintained properly.
4. Erect earth mounds around the site boundary can provide acoustic as well as visual screening.

Noise Emissions from Concrete Batching:

1. Locate noisy equipment behind sound barriers or sound absorbers – for example, gravel stockpiles or constructed barriers.
2. Install silencing devices to all pressure operated equipment

Residual Impact Rating	Nature	Duration	Geographical Scale	Consequence	Probability	Significance
	Direct	Short	Local	Medium	Low	Low

No continuous major source of noise was observed during site visit of project area. Although intermittent sources of noise including road traffic on different roads inside the project's AoI boundary.

During construction and O&M phases of the Hydropower plant there will be several noise generating activities such as noise of traffic from access roads and camp facilities, earthworks, haulage activities, excavation, backfilling, blasting and O&M activities.

The noise during construction, operation and decommissioning activities at Hydropower project would affect the exposed personnel and may cause nuisance or hearing impacts on workers associated with these activities. In addition, elevated noise levels due to project activities can be a source of nuisance for locals and a source of disturbance to wildlife. The noise levels during project activities generally attenuated as the distance from the source and the receiver increases. As the project facilities will maintained appropriate distances from human settlements, impact of noise on communities will significantly attenuated. Likewise, impact of noise emission on communities will not be significant when the access tracks are at safe distance. The

overall impact level is localized as it will be limited to the immediate project corridor and short term as the impact will take place as long as the project activities carried out. During operational phase of Hydropower as a facility is not considered to exhibit any significant noisy operations. Noisy equipment should be labeled and signaled for the use of adequate PPEs.

The results of the baseline noise levels are presented in chapter-5 and locations associated figures.

7.4.7.2 Vibration from Blasting

Blasting will be undertaken at the quarry site and for the tunnel boring. The key impacts of blasting include vibration, noise and dust, hazards due to flying debris, and disturbance to underground water channels.

During blasting and quarrying, if proper care is not taken, it may cause accidents to workers. These operations also have adverse impacts on the surrounding areas. They generate dust and high level of noise. Crushers generate different forms of dust and stone waste. These materials are carried by rain to the surface streams. The sediments in water create turbidity, which is injurious to fish life. The use of explosives in blasting is likely to cause accidents. The adverse impact of these operations will be addressed in the environmental management plan. The quarrying and blasting operations are regulated by the Department of Mines, Provincial Government of KPK, and should be in compliance with the Mines Act.

Impact 13: Vibration from blasting during the construction phase may disturb local communities.

Applicable Project Phase *Construction, Operation*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Short term	Local	Medium	Medium	High

Mitigation Measures: The proposed mitigation measures will reduce vibration due to blasting issues by the Contractor staff during construction phase of Hydropower Project and must ensure the mitigations given below are met:

Construction Corridor Mitigations;

1. Contractor will develop a Blasting and Explosives Management Plan. An will also conduct a pre-construction survey of structures at risk of vibration impacts households.
2. Blasting will be scheduled during the day only.

3. Local communities will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule.
4. A Blasting and Explosives Management Plan will be developed by the Construction Contractor. The Plan will be reviewed and approved by the Supervision Contractor before the initiation of the blasting work.
5. Throughout the blasting activity, vibration sensors will be installed at strategic locations to monitor the impact of blasting and to ensure that the vibration levels are within the adopted criteria. The monitoring plan will be part of the Blasting and Explosives Management Plan.
6. Unscheduled blasting will be strictly prohibited in any case.
7. Meaningful contact with the community shall be maintained and their grievance shall be attended to in a timely manner.
8. Develop a Noise and Vibration Control Plan that will include monitoring of vibration levels and frequency around the blasting sites.

Residual Impact Rating	Nature	Duration	Geographical Scale	Consequence	Probability	Significance
	Direct	Short	Local	Low	Low	Low

7.4.7.3 Hazards of Fly Rock from Blasting

Fly rock is an unplanned projection of material from the blast site to any area beyond the designated safety area. These rocks, if not controlled, may result in damage to the surrounding structures and may also pose a safety hazard

Impact 14: Blasting may pose a safety hazard due to flying debris.

Applicable Project Phase *Construction, Operation*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Short term	Local	Medium	Medium	High

Mitigation Measures: The proposed mitigation measures will reduce fly rocks hazard due to blasting issues by the Contractor staff during construction phase of Hydropower Project and they must ensure the mitigations given below are met:

Construction Corridor Mitigations;

1. Provide a minimum buffer of 500 m between the settlements and point of blasting. If not possible then households falling within this buffer should be temporarily evacuated when blasting is done at the quarry.

2. Leave a layer of about 5 m of undisturbed softs above the top of the overburden blasts. This will act as a blanket to contain air blast, dust and fly rock.
3. Ensure that the holes are correctly collared with respect to the back-break/inclination of the face and that digging alongside the initiation face well controlled.
4. Inadequate forward displacement of the front row burden arising out of the under charging of these holes will result in fly rock from vertical catering of the rear holes.
5. Where fly rock pose a serious problem, the stemming length should not be less than the hole burden. Also, an effective stemming material like crushed angular rock should be used to prevent premature venting of explosion gases through the stemming column.
6. The forward fly rock could be fairly controlled to the commonly used 'inline open loop' pattern. The maximum inter-row delay interval consistent with the absence of cut off helped in minimizing the fly rock formation. As a thumb rule, an inter-row delay of 4-8ms/m of burden could be used for this purpose.
7. Adequate care should be taken while connecting the delay devices in the holes/rows and the initiation sequence properly checked before firing to avoid initiation of blast holes out of sequence.
8. Blasts designed on a face length to width ratio in the range of 3 to 4 produces minimum fly rock.

Residual Impact Rating	Nature	Duration	Geographical Scale	Consequence	Probability	Significance
	Direct	Short	Local	Low	Low	Low

7.4.7.4 Migration of wildlife from the area.

Impact 15: Several noise generating activities such as noise of traffic from access roads and camp facilities, earthworks, blasting, haulage activities, excavation, backfilling may disturb the wildlife during construction phase of Hydropower project..

Applicable Project Phase *Construction, and Decommissioning*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Short	Local	Medium	Medium	Medium

Mitigation Measures: The proposed mitigation measures will reduce noise issues and the Contractor staff during construction phase of Hydropower Project and at the same time they must ensure the mitigations given below are met:

1. The project construction area to be fenced properly as per the Security Management Plan to prevent entry of wildlife.
2. Implementation of mitigation measures in Section 7.4.7.1.
3. Minimize disturbance around the project area.
4. Regulations for Project staff and contractors to avoid illegal poaching to be incorporated in contract documents.
5. Provide awareness training to staff and contractors on: prevention excessive noise around animals;
6. Provide adequate knowledge to the workers on relevant government regulations and punishments for illegal poaching.
7. Encourage personnel to report sightings of wildlife of conservation importance or incidents of poaching to the Proponent.
8. Enforce speed limits.

Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short	Local	Low	Low	Low

In addition, noise generated from generators is only heard when distance is close (i.e. within 5-10 m, however, as distance increases, noise will be greatly reduced, not to mention that they do not generate noise during night time. As a result, during operation phase, the impact likelihood is very low with a negligible consequence, thus, the overall significance is negligible, and no mitigation measures are needed. Although for construction, installation and decommissioning phases the impacts are localized and short term, however the impact is assessed to be of high significance due to high likelihood and measurable threats to the environment.

7.4.8 Scenic Impacts

a. ***Potential Sources***

The construction and operation activities of the proposed Hydropower plant that are likely to create a visual intrusion and a disruption to aesthetics include:

- Materials lay down
- Excavations
- Backfilling
- Spoil
- Tourism spots

7.4.8.1 Visual Intrusion and a Disruption to Aesthetics

Visual impacts are the effects on people of the changes in available views through intrusion or obstruction and whether important opportunities to enjoy views may be improved or reduced. Visual impact to nearby receptors of the Project include:

- Degradation of aesthetic value of the area due to construction activities
- Permanent change in visual character due to proposed Project

Impact 16: Visual Intrusion and Disruption weir/powerhouse sites to Aesthetics due to, Materials lay down, Excavations, Backfilling, Spoil during construction

Applicable Project Phase *Construction,, Operation and Decommissioning*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Medium term	Local	Low	Low	Low

Mitigation Measures: The proposed mitigation measures will further improve odor problem, Health hazards; and Aesthetic issues and ensure the mitigations given below:

1. Ensuring all visual inspections of general housekeeping and cleanliness at site in addition to waste management.
2. For mitigation of this impact, proper landscaping will have to be done and an overall Landscape Plan will have to be prepared, that will be worked out in more detail for the area where the project infrastructure is located in addition to Landscape Plans for the residential areas and the offices. Tree planting will be well organized and where possible vegetation and natural habitats will have to be restored or newly created.
3. There will be a long term visual impact due to the construction of the weir and powerhouse, and the creation of the reservoir, so it is necessary to retain as much natural vegetation as possible supplemented with deception of elements with vegetation where possible.
4. For the disposal and borrow areas a Restoration Plans will be prepared to restore original landscape and vegetation.
5. With the help of the above listed mitigation measures, adverse impacts associated with visual landscape are likely to be somewhat addressed, and hence the associated residual impact has been assessed as low to moderate adverse.
6. Use of colors that better integrate with the landscape will also improve the viewshed . Figure show depictions of the weir, reservoir and powerhouse after completion

Residual Impact Rating	Nature	Duration	Geographical Scale	Consequence	Probability	Significance
	Direct	Short term	Local	Low	Low	Low

The area largely consists of mountainous valleys with large trees and bushes of heights greater than 2 m. The mountainous landscape and deep gorges greatly restrict visibility to a maximum of 0.5 to 1.5 km at receptor locations. An extended visibility was noticed at upstream and downstream river side and for the NullahsQuarries and borrow areas may leave a permanent scar on the hillsides as they once opened, will likely to continue in use and as a result change the surrounding landscape. Access roads, tunnel faces and adits will necessitate the clearing of vegetation for their construction. Some of the access roads to construction sites will be entirely new and permanent and some will reconstruct to accommodate the construction traffic load that will also alter the landscape of the area. The tunnel faces and adits during the construction phase will be obvious cuts into the mountainsides, many of which will be likely to be visible to residents, especially those on opposing sides of the valleys. For all of these features during the construction phase there will be an impact on vegetation, as additional areas will be cleared around the feature to provide a working area. These activities will result in the creation of artificial and unnatural features in the landscape.

Therefore, visual intrusions are anticipated to be limited to employees. Hence, the visual effects of the construction will be of low significance within the project area and largely limited to effect only employees living in the Company's temporary camp facilities during construction. The impact likelihood is low with low consequence, the impact assessment is considered to below.

7.4.9 Atmosphere and Climate

The existing climate of the project area is humid subtropical continental. The winter is very cold with snowfall, whereas the months of June and July are comparatively warm. January is the coldest month and June is the hottest month.

The project will create a reservoir of approx. 800m in length in length with less 100m width in various sections of the reservoir area, and the reservoir storage capacity is small but larger than 238 MW Asrit Kalam hydropower Project , which is relatively small. In general, the humidity level is m width relatively high, so a negligible impact on climate, especially in summer is expected. Some microclimate changes are expected in the form of slight decrease in temperature, increase in humidity and dew formation in the project area.

During the construction phase, the project will cause emission of Greenhouse Gases (GHG) from construction materials and due to emissions from Project transport, which will be reduced after the completion of construction. However, the Project has far fewer emissions as compared other power generation methods such as from the combustion of fossil fuels.

The Kalam-Asrit HPP will in fact contribute towards improvement of the air quality at the national and international level. This hydropower project has zero emission level. The mean annual energy output of the project is 912.9 GWh and the project will save the emission of 645,990 Metric Ton of CO_2 in air annual , if this 912.9 GWh power is generated from a thermal power plant. This carbon credit can be traded in the international market at the prevailing market rates

Impact 17: GHG emissions from weir construction will increase GHG concentration in the atmosphere thereby contributing to climate change

Applicable Project Phase *Construction, Installation, Operation and Decommissioning*

	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
Initial Impact Rating	Direct	Medium term	Local	Low	Medium	Medium

Mitigation Measures: The proposed mitigation measures will further improve odor problem, Health hazards; and Aesthetic issues and ensure the mitigations given below:

1. Implement a Reservoir Clearing Plan
2. Offsets for emissions from vehicles include:
3. a) Contractor will regularly check the maintenance of vehicles.
4. b) Regular inspection of vehicle exhaust emissions to meet required NEQS standard for exhaust emissions

	Nature	Duration	Geographical Scale	Consequence	Probability	Significance
Residual Impact Rating	Direct	Short term	Local	Low	Low	Low

7.4.10 Archaeological / Historical Sites

Archaeological/historical sites in the reservoir area as well as the powerhouse area, do not exist. Therefore, no impact will occur on such parameters. However, during construction, if any such sites are found, the contactor will be made responsible to inform the concerned department, or the Client for their preservation and protection.

However, if contractor finds any such features/sites during construction, he will be responsible to inform to the Proponent and the Archaeology Department immediately for the preservation and protection measures.

Impact 18: Impact on Historical Sites (Chance find)

Applicable Project Phase	*Construction, Installation, Operation and Decommissioning*					
Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Indirect	Medium term	Local	Low	Medium	Medium
Mitigation Measures: The proposed mitigation measures will further improve odor problem, Health hazards; and Aesthetic issues and ensure the mitigations given below: 1. Stop the activity in the area 2. Immediately report to provincial and federal archaeological departments						
Residual Impact Rating	Nature	Duration	Geographical Scale	Consequence	Probability	Significance
	Indirect	Short term	Local	Low	Low	Low

7.4.11 Traffic and Roads

Kalam-Asrit HPP is located in an area that has rugged mountains with steep slopes. Only one main road, running from Madain to Behrain and Kalam is available in the project area. This existing road is congested, especially near markets of main towns along the road.

During construction of the project, it is estimated that daily 50-100 extra trucks, needed for the supply of construction materials, will make use of these routes . Additional project vehicles using the roads and exceptional heavy transports of turbine sections may cause traffic congestions and safety hazards. This impact has been assessed as High Adverse.

7.4.11.1 Heavy Loads Transportation

Very heavy components of the project machinery and equipment to be transported would have been 3-phase transformers, turbine runners, inlet valves and generator rotors, etc. By using singly phase transformers, the heaviest part for transportation would be turbine runner with a weight of 84 tons and diameters of 5.5 meters. The other heavy component of machine like rotors and stators of generators will be received in pieces and will be assembled at power station site. Transformer will be transported on a flatbed trailer giving an axle load of approximately 9.5 tons. If this is not possible, a trailer with two bogies will be used. All other main generator parts will be transported on either of the two trailers.

Runner of the turbines and other hydro-mechanical equipment, including main turbine parts, will be transported on the trailers, which will be used for the transformers; either the flat-bed or the bogie trailer. Depending on the size of spiral casing of turbine, the delivery of casing in one part or two parts will be done. Due to the width or height restrictions, the spiral casing will be cut into parts and later re-joined with an erection weld at site. However, dividing the spiral casing into two with a flanged joint is a more expensive proposition.

The heavy pieces of equipment will be unloaded at each bay of the power station after the power station cranes have been erected. Before that, it is assumed that the contractor will provide a mobile crane with adequate capability. Even with smaller pieces of plant and equipment, bridges with a load carrying capacity of not less than 15 - 20 tons are required. For sharp bends, a transport which allows some measure of articulation may even become necessary.

The suggestion of using helicopters to transport the heaviest pieces of equipment is unworkable on following grounds:

- Restricted lifting capacity of the largest helicopter available in Pakistan.
- Enormous cost
- Risk of using helicopters with heavy loads to be carried.

The heaviest part of the permanent plant and equipment for the project is expected to be main transformer which shall be of 105 tons weight with the following dimensions: (length 5.2 m, width 3.4 m, height 3.8 m). The transformer will be transported without oil. The transformer is required to be transported through hydraulic platform trailer having 15m length, 3m width, 10 axle lines and 80 tires. The key potential impacts of traffic on project access roads are:

- Improved accessibility for locals due to the construction of Project access roads.
- Increase in congestion, due to increased traffic during construction will cause delays
- Increased risk to community safety due to increased traffic volume during the construction phase near communities.

<table>
<tr><td colspan="7">Impact 19: Improved accessibility for locals due to the construction of Project access</td></tr>
<tr><td colspan="7">Applicable Project Phase Construction, Installation, Operation and Decommissioning</td></tr>
<tr><td rowspan="2">Initial Impact Rating</td><td>Nature</td><td>Duration</td><td>Geographical Scale</td><td>Consequence</td><td>Likelihood</td><td>Significance</td></tr>
<tr><td>Indirect</td><td>Medium term</td><td>Local</td><td>Low</td><td>Medium</td><td>Medium</td></tr>
<tr><td colspan="7">Mitigation Measures: The proposed mitigation measures will further improve</td></tr>
</table>

accessibility for locals problem, and while the Contractor will ensure the mitigations given below:

1. Conduct risk assessment for identification of potential hazards associated with traffic and to take appropriate mitigation measure thereafter
2. Construct Project access roads considering the community connectivity with each other.
3. Allow communities use of new Project access roads

Residual Impact Rating	Nature	Duration	Geographical Scale	Consequence	Probability	Significance
	Indirect	Short term	Local	Low	Low	Low

Accessibility for people, living close to the roads, will be improved by the construction of Project access roads. Mountainous terrain in the area is difficult to traverse and construction of new site access roads will improve connectivity in the area.

7.4.11.2 Congestion

Impact 20: Increase in congestion, due to increased traffic during construction will cause delays

Applicable Project Phase *Construction*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Indirect	Medium term	Local	Low	Medium	Medium

Mitigation Measures: The proposed mitigation measures will further improve congestion issues for locals problem, and while the Contractor will ensure the mitigations given below:

1. Prepare and implement a Traffic Management Plan.
2. Retain as much natural vegetation as possible to reduce the impact of smoke due to vehicles.
3. Completely cover the vehicles going on the spoil routes and passing through the communities to avoid dust emissions.
4. Strictly implement speed limits and defensive driving policies

Residual Impact Rating	Nature	Duration	Geographical Scale	Consequence	Probability	Significance
	Indirect	Short term	Local	Low	Low	Low

7.4.11.3 Health and Safety

During project activities, equipment, and infrastructure can increase community exposure to risks and impacts. It is usually the Proponent responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to project affected people.

Impact 21: Increased risk to community safety due to increased traffic during the construction phase near communities

Applicable Project Phase			*Construction*			
Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Medium term	Local	Medium	Medium	Medium

Mitigation Measures: The proposed mitigation measures will further improve safety risk due to traffic and congestion, and while the Contractor will ensure the mitigations given below:

1. Contractor will develop and implement a Traffic Management Plan.
2. Occupational health and safety procedures will be enforced at site and a Traffic Management Plan will be implemented that will aim at ensuring access to residential areas, and preventing of unsafe situations, especially near schools, housing areas, construction areas, camps and offices.
3. Route planning to avoid sensitive receptors (mosques, hospitals, schools) during peak activity hours
4. Special attention should be focused on safety training for workers to prevent and restrict accidents and on the knowledge how to deal with emergencies.
5. Road signage will be fixed at appropriate locations to reduce safety hazard associated with project-related vehicular traffic. Liaison with traffic police will be maintained.
6. Project drivers will be trained on defensive driving.
7. Vehicle speeds near / within the communities will be kept low, to avoid safety hazards
8. Road safety awareness education will also be included during community visits or information sessions so that communities can be familiarized with common road signs and the types of vehicles and equipment that will be moving through the area.
9. Speeds limit (20 km/hr) will be maintained, where there is traffic exchange between roads.

10. Designate traffic wardens/flagmen will be deployed at roads on the transport route near sensitive receptors.
11. Strictly implement speed limits and defensive driving policies.
12. Maintain vehicles, especially brakes

Residual Impact Rating	Nature	Duration	Geographical Scale	Consequence	Probability	Significance
	Direct	Short term	Local	Low	Low	Low

7.4.11.4 Vectors and Communicable Diseases

During project activities, equipment, and infrastructure can increase community exposure to various sources of communicable diseases. It is usually the Proponent responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to project affected people.

Impact 22: Increased risk of communicable diseases

Applicable Project Phase *Construction*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Medium term	Local	Medium	Medium	Medium

Mitigation Measures: The proposed mitigation measures will further improve the risk of communicable disease due to influx and other reasons, and while the Contractor will ensure the mitigations given below:

1. The remedial measures like sanitation, hygienic conditions and prophylaxis (like use of quinine for malaria and COVID-19 vaccination) will be adopted during the construction period.
2. Medical setup with qualified staff and free of cost medication should be provided to the workers, local community and other staff members.
3. This adverse impact will be local but proper care should be taken to avoid any outbreak of such diseases by adopting effective preventive measures timely

Residual Impact Rating	Nature	Duration	Geographical Scale	Consequence	Probability	Significance
	Direct	Short term	Local	Low	Low	Low

7.4.12 Restoration/Decommissioning

Impacts from decommissioning/restoration of the Hydropower site will be carried out more or less with similar impacts as assessed for construction and operation phases. Additional mitigation measures which will be adopted during the decommissioning phase will include the followings:

- Project wastes (hazardous and non-hazardous) will be removed and disposed of according to best industrial guidelines and in compliance with local regulations.

7.5 Impacts on Biological Environment

The project may have minor impacts on the biological environment of the study area due to the creation of the reservoir and interference with the existing water regime.

7.5.1 Impact on River Habitat due to Construction Activities in the River

At the weir site, cofferdam will be placed to facilitate construction of the weir. Aquatic biological production will be eliminated from the cofferdam sites, part of which (the weir footprint) will be removed for the life of the weir. Pre- construction and construction activities have potential to adverse effects on aquatic biota by release of high concentrations of sediment, fuels/oils and other toxic compounds, and solid waste and use of explosives only at limited working sites . High sediment loads will be produced during placement of the cofferdam and again when water first passes through the work area after completion of weir and plunge pool construction. Sediment concentrations above natural levels can cause mortality of biota directly; for fish, damaged gills and sediment clogging of gill chambers eventually leads to death. This impact has been assessed as Moderate Adverse for short time.

7.5.2 Aquatic Fauna

Increased pollution (human waste, sedimentation, refuse, fuels and other contaminants) may have negative impact on the fish population. Sediments can suffocate fish and lead to elevated mortality. High levels of clay are generated during the construction and excavation process. Clay causes localized anaerobic conditions and kills the fish. Similarly the sediments will be carried away and dispersed by the current, and fish will have to move away from the affected section. Most of the fish species, living in the river, are not able to withstand very high level of silt in the water

Impact 23: Pollutants from human and chemical wastes might be deposited in the river can have an adverse effect on the fish and other aquatic life area.						
Applicable Project Phase			*Construction*			
Initial	Nature	Duration	Geographical	Consequence	Likelihood	Significance

Impact Rating			Scale			
	Direct	Long term	Local	Low	Low	Low
Mitigation Measures: The proposed mitigation measures will further improve the issues related to the obstruction within the project area and proposed mitigations include: 1. Provision of awareness training to staff and contractors on Disposal of waste in River 2. Efforts should be made by the contractor to minimize the inflow of sediments and other contaminants in the water. 3. Slope protection measures will be ensured on disposal areas. 4. Sediment erosion plan will be developed to reduce the flow of sediments into the River. 5. All possible measures will be adopted to avoid contamination of water and unauthorized catching of fish by the labor. 6. It is also imperative to construct fish hatchery for the safe breeding of the fish . 7. Solid waste will only be disposed of at designated sites via approved waste contractor;						
Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short term	Local	Low	Low	Low

The access roads and other project facilities may obstruct natural drainage within the project area. This can affect the survival and or composition and characteristics of vegetation. In order to avoid this from occurring it is recommended that in case of access road the windrows formed along the access tracks should not obstruct natural drainage. Moreover, project related facilities should be located with care so that natural drainage is not blocked.

7.5.2.1 Fisheries

The relatively highwater velocities suggest that conditions may be mainly compatible for riverine fish species, particularly along the reservoir shoreline.

Swat 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. Therefore, on the commercial level the impacts of construction and operation activities on fishery would be insignificant, however, on a domestic level it has been a source of income for locals.

By constructing the main structure in the River, a barrier in the river will be created, which will impair the ecological connectivity in the river, including the movement of biota and the migration of fish. Fish production in the River within the project area is low. No long distance migratory fishes are present in the project that could be affected by the weir. Migration within the tributaries also will not be affected by the weir. Kalam-Asrit HPP in particular and cascading hydropower projects in general have the potential to affect the aquatic ecology of the Swat River & its tributaries in area of influence during construction phase. Fuels and chemicals stored and used at such locations can affect aquatic biota & riparian users in downstream areas.

Impact 24: The important factor governing the severity of all above impacts is timings of construction of various cascading projects

Applicable Project Phase *Construction*

	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
Initial Impact Rating	Direct	Short term	Local	Medium	Low	Low

Mitigation Measures: The proposed mitigation measures will further improve the issues related to the fisheries within the project area and proposed mitigations include:

1. Maintain environmental flow as recommended in Project design.
2. Regulate activities of the staff so that they do not engage in illegal exploitation of illegal fishing and poaching.
3. Construction activities should be carried out whilst ensuring that there is no run-off of silt into the river and that the river is not contaminated to ensure that water quality is not affected.
4. Illegal fishing activities will be curtailed by providing support to the government in implementation of river protection.
5. Involvement of local administration and law enforcement agencies in the fisheries conservation process as it is majorly important as nothing happens without their will and commitment.
6. River diversion is proposed in the project design which will be used as diversion river water during construction, which will allow the enough discharge for the fish species in the project area;

Good Practices:

1. The mitigation measures described above a multi-prong approach has been adapted, which will ensure a net gain in habitat and biodiversity of the area

2. The reservoir with vertical and seasonal variations in temperatures will provide wintering habitat to fish species, and some species of cold water may also get established here.						
Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short term	Local	Medium	Low	Low

The ecological flows will be maintained as per design during the construction works and flow of 2.8 cumec will be maintained during works to maintain the ecological integrity of River.

7.5.3 Vegetation

Loss of vegetation can occur due to proposed establishment of Hydropower project related activities. Existing sources of disturbance to vegetation include clearing of land for agricultural fields (around project proximities), livestock grazing, chopping of trees for fuel and construction material by locals. Impacts on vegetation due to the sources mentioned above keeping in view the existing impact sources, cumulative impact will not be significant if existing blacktops and dirt local tracks are used as much as possible. No endemic or rare vegetation species were identified in the project area during the current EIA site visit. Loss of vegetation from a small area will not result in extinction of any vegetation community. In addition to that cutting of trees will be limited.

Similarly, the proposed campsite for construction, and operational phase of the Hydropower project is planned near the proposed Hydropower project boundary therefore, no separate clearing of vegetation for this facility will be required. Construction and development of new tracks will be avoided as much as possible. Impacts on vegetation due to dust emissions arising from road travel or movement of working personnel will be minimized by adopting the mitigation measures recommended in this EIA.

The project will have impacts on fruit and non-fruit trees which will ultimately be uprooted. According to the assessments of the forest expert, 378 trees will be affected of which 132 are fruit trees and 246 are other trees. The summary of tress affected as per project component is in below table, and the details are provided in table.

Table 7-4 Impact on Trees

Project Site	Wild trees	Fruit Trees	Firewood / Timbre Trees	Total Trees
Weir / Reservoir Side (Right Bank)	61	100	39	200
Weir / Reservoir Side (Left Bank)	44	4	-	48
Adit 1	20	-	5	25
Adit 2	12	-	-	12

Adit 3	22	-	1	23
Powerhouse	35	28	7	60
Total				**378**

a. ***Potential Sources***

During the construction and operational activities of Hydropower plant vegetation clearing can occur along project site area, and access tracks (the track prepared to access the site location).

This section of the report also discusses the potential effects on vegetation due to the proposed development activities within the project area. The potential effects on vegetation will include:

- Loss of vegetation due to land clearing/earthworks for campsite (if any) and access road;
- Effects of dust emissions on road side vegetation; and
- Effects on vegetation due to obstruction of natural drainage.

Based on mitigation measures suggested for the aspects of land uptake, land clearing and air quality, it can be concluded that after adopting suggested mitigation measures the impacts on vegetation during construction and operation phase will be localized and short term. Impacts likelihood of vegetation loss will be low, with a high consequence, yielding medium impact significance. However, for operation phase, the impact likelihood is very low with a negligible consequence, thus, the overall significance is negligible, and no mitigation measures are needed.

7.5.3.1 Loss of Shrubs/Vegetation

Impact 25: loss of vegetation caused by construction related activities						
Applicable Project Phase			*Operation*			
Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Medium	Local	Low	Low	Low
Mitigation Measures: The proposed mitigation measures will mitigate the loss of shrubs within the project premises and outside the project area: 1. Tree plantation plan under the SSMP's will be prepared by the Proponent to offset unavoidable damage to trees and vegetation cover. 2. Off-road travel will be strictly prohibited and observance of this will be monitored during the operation;						

3. Uncontrolled and unnecessary clearing, dozing or excavation activities will be avoided;
4. Total land uptake by project facilities (if any), O&M phases and access road will be kept to the minimum operational requirements;
5. The access track to project site will be selected to utilize existing tracks as much as possible;
6. The access track will be properly compacted at the time of construction and thereafter properly maintained throughout the entire construction and operational phases;
7. Unnecessary movement of vehicles and equipment will be restricted by efficient management;
8. Clearing of vegetation and the cutting of trees will be minimized as much as possible;
9. Provide awareness training to staff and contractors on: prevention of shrubs/vegetation loss; identification of likely species found on site;
10. Minimize disturbance to, or movement of, soil and vegetation.
11. Prevent soil damage and erosion
12. Retain as much natural vegetation as possible.
13. Vehicle speeds will be regulated and monitored to avoid excessive dust emissions; and
14. Use of local vegetation as fuel by crew personnel will be prohibited.
15. Periodic trainings of the project staff will be conducted on biodiversity conservation issues to sensitize them about the biodiversity and protected areas.
16. The trees cut will be compensated by planting 10 trees(3780 in total) against one cut tree and by this measure, adverse impact, if any on the flora, will be mitigated effectively
17. Contractor will enforce EMP for flora and other natural resources
18. Tree plantation around the periphery of the project will be proposed to be part of annual tree plantation campaign undertaken by Forest Department of the Government of Khyber Pakhtunkhwa.

Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Indirect	Short term	Local	Low	Low	Low

The vegetation of the project area and in its surroundings mainly comprise of those species which are not rare or endemic to the project area. All the species are widely distributed within the similar habitats of other parts of District as well as in KPK region. As the project site mainly includes only the mountainous land least important vegetation therefore, clearing of land will have less significant impacts.

The effect of vegetation clearing may have relatively significant impacts however, mitigation measures recommended at the end of this section will ensure that the impacts are kept to the minimum possible. For all project activities temporary facilities such as construction camp will be located in existing clearing, dense patches of vegetation will not be removed, removing/chopping of trees will be avoided and existing tracks will be used to the extent possible. **Table 5-18** provides the complete list of floral species with their known local names, family name and life form, and ecological impacts are considered in low category by the specialist.

7.5.4 Dust Emissions

Impact 26: Dust will be generated which may accumulate on the road side vegetation

Applicable Project Phase *Construction and Decommissioning*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Medium	Local	Medium	Low	Low

Mitigation Measures: The proposed mitigation measures will further improve the conditions and impacts that may arise during the dust generation process:

1. Off-road travel will be strictly prohibited and observance of this will be monitored during the operation;
2. Uncontrolled and unnecessary clearing, dozing or excavation activities will be avoided;
3. Total land uptake by project facilities (if any), O&M Structure and access road will be kept to the minimum operational requirements;
4. The access track to project site will be selected to utilize existing tracks as much as possible;
5. The access track will be properly compacted at the time of construction and thereafter properly maintained throughout the entire construction and operational phases;
6. Unnecessary movement of vehicles and equipment will be restricted by efficient management;

7. Vehicle speeds will be regulated and monitored to avoid excessive dust emissions; and 8. Ensure water sprinkling on unpaved roads to reduce dust emissions.

Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short	Local	Low	Low	Low

During construction, decommissioning and road travel particularly during transportation of materials to the site and vice versa, dust will be generated which may accumulate on the road side vegetation. In certain cases, dust emissions can possibly hinder the plant growth and metabolism. However, because the vegetation species in the area are adapted to exposure to dust the impacts due to the project are considered to be negligible. The EIA recommends regulation of vehicles speed, sprinkling of access tracks, and compaction and maintenance of permanent tracks to further reduce the likelihood and consequence of any adverse effect.

During operational phases of the project due to compacted access track the risk levels will be reduced, however the Operational Contractor will ensure the speed limits and other mitigations as suggested in EMP.

7.5.5 Disturbance to Wildlife

There will be no danger to wildlife with the execution of the project as they live in forest areas, which are located at higher altitude far above the project area.

Increased pollution (human waste, sedimentation, refuse, fuels and other contaminants) may have negative impact on the fish population. Sediments can suffocate fish and lead to elevated mortality. High levels of clay are generated during the construction and excavation process. Clay causes localized anaerobic conditions and kills the fish. Similarly the sediments will be carried away and dispersed by the current, and fish will have to move away from the affected section. Most of the fish species, living in the river, are not able to withstand very high level of silt in the water.

Impact 27: Pollutants from human and chemical wastes might be deposited in the river can have an adverse effect on the fish and other aquatic life						
Applicable Project Phase	*Construction, Operation and Decommissioning*					
Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Long	Local	Low	Medium	Medium
Mitigation Measures: The proposed mitigation measures will improve the wildlife conditions and reduce the threat levels to the wildlife in and around the project area which are as below:						

1. Provision of awareness training to staff and contractors on Disposal of waste in River 2. Efforts should be made by the contractor to minimize the inflow of sediments and other contaminants in the water. 3. All possible measures will be adopted to avoid contamination of water and unauthorized catching of fish by the labor. 4. Solid waste will only be disposed of at designated sites.						
Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short	Local	Low	Low	Low

However, for operational phase, due to the onsite waste generation activity the impact likelihood on wildlife is low with a medium consequence, thus, the overall significance is medium and mitigation measures are suggested in the table above.

7.5.6 Impacts on Avifauna

There will be no impact to the birds and fowl communities, rather the project will create a suitable habitat for this community with the creation of reservoir, which is another positive impact. This will increase the aesthetic value of the area and attract the bird hunters of the project and surrounding areas.

7.6 Impacts on Social and Socioeconomic Environment

The project activities to be carried out in EIA Study Area fall in Swat District of KPK province. Proposed project will bring certain socioeconomic changes in the project surrounding areas. Some of the impacts would be directly beneficial to the socioeconomic environment due to employment potential, improvement in infrastructural facilities under the CSR and especially the tourism sector, resource utilization from nearby markets by the employees, whereas some of them would be of adverse nature.

The adverse impacts on project communities due to project activities include invasion of privacy, sharing of local resources (in case water sources used), excessive dust emissions, improper disposal of waste, noise pollution and restriction of mobility of local women due to influx issues etc.

Development projects induce or stimulate associated secondary impacts that manifest themselves as changed socioeconomic receptors. Socioeconomic impacts vary from project to project and may not be easily quantifiable. These are consequences of project activities on the human population that alter the ways in which people live, work, interact, relate to one another, organize to meet their needs and generally exist as members of society. These also include more long-term impacts such as cultural

impacts involving changes to the norms, values and beliefs that guide and rationalize their cognition of themselves and their society. However in case of 238 Kalam-Asrit the social profile of the area is already associated with tourism where influx has impacted the tourism sector.

In the past socioeconomic impacts of large development projects were mitigated through monetary compensation or were altogether ignored. However, the importance of these impacts has been recognized, and it is very strongly felt that impacts on a community's cultural activities, local practices and day-to-day activities have far reaching impacts on their psychological, emotional and social wellbeing, whereby influencing their quality of life.

In this section of the report the effects of the proposed construction and operation of hydro power project activities on various socioeconomic parameters have been assessed during all three stages of the project cycle (construction, operation, and decommissioning phases) and methods to mitigate these impacts have been proposed.

Operation of the powerhouse and maintenance of the Weir site and other structures will result in positive impacts as under:

- Construction and operation of the project will create job opportunities for the local population.
- Transportation and business opportunities will be created.
- Tourism will be developed.
- The project area will attract population from higher altitude to this area.
- Induced population growth will take place

7.6.1 Employment Opportunities

The project offers good opportunities for local residents to apply for employment, as unskilled and skilled construction worker. Within the construction contracts, the contractor(s) would have to attract local workers and technicians on basis of agreed quota. Construction works could offer, at least for a period of 5 years, many opportunities for unskilled workers and technicians. The project will create employment opportunities for the people on temporary and permanent basis close to the project area during the construction and operation stages. This is a positive impact of the project and will improve the socio-economic conditions of the people of the project and surrounding areas.

Impact 28: Positive benefits of the project may arise either from short term job opportunities due to direct, indirect and induced employment at the local level, which can result in the increase wellbeing due to higher and stable incomes.						
Applicable Project Phase			*Construction, Operation and Decommissioning*			
Initial	Nature	Duration	Geographical	Consequence	Likelihood	Significance

Impact Rating			Scale			
	Direct	Long	National	Medium	Medium	Medium

Mitigation Measures: The proposed mitigation measures will further improve the positive benefits form the employment opportunities such as:

1. Maximum employment for locals would be ensured without giving any favor to any particular tribe of the area;
2. Preferential employment of local candidates.
3. Provision of preferential recruitment of local candidates provided they have the required skills and qualifications.
    a. The Contractor will develop a local recruitment plan, which include
    b. A clear definition of what is meant by the term “local”
    c. Reporting of labour profile
    d. An employment/HR officer and office set up
    e. Disclosure of recruitment and procurement policies
    f. Preferential hiring of project affected people
4. Employment should be provided in a transparent manner in consultation with local communities; and
5. It should be ensured that workers must have adequate experience so that smooth working practice would be achieved.
6. Evidence of disclosed recruitment and procurement policies/plan will be maintained including
    a. Percentage of local employee
    b. Local people hiring statistics:
7. To achieve the abovementioned targets, onsite job trainings can be a good initiative for unskilled labor.

Improved Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Long	Local	High	High	High

The red color impact present enhanced positive impact after the mitigations

Good practice measures:

1. The Proponent will ensure and determine what is considered to be ‘fair and transparent’ in employment and in distribution of jobs

Most importantly, positive benefits of the project may arise either from short term job opportunities during construction, or long-term job opportunities during operation. It is important that construction and operation jobs to be targeted to the local people. It is noted that when the operation phase starts, the Project will contribute tax revenue to the Provincial budget of KPK as well as with water use charges. At current stage, the amount of annual tax revenue that the Project will contribute to the Province's budget cannot be provided. Moreover, Proponent will play a significant role in the training and employment process. As a result, the impact significance can be considered as positive. The incomes of people employed by the Project are likely to lead to improved nutritional status, better housing, access to education and improvement in overall well-being of their families. Poverty cycles in poor families could be broken if children in the families become better educated and have more livelihood options than their parents had. The Project will provide employment opportunity (30% or more) to local community in the construction stage and about (20% or more) in the operations stage. Project will require approximately 4000 workforce at the peak workers/staff of both construction contractors and Proponent . The construction phase is projected to be completed in 60 months after the commencement. At this stage, there is no information on the proportion of unskilled jobs that can be filled by local community identified under the SEP. Based on the socio-economic baseline results, local communities/villages have low education and skill levels and as such, it would be difficult for them to meet the recruitment requirements for skilled positions. In addition to the employment opportunity, Proponent will also require goods and services for its construction and operation activities such as equipment, cleaning, catering and other hospitality services. Therefore such opportunities can further generate a localized market at a very small scale in the surrounding areas of villages and increase the livelihood conditions of the project.

Impact 29: Negative impacts of the project may arise either from not ensuring their commitment to short term job opportunities due to direct, indirect and induced employment at the local level, which can result in the social conflicts and adverse impacts on the wellbeing due to lower and un-stable incomes.

Applicable Project Phase *Construction, Operation and Decommissioning*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Long	Local	Medium	Medium	Medium

Mitigation Measures: The proposed mitigation measures will further improve the positive benefits form the employment opportunities such as:

1. Commitment in EIA on employment quote for the local community;
2. Proponent to include a clear stipulation of using local labour, particularly in the Construction Contracts and instruct the contractors to priorities qualified local people as construction workers in accordance with the needs of the Project;.

3. Employment should be provided in a transparent manner in consultation with local communities; and
4. It should be ensured that workers must have adequate experience so that smooth working practice would be achieved.
5. To achieve the abovementioned targets, onsite job trainings can be a good initiative for unskilled labor.
6. Establish and communicate a clear grievance mechanism to the 4 identified communities especially.

Improved Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short	National	Low	Low	Low

Good practice measures:

2. The Proponent will ensure and determine what is considered to be 'fair and transparent' in employment and in distribution of jobs

7.6.2 Sustenance Income

The major occupation in the project area is tourism and agriculture followed by livestock management. A small number of people are also working as laborers where opportunities are available in the area.

During proposed activities the following may be the potential sources of impacts on the sustenance income of local communities.

Leasing/Purchase of Private Land

For the operations of construction activities land will be purchased from the private owners. Compensation of the leased/purchased land is a standard mitigation. The compensation is usually paid to the title holders of the land in a fair manner. However, the following four issues will need to be addressed in order to ensure that the compensation in effect does compensate for the potential effects on local communities due to the land uptake by the project facilities:

- In order to ensure that compensation is given to the right person, the claims of land ownership were verified through the local administration where complete records of such ownership are maintained.
- The compensation amount should be in all cases at least equal to the market price, mutually agreed between the landowner and the Proponent furthermore in case of dispute arbitrated by the representative of the local administration.
- The compensation should be paid in transparent manner and within agreed time frame. Any delays in disbursement of compensation amounts should

be avoided so that the already marginalized communities of the area are not affected.

- Furthermore a comprehensive tourism management plan will be prepared with local government to offset the affected people and ones dependent on the river for economics. This plan will be part of the SSMP's and detail Tor's will be prepared as part of this EIA studies.

Displacement of Inhabitants

There few houses to be affected direct impact areas of the project components of proposed hydropower project. Therefore, displacement of communities would kept to minimum during the construction activities at Kalam-Asrit Hydropower project.

CSR and Community Investment

The implementation of Kalam-Asrit will raise the hopes and expectation of the population in general regarding the welfare facilities and expected impacts on tourism due to construction work.

Therefore the Proponent will prepare a comprehensive CSR and Community investment program to provide facilities in the form of education and health. It's also cause the improvement of existing access roads and development of parks to the people of the project area and improvement of the impacted tourism.

7.6.3 Health and Safety

During project activities, equipment, and infrastructure can increase community exposure to risks and impacts. It is usually the Proponent responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to project affected people. There is only no community health center is available in immediate vicinity of the proposed project area. However, medical facilities are available in Mankial Town about 5 km away from the site. Qualified doctors are always available in only Bahrain Town with support of paramedic staff.

Traditionally, people use different local herbs and plants for common diseases. In the case of emergency, patients are taken to government hospital at Bahrain and Mingora. In case of non-availability of any specialty at Mingora, patients are shifted to preferably to Peshawar and Islamabad. Vaccination/immunization campaigns organized under the Extended Program of Immunization cover most of the villages in the region.

Impact Assessment

Impact 30: Improper disposal of wastes, dust and exhaust emissions and traffic may impact the health of the local population.						
Applicable Project Phase			*Construction and Operation*			
Initial	Nature	Duration	Geographical	Consequence	Likelihood	Significance

Impact Rating			Scale			
	Direct	Long Term	Local/National	Medium	Medium	Medium

Mitigation Measures: The proposed mitigation measures will ensure the land after use is restored to its previous conditions and in this regard the mitigations will be adopted such as:

1. Strict compliance will be observed with occupational HSE guidelines of Pakistan and IFC EHS Guidelines;
2. Drivers will be trained in responsible and safe driving practices, safe speed limits for vehicles will be followed;
3. To avoid effects of dust emissions minimum distances should be maintained from local communities as suggested in the EIA,
4. Awareness training sessions (defensive driving and community safety) should be established and provided to all personnel involved during the construction phase in order to highlight the heat related illnesses of working in hot conditions such as heat cramps, heat exhaustion, heat stroke and dehydration etc.
5. Restricting public access to the site of Hydropower generation facility (according to internal company regulation)
6. Regular noise exposure assessments and noise level surveys of noisy areas, processes and equipment shall be carried out in order to form basis for remedial actions when and where necessary;
7. As far as reasonably practical, all steps to reduce noise exposure levels of employees by means other than that of personal protective equipment shall be taken, such as reducing exposure times, enclosures, silencers and machine guards, averting idling of vehicles and equipment etc.;
8. Provide suitable and effective hearing protection to employees working in high noise levels;
9. Designate and clearly mark hearing protection zones, which may include particular areas, operations or pieces of equipment. All personnel entering these zones shall be required to wear hearing protection inside these areas;
10. Provision of malaria nets and vaccination will be ensured during the regular health checkups.
11. The Contractor will ensure to undertake the regular health checkups of the work-force and reporting any major illnesses at the earlier to the medical officer.
12. Regular Health checkups of the workforce and reporting to THQ in case contagious disease identified.

Improved	Nature	Duration	Scale	Consequence	Probability	Significance

Impact Rating	Direct	Short	Local	Medium	Low	Low

To avoid these impacts along with Covid-19 health issues, minimum safe distances should be maintained from local communities as suggested in the EIA and all mitigation related to waste management should be adhered with. The operations may affect the safety of the inhabitants and local employees present at the project site.

On the basis of abovementioned assessment, for impacts on health and safety, it is anticipated that during construction and operation phase impacts likelihood will be medium, with a medium consequence, yielding medium impact significance which will be reduced to lower level on mitigations implementation. However, for operational phase impacts significance is negligible.

Impact Assessment

During construction phase, the project local community and the workers may be exposed to water-borne diseases due to poor sanitation and vector borne diseases such as yellow fever and dengue fever. In addition, the presence of a number of non-local workers in the area may lead to an increased risk of diseases, including:

- sexually transmitted infections (STIs) and HIV/AIDS;
- influenza outbreaks; and
- gastro-intestinal diseases and other food borne diseases such as Hepatitis
- COVID-19

Impact 31: Increased Risk of Infectious Diseases including Sexual Transmitted Infection

Applicable Project Phase *Construction and Operation*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Long	Local/National	Medium	Low	Low

Mitigation Measures: The proposed mitigation measures will ensure the increase risks due to infectious diseases including STD's are reduced to minimum which include mitigations such as:

1. Compulsory medical examinations (i.e. annual health check-ups) for Project workers, including contractors, as required, to ensure they are fit for work and to monitor the prevalence of communicable diseases detected through annual medical check-ups;
2. Strict compliance will be observed with occupational HSE guidelines of KPK and IFC EHS Guidelines;

3. Awareness training sessions should be established and provided to all personnel involved during the construction phase in order to highlight the heat related illnesses of working in hot conditions such as heat cramps, heat exhaustion, heat stroke and dehydration etc.; and
4. Restricting public access to the site of Hydropower generation facility (according to internal company regulation)
5. The Contractor will ensure to undertake the regular health checkups of the work-force and reporting any major illnesses at the earlier to the medical officer.
6. Regular Health checkups of the workforce and reporting to THQ in case contagious disease identified.
7. The workers' accommodation will be managed by developing and implementing regulations/policies on behavior towards local communities and restricted hours for going out applied for non-local workers staying in camps in construction;
8. Develop a specific Project's Code of Conduct
9. Establish and implementation of Grievance mechanism to report incidents.
10. Implementation of Government of Pakistan Covid-19 SoP's for social distancing and other preventive measures.

Improved Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short	Local	Low	Low	Low

Improper management of contagious disease by the construction contractor may impact the health of the local population. To avoid these, minimum safe distances(100m buffer if possible) should be maintained from local communities and all mitigation related to management of contagious diseases should be adhered with. Meanwhile during operational phases the expected number of workforce will be much smaller as compared to construction phase and majority of non-locals will stay inside the project specific premises and will have much better level of familiarity and understanding of community and vise verse.

On the basis of above mentioned assessment, for impacts on health and safety, it is anticipated that during construction and installation phase impacts likelihood will be medium, with a medium consequence, yielding medium impact significance. However, for operational phase impacts significance is negligible.

7.6.4 Transportation

Dirt tracks are also prepared by locals to commute between villages in the area. Black top road infrastructure is present from Kalam to Swat. Four-wheel drive vehicles are mostly used to commute in the project area and vicinity by the other development projects. Public transport by means of pick-up, Datsuns or bus is available in the project area however, from Kalam-Asrit, public transport is available to Swat and further to other parts of the country. People mostly use motorcycles and jeeps for local transportation.

The proponent will mitigate impacts related to construction of new tracks and any effect on road infrastructure.

Impact Assessment

Impact 32: Construction of any new access tracks in the area will have a positive impact						
Applicable Project Phase			*Construction and Operation*			
Initial Impact Rating	Nature	Duration	Geographical Scale	Severity	Likelihood	Significance
	Direct	Long	Local	*High	*High	*High
Mitigation Measures: The assumed positive effects of the construction of access road are; 1. It will improve access for rural residents 2. It will also reduce travel time and vehicle operating costs. 3. This may also open other opportunities for the local population, in terms of transportation.						
Improved Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Long	Local	*High	*High	*High

**The red color impact present enhanced positive impact*

7.6.5 Community Grievances

Community grievances/complaints related to project activities will be addressed by the Proponent. Local complaints (if any) on dust, elevated noise, waste from different project activities, spilled oil and chemicals, hiring issues, stress on existing civic amenities etc. may provide basis for conflict between the locals and the Proponent.

Impact 31: Community related grievances, worker related complaints

Applicable Project Phase		*Construction, Installation and Operation*				
Initial Impact Rating	Nature	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*
	Direct	Long	Local	Medium-	Medium	Medium
Good practice measures: 1. Grievance handling system must be established to address community grievance/complaints; 2. Appoint a Community Liaison Officer (CLO) as focal contact point regarding locals' grievances if any; 3. A social complaint register should be maintained on site by the Proponent.. All complaints received from local communities should be well recorded; and 4. Community complaints shall be duly addressed and appropriately resolved. The measures taken to mitigate these concerns shall also be recorded in the social complaint register 5. Encourage local communities to use the grievance procedure for concerns related to project activities. 6. Support reputable NGOs specializing in community development. 7. Successful implementation of SEP and CSR Plan within timeframes.						
Residual Impact Rating	Nature	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*
	Direct	Medium	Local	Low	Low	Low

7.6.6 Influx

During project activities which span over 60 months during which Project can lead to an immigrant influx of people who come to the Project area to open their small businesses around the project surrounding areas, and project employee who will increase their presence in the surrounding area. It is usually the Proponent. responsibility to avoid or minimize the risks and impacts to social and cultural norms as result of influx in Kalam-Asrit that may arise from project related-activities, with particular attention to project affected people. As a result, during construction and operation, the following potential impacts from this influx are considered:

Impact Assessment

During construction phases influx of workforce can generate impacts on the local communities such as exploitation of social and cultural norms, communicable diseases etc. Meanwhile during the operational phase, the expected number of workers will be much smaller . It is expected that the non-local workforce will stay within the project's site accommodation, the number will be significantly less and it is expected that community would already familiar with the presence of non-locals in the area and awareness campaign will alleviate the matter.

Mitigation Measures

Impact 34: Disturbance and tensions between migrant staff and local communities on the cultural issues such as (purdah) and cultural norms in addition to communicable diseases such as HIV and Hepatitis.

Applicable Project Phase	*Construction and Operation*					
Initial Impact Rating	Nature	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*
	Direct	Long	Local	Medium-	Medium	Medium

Good practice measures:

1. Contractor will develop a worker accommodation plan
2. Compulsory medical examinations (i.e. annual health check-ups) for Project workers, including contractors, as required by HR Policy, to ensure they are fit for work and to monitor the prevalence of communicable diseases detected through annual medical check-ups
3. Labor camps are selected away from the settlements to avoid such impacts and already existing camps.
4. Zero tolerance towards inappropriate behavior from and amongst the workforce.
5. Develop a specific Project's Code of Conduct.
6. Proper implementation of Proponent Stakeholders Engagement Plan with Proponent . CLO. Proponent will deliver induction training to provide guidance on requirements for culturally appropriate behaviors, and an overview of the risks to migrant staff and workers
7. Proponent to ensure sharing of workers code of Conduct in KPK language (Pashto) and request for compliance.
8. The workers' accommodation will be managed by developing and implementing regulations/policies on behavior towards local project communities and restricted hours for going out applied for non-local workers staying in camps in construction.
9. Establishment and proper disclosure of grievance mechanism to communities around project area.
10. Conducting SEP regular meetings with communities.
11. Ensuring leisure activities under the Workers accommodation plan to engage the working staff in sporting and other events.
12. Wherever possible the local community should be given priority in all work opportunities so that the locals can share equally the increased economic benefits and opportunities generated by the project. Consequently, this will create congenial atmosphere between the project and the local community

Residual Impact Rating	Nature	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*
	Minor	Short Term	Local	Medium	Low	Medium

The significance of impact to social and cultural normal as a result of migrant's presence are assessed as being moderate for construction and operational phases.

The magnitude is moderate after mitigations due to potential interaction between migrant workers and local people is limited since nonlocal workers will stay in the accommodation during construction and operation, and other migrant people will be limited in number since the Kalam-Asrit Hydropower Project is small in scale. Implementation of all mitigations via various Site-Specific Management Plan (SSMP's) under the EMP and ESMS will further ensure this impact is reduce to low level both in terms of severity and likelihood.

7.6.7 Gender (Conflicting Socio-Cultural Norms)

During the social surveys, community members presented their concerns about privacy issues though due to influx of tourist in the region, the aspect is considered as low risk, however keeping in view the sustainability of the project and ensuring the social and cultural norms are adhered to at maximum Contractor will ensure proper training of the project personnel are conducted on this aspect.

a Mitigation Measures

Impact 35: Potential social unrest in the Study Area due to conflicting socio-cultural norms amongst the inhabitants and in-migrants.						
Applicable Project Phase			*Construction and Operation*			
Initial Impact Rating	Nature	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*
	Direct	Short Term	Local	Medium-	Medium	Medium
Good practice measures: 1. Proponent will prepare and implement a project specific Grievance Redress Mechanism 2. Encourage local communities to use the grievance procedure . 3. Support NGOs specializing in the development of local infrastructure under the CSR Plans and Programs.						
Residual Impact Rating	Nature	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*
	Minor	Short Term	Local	Medium	Low	Medium

7.6.8 Indigenous People Assessment

an Impact Assessment

During consultations it is also noted with local authority and community within the scope of this EIA, that there is not internationally, nationally or provincially recognized critical cultural heritages located within the Project Area of Influence. No such groups

or individuals were identified during the study which fulfill the requirements of being classified as indigenous group/people. A screening was performed by social expert. It is usually the proponent responsibility to avoid or minimize the risks and impacts to social and cultural norms as result of influx in area that may arise from project related activities, with particular attention to project vulnerable people especially the communities around site.

7.7 Operational Phase Impacts

The operational phase environmental impacts are briefly described as follows:

7.7.1 Water Resources

The important hydrological parameter to be evaluated is the availability of flows.. The runoff potential is high. The river carries both snow melt and rainfall runoff flows. The mean annual flow at the weir site is 88.59 m3/s.

Construction of Kalam-Asrit HPP will result in reducing the flow downstream in about 12 km stretch of the river from the weir site to the powerhouse site. This may have some adverse impacts on the aquatic life, fowl life, lower riparian people downstream of the weir, and other environmental elements in this stretch. This will be a major adverse impact of the project.

The morphology of the bed in this reach will also have an impact on the scouring and silting whereby the rate of bed degradation will increase. The dry river bed will also have an adverse impact on the aesthetic value of this river reach.

Settlements are normally not dependent on the river and depend mostly on the nullahs/tributaries joining the river with respect to water consumption for livelihood and other utilities. The smaller village settlements consist mostly of clusters of houses that extend both vertically and laterally along the river depending on the land and water availability. Spring water is plentiful in the area and communities have further developed its distribution through pipes of various sizes to their homes for domestic consumption, wherever this resource is available. Thus the majority of the communities that have settled on the valley floor are present there due to better communication and road access that is provided along the valley floor rather than from any advantage that the river may provide. For these communities, the importance of the river is secondary. The water for drinking purpose and small farm irrigation in these lower riparian areas is almost wholly supplied from springs and nullahs

Impact 36: Approx. 12 km stretch of the river from the weir site to the powerhouse site, will be affected from low flows.						
Applicable Project Phase			*Operation*			
Initial	Nature	Duration	Geographical	Consequence	Likelihood	Significance

Impact Rating			Scale			
	Direct	Long Term	Local	Medium	Medium	Medium

Mitigation Measures: Catchment area of the river at the weir site is2,030Km^2. The mean annual flows at the weir site due to the snow melt and rainfall are 88.59m3/s. The construction of the project will result in reducing the flow downstream in about 12 km stretch of the river from the weir site to the powerhouse site.

In the process of the assessment of the downstream water requirements, it was observed that some streams/nullahs are falling into the Swat River between the weir and powerhouse sites. The water use study was conducted downstream of the Swat River from the weir site up to Kalam-Asrit Village in a distance of about 12 km, where the river flow will be considerably reduced after the execution of the project.

The ecological and environmental flows have been assessed using the method based on the airthematic calculations and predicted to be 2.8 cumec.

Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short term	Local	Low	Low	Low

7.7.2 Inundation of Terrestrial Habitat

The flooding of reservoir will cause submergence of a minor area of terrestrial habitat, which consists of mostly few sloping range/trees land covered with natural vegetation and some land. The same habitat is also present at higher altitude. This impact has been assessed as Low after mitigations..

Impact 37: Approx. 800m stretch of the river from the weir site to the upstream area, will be affected from Inundation. Approx. 12 km stretch of the river from the weir site to the powerhouse site, will be affected from low flows.

Applicable Project Phase *Operation*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Long Term	Local	Medium	Medium	Medium

Mitigation Measures: •

Coordinate with the government departments (Fisheries and Wildlife Departments) during the
inundation process and seek advice.
▪ Introducing flood management at hydropower facilities is to prevent or minimize the impacts of
dam-overtopping on downstream communities.
▪ Accessing the ecological values with help of Contractor environmental specialist and devising plan
for mitigations.
▪ Awareness training to staff will be provided on

o Prevention of injury of animals o Identification of likely species found on site o Identifications of animal hazards (such as venomous snakes). o What to do if dangerous animals are encountered. o Report kills of large mammals and other migratory waterfowls particularly designated ▪ Species of conservation concern..						
Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short term	Local	Low	Low	Low

7.7.3 Sedimentation Impacts

Suspended sediment load computations for the reservoir have been carried out by using the suspended sediment data of Kalam sediment gauging station, which is situated on the upstream of the proposed Kalam-Asrit weir site.

The sediment transport at the weir site is estimated with the monthly sediment concentration and the average flow, 88.4 m³/s at the weir site.

Table 7-5 Monthly Average Discharge (m³/s)

Month	Kalam	Weir
Jan	15.3	15.4
Feb	14.0	14.1
Mar	17.7	17.8
Apr	49.4	49.7
May	135.0	135.6
Jun	249.0	250.2
Jul	255.1	256.4
Aug	166.9	167.7
Sep	79.4	79.8
Oct	35.5	35.6
Nov	22.8	22.9
Dec	17.9	17.9
Annual	**88.0**	**88.4**

Table 7-6 shows the estimated total amount of the suspended sediment, and bedload takes 20 % of the suspended sediment amount considering mountainous area.

Table 7-6 Monthly Sediment Transport at Weir Site

Month	Suspended (Ton)	Bedload (Ton)	Total Sediment Transport (Ton)
Jan	2,988.4	597.7	3,586.1
Feb	2,803.8	560.8	3,364.6
Mar	3,815.3	763.1	4,578.4
Apr	13,270.3	2,654.1	15,924.4
May	36,135.6	7,227.1	43,362.7
Jun	74,643.0	14,928.6	89,571.6
Jul	123,604.2	24,720.8	148,325.0
Aug	59,503.6	11,900.7	71,404.4
Sep	14,778.8	2,955.8	17,734.5
Oct	9,898.6	1,979.7	11,878.3
Nov	2,802.7	560.5	3,363.3
Dec	2,943.2	588.6	3,531.9
Total	**347,187.4**	**69,437.5**	**416,624.9**

The average annual suspended sediment yield is estimated at 0.35 million metric tons, corresponding to a specific yield of approximately 172 t/km2. It should be noted that the Swat River carries a small quantity of suspended sediment when compared to other rivers in Pakistan. Results also indicate that more than 88.9 % of the solid flow occur during the monsoon months (May to September). This impact has been assessed as Moderate Adverse.

The detailed sedimentation studies are conducted in volume-2; Hydrology and Sedimentation Studies Report of the Feasibility Study Report.

Impact 38: Sedimentation can affect hydropower production due to loss of reservoir storage and/or damage to the facility's mechanical components. Sediments deposited in reservoirs may affect the safety of the weir and, without proper management, negatively impact the environment.						
Applicable Project Phase			*Operation*			
Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct and	Long Term	Local	Low	Medium	Low

	Indirect					

Mitigation Measures: •

- Flushing will be done scouring out of deposited sediment from reservoir through the use of desanders in a weir to lower water levels, resulting increase the flow velocities in the reservoir
- The frequency of sediment flushing is kept 5 days once a year in case of desander
- Based on social, environmental and technical limitations, March is the appropriate time for flushing.
- The suitable values for flushing time, concentration limits, and flushing discharge will be assessed before each flushing operations
- Public awareness measures, such as notices and public education on sedimentation flushing operations will be conducted regularly, before flushing operations.

Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short term	Local	Low	Low	Low

7.7.4 Dam Safety

Causes for weir failure can be controlled through good design, proper construction, regular inspection by qualified personnel, and a commitment to strong enforcement to correct identified deficiencies. Likewise, the risk to downstream life and property can be reduced substantially with efforts to limit some types of settlements adjacent to the streams and rivers. Weir Safety Program oversees the regulation and safety of weirs and reservoirs throughout in order to protect the health, safety, and welfare of its citizens and their property. This program is required to assure proper planning, design review, construction oversight, and inspection monitoring.

Consideration of Dam Breach

In case of dam breach, hydraulic modelling of the consequences of such breach is divided into two steps: first, finding causes of such failure and estimating flow hydrograph at the structure site; second, calculating flood wave propagation at the downstream of the structure (Paquier and Goutal, 2016). Dam breach modeling can be performed using HEC-HMS and Hec-Ras (Jang and Jung, 2012).

Considering the reservoir volume, it is expected that the increase of water level is subtle, but the expected damage by the water rising should be checked along the river downstream to where the flood wave is completely attenuated. The dam breach analysis should also consider GLOF amount.

Design Flood

The estimated floods by the frequency analysis and GLOFs study, are as shown in Table 7-7. The maximum flood occurs in summer, and it is expected that the possibility of glacier lake outburst is high. It is highly recommended to consider the estimated GLOF, 249.59 m3/s for safety check on weir overtopping.

Table 7-7 Design Floods Estimated by Frequency Analysis and GLOFs at the Weir site

Return Period Years	Frequency Analysis (m^3/s)	GLOFs (m^3/s)	Design Flood (m^3/s)
100	901.4	-	901.4
200	1001.2	-	1001.2
1,000	1258.3	-	1258.3
10,000	1698.5	249.59	**1,948** for weir safety check

Impact 39: A potential flood and seismic hazard under natural extreme conditions or Weir failure for which the weir is not designed, albeit very unlikely, has potential to cause loss of life and damage to property

Applicable Project Phase *Operation*

Initial Impact Rating	Nature	Duration	Geographical Scale	Consequence	Likelihood	Significance
	Direct	Short Term	Regional	High	Low	High

Mitigation Measures: •

- Public awareness measures, such as notices and public education on weir safety are proactive mitigation measures that should be implemented by the local communities.
- The authority to prevent encroachments and to deal with existing encroachments, including removal, should be strengthened.
- An emergency preparedness and response plan for the Project will be developed that includes consideration of flooding, earthquake, evacuation procedure, co-ordination with local administration and communities.
- Also, Emergency Plans that establish potential weir failure inundation limits, notification procedures, and thresholds are prepared for response to potential weir related disaster events
- A network of climate gauges in the catchment to monitor potential floods through WAPDA or in conjunction with other hydropower developers will be maintained.
- Automated telemetric flow gauges can be installed upstream of the weir. This

	will allow the Hydropower operators to be well aware of any potential flooding conditions using upstream flow data, in addition to climatic conditions recommended above. ▪ Where climatic data and flow data indicate eminent floods, appropriate measures for management of reservoir level can be undertaken. This includes full opening of gates (including low level outlets) with aim of reducing water levels to below Normal Operating Level weir. ▪ Design Basis Earthquake included in the structural design for Powerhouse and weir. ▪ Design the river diversion facilities according to 10-years return period flood as per international practice. ▪ The design of the Project to be based on 10000 years return period flood.					
Residual Impact Rating	Nature	Duration	Scale	Consequence	Probability	Significance
	Direct	Short term	Local	Low	Low	Low

7.7.5 Reservoir impact on Aquatic life River Swat

The character of the River and its valley bottom will change from a fast flowing uncontrolled sediment-laden river with steep rocky slopes into a narrow controlled water reservoir (average width 100m) and extending for about 800m up stream. Reservoir ecology will not be typical of a natural lake environment and will undergo rapid reduction in size caused by rapid sedimentation. Water velocities along the length of the reservoir will generally be lower than in pre- reservoir river conditions. Although reservoir features will be lake-like, surface water velocities will be high compared to most lakes and storage reservoirs. The relatively highwater velocities suggest that conditions may be mainly compatible for riverine fish species, particularly along the reservoir shoreline. This impact has been assessed as Moderate Adverse.

7.7.6 Fisheries

The risk of loss of vegetation will be compensated by the creation of the reservoir. The habitat is modified habitat in the stretches of river.

Furthermore, line departments of the government such as fisheries department will be consulted and line up with the protection measures for the river which will also add up to the better livelihood opportunities.

This Impact is assessed as Low Beneficial

Impacts on Fish Migration

By constructing the main structure in the Swat River, a barrier in the river will be created, which will impair the ecological connectivity in the river, including the movement of biota and the migration of fish. Fish production in the Swat River within the project area is low. No major population of long-distance migratory fishes were

found in the project that could be affected by the weir. Migration within the tributaries also will not be affected by the weir. This impact has been assessed as Low.

Furthermore, fish hatchery is recommended for the migratory fish species breeding.

7.7.7 Impact on Fish during Flushing Operation

The potential impacts on the downstream during flushing operations are turbulent habitat conditions, release of medium level sediment load and altered water quality from the reservoir. Flushing events will not occur earlier than the planned early summer period to prevent possible adverse effects outside the intended timing window especially during the winter low-flow period. Release flows during flushing will be within limits of historical flows for the season over which flows will be released. As explained earlier, the impacts on water quality in the reservoir are estimated to be minor due to these short retention times. However, if low oxygen conditions are evident during monitoring prior to flushing a lead-in period may be required whereby the lower-level outlets are used to draw out low oxygen-concentration lower-elevation water in combination with spillway releases to provide adequate oxygen concentrations in water downstream of the plunge pool. The impact has been assessed as moderate. With proper operational plan the impacts will be mitigated to fullest.

7.7.8 Ecological Flows

Issues related to ecological flows will be managed and any expected threats to river and habitat will be kept to minimum with in river diversion channels.

All the definitions of the 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 calculations of reserved or minimum flow. However, most common used formula adopted is the Cemagref Formula. The formula developed for environmental flow by CEMAGREF Agricultural and Environmental Research Institute, Antony, France is Q = [(0.0651 Qmm+2) /100] Qam where Qmm is monthly mean and Qam is annual mean discharge of the 238 MW Asrit Kalam hydropower Project. According to this formula the environmental flow required is 2.58m3/s using values given in below table.

Month	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**
Monthly Mean	15.4	14.1	17.8	49.7	135.6	250.2
Month	**July**	**Aug**	**Sept**	**Oct.**	**Nov.**	**Dec.**
Monthly Mean	256.4	167.7	79.8	35.6	22.9	17.9
Qam (Mean Annual Flow)						88.59

Mean Minimum Monthly Flow	14.10

3

Cemagref Formula: Q = [(0.0651 Qmm+2)/100]

	Qmm	Qam	(0.0651* Qmm +2)	(0.0651* Qmm +2)/100	E-Flow
	14.0	88.59	2.918	0.029	2.585

1. The same formula was earlier used by Fitchner Consultants of Germany for 106 MW Golen Gol HPP, Chitral Pakistan. Golen Gol HPP is being developed by WAPDA, the state-owned organization for the development of water resources and hydropower. The EIA for Golen Gol HPP has already been approved by EPA showing no reservations on the environmental flow calculation method.
2. Formula was later used by Star Hydropower Ltd. for ADB finance 147MW Patrind Hydropower Project (ecological flow of 3.7 cumecs).
3. Formula was also adopted for 9.2 MW Darral Khwar-II Hydropower Project, Bahrain, KPK. The report has been presented to EPA-KPK and is under review.

To further confirm ecological flows of this project, other projects in the cascade E-flows (Gabral Kalam and Gorkin Matiltan) were checked. The E-flow calculations of the upstream hydropower projects e.g., Gabral Kalam19F[i] is estimated at 2.3 m3/sec and that of 84 MW Gorkin Matiltan Hydropower Project20F[ii]is 0.5-1.5m3/sec, therefore it is confirmed that the E-flow is sufficient and more than other projects. Furthermore, downstream monitoring and adjustment of the flows will be done in future if required.

7.7.9 Risk of Bird Collisions with Transmission Cables

The Project Area is one of the fly-route for bird migration. Huge flocks of migrating birds follow the valley fly-way likely be in autumn and in spring. Especially for birds with a large wingspan such as storks, cranes, herons and birds of prey there is a risk of bird collision with transmission cables. Fatal collisions occur mostly with cables hanging perpendicular to the flight direction. This impact has been assessed as Moderate Adverse.

During operational phases NTDC will conduct the environmental impact assessment of the transmission line as their employer responsibility for the project of transmission of electricity.

7.8 River Swat Cumulative Impacts

Overall the cascade is expected to be occupied by various developers, therefore a strategic cumulative impact assessment of River Swat should be conducted by regulator at a broader level with the support of all the developers to holistically plan broader level mitigation measures for River Swat.

The cumulative impact assessment presented in this section assumes the following development projects whereas below section presents the various projects cascade of River Swat.

7.8.1 Feasibility Stage Projects:

- 84 MW Matiltan Hydropower Project (upstream of KAHPP)
- 105 MW Gabral-Kalam Hydropower Project (upstream of KAHPP)
- 238 MW Kalam-Asrit Hydropower Project
- 215 MW Asrit-Kedam Hydropower Project (Downstream of KAHPP)
- 157 MW Madyan Hydropower Project (Downstream of KAHPP)

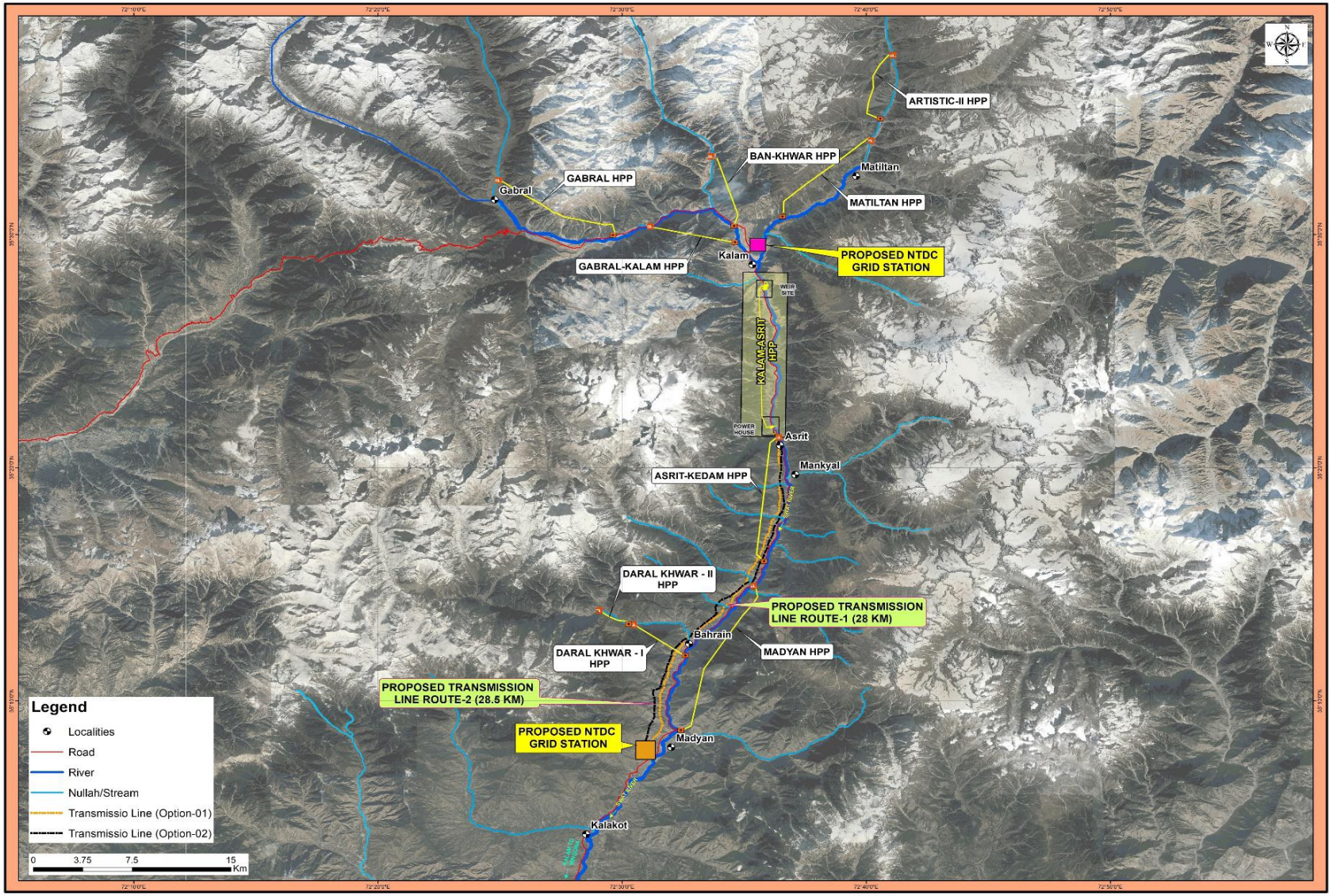


Figure 7-6: **Hydropower Projects in Cascade**

7.8.2 Cumulative Impact on River Flow

The hydropower projects in the Swat River will directly affect the Swat River flow. Their diversions will release diverted flows back into the Swat River. Fish migration will be restricted, and fish biodiversity may be altered by the construction of cascade of hydropower projects resulting in river compartmentalization. Changes in turbidity created by reservoir impoundment, combined with an increase in primary productivity, will also alter the composition of fish species. Accordingly, the potential impact on fisheries is negative and of moderate magnitude.

To mitigate the losses/reduction in fish numbers due to the project, in situ fisheries management techniques including culture-based fisheries management, reduction in carnivore varieties, and adoption of conservation measures will result in enhancement in fisheries bio productivity.

The environmental flow from these projects shall be sufficient for bare survival of the aquatic life of the affected reaches in the Swat River.

7.8.3 Cumulative Impact on River Ecology

Fish migration will be restricted and fish biodiversity may be altered by the construction of cascade of hydropower projects resulting in river compartmentalization. Changes in turbidity created by reservoir impoundment, combined with an increase in primary productivity, will also alter the composition of fish species. Accordingly, the potential impact on fisheries is considered to be negative and of moderate magnitude.

To mitigate the losses/reduction in fish numbers due to the project, in situ fisheries management techniques including culture based fisheries management, reduction in carnivore varieties, and adoption of conservation measures will result in enhancement in fisheries bio productivity.

7.9 Climate Change and its Relevance

It is widely accepted that increasing concentrations of (GHG) in the atmosphere are causing climate change, but there still exists uncertainly in magnitude; timing and spatial distribution of these changes. The role of simulation modeling in assessing climatic changes impacts on hydrology & river shall be well documented.

The study namely, “Climate Change Impacts and Adaptation to Flow of Swat River and Glaciers in Hindu kush Ranges, Swat District, Pakistan (2003-2013) by Saifullah Khan (Institute of Social Sciences and Directorate of Distance Education) and Mahmood-ul-hassan (Department of Geography, University of Peshawar, KP), was conducted. The findings of study are;

Precipitation is the most important element of the climate that affects water resources of area. The sum of deviation from the mean shows total decrease of -0.1inch (-2.8

millimeters) during 2003-2013. The total precipitation of the area was 52.5 inches (1333 millimeters) in 2004 (humid climate) that declined to 33.9 inches (861millimeters) in 2013 (sub-humid climates). If the precipitation concentration is decreasing at this rate, then the area will shift to have sub-humid climate by the year 2015.

- The area signifies two types of temperature zones. The temperature of coldest months of Kalam valley is less than 00C from December to March and constitutes cold climate. The mean monthly temperature of the valley is 10.70C with mean monthly maximum temperature of 17.80C and mean monthly minimum temperature of 3.50C (2003-2013). The winter season of the area is characterized by cold climates with heavy snowfall and chill condition. During winter, the deviation of mean monthly maximum and minimum temperature shows an increasing trend from 2003 to 2013. The sum of deviation of mean maximum temperature is 0.50C with a regression value of 0.170C. The lowest maximum temperature is negative (-1.20C) in 2003 that raise to positive deviation of 3.70C in 2013 (almost 50C increase). The sum of deviation from the mean minimum temperature is 0.30C and shows an increase throughout the series.
- The sternest potential threat arising from climate change in the Kalam and Utror valleys of Swat district is retreat of glaciers, water flow in Swat River, water springs, streams irrigation, and freshwater availability for domestic use. Kalam valley is cold area and most of its economy is based on the primary activities particularly agriculture.
- Water quality would suffer from the fluctuation in temperature and precipitation in terms of seasonal floods, absorption of freshwater for recharging of water table. The poor water quality effectively diminishes the availability of potable water particularly spring feeding areas of the Kalam. Lower water levels tend to lead to higher pollutant concentrations in Swat River as well as water table, whereas high flow events and flooding increase turbidity and the flushing of contaminants into the water system.
- Water is a precious resource for the existence of the mankind and without water availability it is hard to survive. Water sector is playing a vital role in the development of the human societies in the entire upper Swat River catchments area. The water flow in Swat River and its tributaries are running dry and it is expected that it will be further affected due to the ongoing climate change and result in decline of the agriculture productivity and the wellbeing of the people.
- The annual flow of Swat River reveals that the discharge remains high in June and July (169m3/sec) with the positive deviation in maximum temperature up to 8.50C. Generally, the flow is lower from October to April (winter months) and higher during May to September (summer months). The water discharge is directly proportional to the maximum temperature and inverse to precipitation. The average flow of the river is 192.2 Cubic m/sec during 2003 to 2013 with a total decline of -0.03 cubic m/sec
- The annual discharge of the river shows decrease throughout the series. The deviation from the mean of water flow is presenting a decrease of -0.03 cubic variables represents the relationship between flow and the weather elements.

The conclusion and recommendations of study are;

- The total decrease in precipitation of the area is 0.1inches (-2.8 millimeters). The area was strongly during summer season. During cold and pre-monsoon seasons, the trend is negative since 2010. There is a slight increase in precipitation during monsoon and post monsoon seasons. The annual cycle of temperature leads to four sub-seasons namely cold, mild, warm, and cool season. The mean monthly temperature of the valley reveals an increase of 0.90C, maximum temperature of 0.40C, and mean minimum temperature of 0.50C. In sub-seasons, the change in maximum temperature during cold and warm seasons is negative and inverse during mild and cool seasons. The minimum temperature remains high during cold season and converse in mild, warm, and cool seasons. Both maximum and minimum temperature shows three times double increase during 2013 as compared to 2003. This increase in the temperature of the area has caused water stress and retreat the glaciers of the valley.
- The annual flow is directly proportional to the mean maximum temperature and inversely proportional to precipitation. The annual flow of the river is 192.2 cubic m/sec with a total decline of -0.03 cubic m/sec from 2003 to 2013. The annual trend of water flow in Swat River is directly proportional to precipitation and inverse to maximum temperature during 2003 to 2012 and shows converse condition till 2013. The discharge remains high during summers with the rise in temperature and low during winters. The decrease in flow during summer is -0.3 cubic m/sec, while in winter there is increase of 0.2 cubic m/sec.
- Due to rise in temperature, the rate of glaciers retreated is higher than earlier and has caused depletion in the annual flow of streams and seasonal springs. The glaciers covered area of the valley during 2000 has been decreased up to fifty percent in 2010.
- The water sector is more vulnerable to the impacts of climate change that can be minimized by the construction of new water reservoirs, inland weirs, and improvement in the water supply, planning for flood water, revised policy of the water management, implementation, and establishment of research and development funds

7.9.1 Adaptation in the wake of Climate Change Impacts

The climate change-oriented adaptation measures in case of future viability of Swat River fisheries, include basin wide understanding of intricacies of water budget changes, integrated water resource management, construction of cascading HPP in the anticipation of changing climatic scenarios. Introduction of eurytopic fish species, having flexible feeding, breeding and living habits can thrive in changing environment. Fishing efforts, stocking sprees, in situ research activities should always encompass changing climatic conditions and water availability.

An awareness companion regarding the impacts of changing climatic scenario among stakeholders may be inculcated so that they may always be on toes to adopt the management techniques according to the changes in fisheries patterns. Finally water loss through evaporation in cascading reservoirs will require further knowledge about species which can adopt in changing epilimnion i-e surface feeders aquatic environment

8 Conclusions and Recommendations

8.1 Conclusions

Pakistan is an energy deficient country; a large part of the country's energy demands is met through imports which is a severe burden on country's foreign reserves and economy. There is, therefore, a vital need to explore for additional energy resources.

Energy plays a vital role in improving the living standard of national and strengthen all economy concerned matters. Nature has gifted this world with several abundant and non-replenish-able sources of energy that are large enough to accomplish current overall energy requirements. Within past few years, mankind has encountered various challenges related to energy and environment. Depletion of conventional energy resources associated with environmental concerns has urged people living on this planet to exploit renewable and non-conventional resources.

International Energy Agency predicted an increase of ~53% in global primary energy consumption up to 2030 and 70% of this value is expected to come from developing nations. Pakistan is naturally benefited part of the world where natural resources are in much excess that can be utilized to produce electricity. In Pakistan, daily.

With the same objective as of Government of Pakistan; 238MW Kalam-Asrit Hydropower intends to play a significant role by construction of power generation plant with renewable energy resource. This hydro power project of 238 MW capacity in Kalam-Asrit of Swat District will provide clean and environmentally friendly alternative energy. In comparison to coal or oil-fired power generation plant, this plant will reduce the greenhouse gas emissions. It will not cause any significant, lasting environmental or social impacts during its construction, installation and operational phases. Only minor and transient environmental disturbances would be experienced at the project site during construction, installation and operation, and will be managed/ minimized through implementation of the EMP.

On behalf of the Proponent, AZMEC has successfully materialized the EIA study of the proposed project in the light of the Pakistan / KP EPA requirements and the project has been classified as a "Schedule-II project", being a large weir that will cause involuntary resettlement. According to the IFC, it is also 'A Category Project', and requires the preparation of a full ESIA. There are no environmentally sensitive or protected areas likely to be impacted by this project. Similarly there are also no threatened or endangered flora and fauna species in the area. The cost of resettlement has been worked out in accordance with the guidelines, objectives and policies made by Pakistan/KP EPA The study was based on baseline environmental and socioeconomic information which was collected from a variety of sources, including reports of previous studies, desktop studies, census report etc. All adequate

requirements have been addressed in this EIA report, which has a viable length covering the following:

- The proposed project activities;
- Environmental and social baseline conditions of the proposed site and its immediate surroundings;
- Statutory, legal and financers' requirements related to the project;
- Analysis of alternatives;
- Significant environmental impacts of the proposed project activities on the physical, biological and socioeconomic receptors;
- Mitigation measures in order to reduce any impact on physical, biological and social receptors; and
- An EMP has been provided that will help in effective implementation of the suggested mitigation measures.

The EIA concludes:

- The installed capacity is 238 MW as of the expected role from the project in Pakistan's power system. The project is expected to deliver average annual generation of 912.9 GWh with the plant factor of 43.7%.
- The mean annual flow is about 88.4 m3/s.
- Main power supply scheme at powerhouse is that the applied connection scheme between the generators and four respective step-up transformers will be of conventional arrangement, with generator circuit-breaker and with tap-off to the excitation transformers and to the station service transformer.
- The main environmental issues will be related with the construction period concerns and the effect of the reservoir on the existing terrestrial habitat. The reservoir area will be affected by deforest from human activities.
- Social impacts will include effects on local population due to economic activities while the construction is ongoing. Some resettlement will take place for people currently living in the reservoir area and for people affected by some construction sites. The project will bring some significant change of lifestyle for all inhabitants of the area. A possible positive impact will be improved access to health, education and other public services.
- The key environmental issues during design, construction and operation phases of the project include bank stability of the river, dam safety and safety hazards for the staff requiring site specific EMP.
- The overall findings of the environmental and social impact assessment show that the project is environmentally and socially viable provided that the mitigation.
- This project expects stable generation of positive net cash flow throughout the project period, which indicates that principal repayment seems promising under the base case scenario.

8.2 Recommendations

- Based on the data collected during the focus census survey, discussions with the stakeholders and public consultation, there are no potential adverse environmental impacts of the Kalam-Asrit HPP, which cannot be mitigated including the environmental water requirement releases for the downstream population and ecology.
- The Environmental Management and Monitoring Plan will be made a part of the Contract awarded by the Company for project implementation.
- The releases from the weir are 2.8 Cumec which are provided in the project to meet the environmental, ecological, aesthetic and sewage dilution requirements of the downstream villages up to the powerhouse. However, drinking water (generally spring, stream and nullah water is used), other human needs and environmental requirements will remain the priority for the downstream releases.
- By following appropriate and timely mitigation measures for the identified adverse impacts, there will be a major improvement in the socio-economic conditions of the residents of the project area.
- The project will assist the national economies of KP and Pakistan.
- Keeping in view the benefits to be achieved by the residents of the project area and Government, the environmental costs are at an acceptable level because the project will use the resources in a rational manner. These costs are 1% of the total project costs.
- The project should be implemented as planned for achieving the envisaged benefits and sustainable development of the country.
- A committee, consisting of weir construction, operation and maintenance experts, should be formed, which should develop general guidelines for the planning, execution, construction, operation and maintenance of the weirs in the country. These guidelines should be updated, keeping in view the new technologies, the gained experience and the identified issues/ problems.
- The contractor will ensure to prepare SSMP including temporary traffic management, waste management plan, blasting management plan, oil spill management plan, CSR Plan and HSE plan. The SSMP should be deliverable by the contractors and approved by both EPA's and IFC before construction commences.
- The Company will ensure adherence to the environmental legislation and regulations.
- The Company/contractor(s) will employ local labour as far as possible.

The nature of the project does not involve significant negative environmental impacts such as emissions or other pollutants. The main potential impacts are minor and related to the construction including land clearing, construction works and support structure which are considered minor and localized for relatively short duration. Impacts of the environment on the project will be minimized through implementation of design integrated measures. The operation will have a visible positive impact on the socioeconomic conditions of the local residents of the area, manifested as increased local businesses, increase in tourism, local employment generated during the

construction, and operations, increased mobility and increased income due to disbursed land compensation money.

On the basis of the above, this EIA concludes that if mitigation measures for all impacts identified in the EIA are implemented as per the prescriptions, no significant or unacceptable/adverse change in the baseline environmental or social conditions will occur.

Appendices

Appendix-A List of References

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Appendix-B Hydrology Study of the Site

Appendix C Water Quality Sampling Results

Appendix D Noise Monitoring Results

The noise monitoring conducted with noise equipment’s.

Appendix E Ambient Air Monitoring Results

Appendix F Geological Studies

Appendix G Environmental Code of Conduct

Appendix H Chance Find Procedure

Appendix I Project Schedule

Appendix G Indigenous People Screening by Expert

Appendix K NEQS

Appendix L Sediment Analysis Report

Appendix M Environmental Monitoring Report

Appendix N Flood and GLOF

Appendix O Seismic Hazard Analysis

Appendix P Hydrological Data for E-Flow Assessment

Appendix Q Socio Economic Questionnaires

Appendix L Sediment Analysis Report