

# Environmental and Social Monitoring Report

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Project Number: 44914-014  
Quarterly Report (January-March 2018)  
March 2018

## Pakistan: Patrind Hydropower Project

Prepared by Star Hydro Power Limited for the Asian Development Bank.

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# 147 MW PATRIND HYDRO POWER PROJECT

## Environmental & Social Monitoring Report January to March 2018



**STAR HYDROPOWER  
LIMITED**

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## **Acronyms**

ADB	Asian Development Bank
AJK-EPA	Azad Jammu & Kashmir Environmental Protection Agency
KPK	Khyber Pakhtunkhwa
CDP	Community Development Plan
EH&S	Environmental Health & Safety
EPCC	Engineering Procurement Contracts Contractor
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GRC	Grievance Redress Committee
IEE	Initial Environmental Examination
IDB	Islamic Development Bank
IFC	International Finance Corporation
ILO	International Labor Organization
KEXIM	Export Import Bank of Korea
NEQS	National Environmental Quality Standards
NTP	Notice to Proceed
PAPs	Project Affected Persons
PS	Performance Standard
RAP	Resettlement Action Plan
SHPL	Star Hydropower Limited

## INTRODUCTION

### **i. Background**

Patrind Hydropower Project (the “Project”) is a run-of-river project located on the boundary of Khyber-Pakhtunkhwa and Azad Jammu & Kashmir. The project is financed by multilaterals like IFC, ADB, IDB and KEXIM with total capacity of 147 MW. The Project was completed in first quarter of 2017 and was officially commissioned on November 08, 2017 and started generating electricity.

### **ii. Objectives:**

The purpose of this Quarterly Environmental & Social Monitoring Report is to describe O&M Contractor’s compliance with the environmental and social requirements of IFC/ADB (including implementation of the Environmental and Social Management Plan) and to assess any corrective actions implemented/proposed. This includes:

- A description of all significant health, safety, environmental and social activities and events that occurred during the reporting period.
- Provision of additional information about activities (i.e., status of permits or other approvals, ongoing public consultation etc.).
- Quantitative performance monitoring data summaries in comparison to appropriate ADB and IFC policies, guidelines and national requirements.
- An explanation of any cases of non-compliance with lender’s guidelines or applicable regulatory limits that have occurred, identifying the cause and the corresponding corrective measures planned or underway to prevent future occurrences.
- Resettlement Action Plan activities and progress on the implementation of project within the Sustainable Development Strategy Framework

**RELEVANT ENVIRONMENTAL PERMITS OR COMPLIANCE CERTIFICATES**

**a) Summary of permit conditions and media covered:**

Following conditions were imposed by EPA-AJK during the operations phase of the Project.

The status of compliance with the conditions is presented in below table:

<b>Condition</b>	<b>Status of compliance</b>
Proponent shall ensure strict compliance to National Environmental Quality Standards (NEQSS).	Compliance with NEQs will be monitored throughout the project life.
During lean period, the proponent shall ensure 2 cumecs water, as E-flow, downstream during the operational phase of the project.	2.2 cumecs environmental flow is being released from weir. The data is attached as <b><u>Annex-1</u></b> .
The proponent shall in-place proper metering arrangement to ensure and verify the release of approved E-flow downstream.	Upstream and downstream gauges have been installed for monitoring of E-flows.
Mitigation measures, as suggested in Environmental Management Plan (EMP) for operational phase, shall be strictly adhered to.	Compliance will be strictly monitored throughout the project life.
The proponent shall in place Environmental Management & Monitoring unit headed by an Environmental Monitoring Expert.	HSE team has been formulated which consists of HSE Manager, Environmentalist, HSE Officer and Community Liaison Officers in the O&M team apart from Senior Manager-E&S who is monitoring the compliance from SHPL side.
The proponent shall be responsible to carry out Fish Study on annual basis through certified Fish Expert/Firm throughout the operational period of the project and undertake mitigation measures to minimize the adverse effect on fish species, if any, in consultation of Fisheries Department, Govt. of AJ&K, under intimation to EPAAJK.	The fish and vegetation studies are being conducted from start of the construction period and will continue during the entire operational phase.
The proponent shall carry out the Environmental Audit through 3rd party consultant after every 05 years during the Operational Phase of the Project.	Will be complied when required.

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<b>Condition</b>	<b>Status of compliance</b>
The proponent shall undertake a plantation (of indigenous species) activity, in consultation with Forest Department, Govt. of AJ&K, both at the Weir & Powerhouse sites as a measures to enhance the watershed in immediate vicinities, increasing carbon sink and for the purpose of aesthetic beauty of the area.	Company and its EPC Contractor participated in annual tree plantation campaigns and planted several species within the project area. This will be continued during the operational phase as well.
Monitoring shall cover the entire life of the project and monitoring reports in this regard shall be submitted to AJK-EPA on quarterly basis.	Quarterly monitoring reports have been shared with EPA-AJK during the construction period. The same will also be shared during the entire operational phase of the project.
Proponent shall ensure the adequate arrangements for addressing public grievances, if any.	GRM and GRC is proposed in ESMP. The formal notification will be shared once the establishment of both is finalized.
In case an independent Environment Specialist Companies are to be hired, as an arrangement, to undertake measurements of different parameters critically important in determining water & air quality and assessing noise emission level during the operational phase of the proposed project, the findings of monitoring shall be shared with AJK-EPA as a part of quarterly monitoring reports.	Third part monitoring was done during the construction period and the results were shared with all the stakeholders including EPAs. The same will be done during the entire operational phase of the project.
The proponent shall finalize the plan and ensure the arrangements in-place for the execution of CSR within a month of issuance of this approval.	The document is under preparation and will be shared with the relevant stakeholders once finalized.
The proponent shall ensure that strict and efficient Occupation Health & Safety Plan in-place and the same shall be shared with AJK-EPA accordingly.	Will be complied as desired.
As far as possible, the local people shall be given preference for all unskilled jobs. Preference may also be given to them for all semiskilled and skilled jobs as well.	Being complied. Please note that during the operational phase, very few vacancies are available. Hiring is being done keeping the locals on priority.
The mechanized plants and machinery and other equipment must be fitted with noise abatement devices and should have the conformity to NEQS standards.	Agreed.
The proponent shall be liable for the correctness and validity of the information provided in EMP.	Agreed.

<b>Condition</b>	<b>Status of compliance</b>
Proponent shall be responsible to facilitate EPA team for any visit for inspection/monitoring, etc.	Agreed. The Company has always facilitated all the stakeholders for site visits.
This approval shall stand null and void if the conditions, mentioned herein before, are not fully complied with.	Agreed.
This approval does not absolve the proponent of the duty to obtain any other approval or clearance that may be required under any law in force or by any competent forum/court of law.	Agreed.
This approval can be withdrawn at any time with any prior notice if deemed necessary in the public interest.	Agreed.

**b) Relevant Government Agencies**

As the Project is located on the boundary of Khyber Pakhtunkhwa and Azad Jammu & Kashmir, Star Hydro Power Limited (the “Company”) had to seek approval of Environmental Impact Assessment (EIA) from following two Environmental Protection Agencies (EPAs).

- i. EPA Azad Jammu and Kashmir
- ii. EPA Khyber Pakhtunkhwa

**c) Issuance dates and duration of validity**

<b>Issuing Authority</b>	<b>Issuance Date</b>	<b>Duration of Validity</b>
EPA-AJK	10-08-2010	Project construction phase
EPA-KPK	14-04-2011	Project construction phase
EPA-AJK	08-08-2017	Project operational phase
EPA-KPK	29-09-2017	Project operational phase

**INCIDENTS OF VIOLATIONS OR NON-COMPLIANCE**

HSE compliance monitoring has been undertaken regularly during the reporting quarter. To ensure implementation of recommended procedures, regular liaison was maintained by the O&M operator with the Company. To prevent incident and mitigate risks, during the quarter, close supervision was carried out by O&M’s HSE team.

Waste collection is being done on daily basis on powerhouse site. Waste collectors collect the trash (waste) from the site and O&M accommodation buildings and dispose in the trash bins. Afterwards, the waste is segregated, non-recyclables are taken to the government approved landfill for proper disposal of waste. No environmental incident has been reported during the quarter.



#### **a) HSE monitoring during maintenance**

During the reporting quarter, maintenance works for installation of new upper draft tube cone was conducted by the maintenance team and entire activity was supervised by O&M HSE team.



**b) Warning Letters for Non-compliances**

No warning letters were issued during the reporting quarter. As per policy, warning letters will be issued depending on nature and severity of violation. Verbal warning for the first time on minor violations and if any employee fails to abide by HSE policies after verbal warning a written warning letter will be issued.

**INCIDENTS OF ENVIRONMENTAL AND SAFETY ACCIDENTS****a. Environmental Accidents and Mitigation**

No environmental incident occurred during the reporting quarter on both the sites (weir and powerhouse).

**b. Health and Safety Accidents and Mitigation**

Accidents can be minimized by providing necessary health and safety information, instruction, and supervision to employees. Employees are encouraged to take reasonable care for their own health and safety.

Summary of health and safety incidents during quarter is in the table given below.

<b>Incident</b>	<b>Frequency</b>	<b>Description</b>	<b>Media or Community Reaction</b>
Fatality	None	None	None
Medical Treatment Case	0+0+0	None	None
Near Miss	0+0+0	None	None
First Aid	0+0+0	None	None
Fire Incident	0+0+0	None	None
Property damage/environmental incident	0+0+0	None	None
Medical Checkup / Examination / Treatment	0+0+0	None	None

**EXTERNAL MONITORING /INSPECTION**

No external monitoring conducted during the reporting period.

**INTERNAL INSPECTIONS CONDUCTED DURING REPORTING PERIOD**

Site HSE inspection has remained an ongoing activity. To mitigate safety incidents, machinery, equipment and electrical appliances are being inspected by HSE staff to ensure fitness.

According to the nature of work, inspections have been carried out by the HSE team during the reporting period to reduce the risk of accidents and impacts on environment and for proper maintenance of machineries and other equipment regularly.

Following inspections were undertaken during first quarter 2018;

- Site Overall Inspection
- Fire Extinguisher Inspection
- Health and Hygiene Inspection
- Hand & Power tools Inspections



## MITIGATION MEASURES

To ensure health and safety of both staff and labor on Project area, following were some of the prominent activities undertaken during the quarter:

1. Maintenance team is provided with necessary Personal Protective Equipment (PPE) comprising of helmets, safety shoes and safety jackets and ankle belts to prevent injuries.
2. Regular trainings/education sessions for all employees.
3. Newly employed staff, labor and daily wagers were given HSE inductions so that they are aware of potential risks associated with the sites emergency procedures.

## LABOR RELATIONS AND CONDITIONS

### (i) Nature of dispute or grievance

No dispute or conflict with workers or local community was observed or reported during the reporting quarter. Complaints box are positioned on each site on detectable location for the ease in submitting complaints.



**(ii) Authorities in charge of investigation/recording**

In case of any incident, relevant team manager and HSE staff is responsible to record, investigate and address it appropriately.

To address any dispute or work related complaint received from staff /workers. Internal Grievance Redress Committee (GRC) comprising of Admin Manager and HSE Manager are mandated to investigate the matter in an unbiased manner and resolve it amicably so that the concerned party or individual may be satisfied and a friendly / peaceful environment is reinstated.

**(iii) Corrective actions, deadlines, identification of responsible parties.**

O&M HSE department indicates corrective actions as and when required for further compliance by entire team of O&M operator.

**(iv) Labor relations and living conditions for employees**

Safety measures such as fire extinguishers and emergency contact numbers are placed on main locations. Following standards are implemented for adherence of local Labor standards:

- Government of Pakistan Labor Policy 2010.
- Standards for labor health and safety are executed according to O&M Contract.
- O&M has made all necessary arrangements for payment, housing & feeding.
- The living conditions are up to merit with all necessities.
- Preference to hire unskilled /skilled staff from AJ&K or KP.

**(v) Medical facilities provided during quarter:**

Availability of first aid boxes has been ensured at both sites.

**PROJECT PROCEDURES FOR: (A) HIRING; AND (B) ACQUISITION OF GOODS AND SERVICES:**

Procedures for hiring have been adopted as per O&M policy and also in compliance with O&M Contract. While, procurement of goods and services by O&M contractor is being carried out under Quality Assurance and Quality Control plan.

**(i) Local Employment Status:**

As per the O&M contract, O&M is bound to employ unskilled workers/lower staff from local areas/ adjacent villages and for skilled jobs preference has to be given to the qualified locals.

The summary of employment status is presented below.

S. No	Description	AJK	KPK	Others	Total
1	K-water O&M	40	10	10	60
2	Security Staff	18	13	--	31
3	Third party Staff	02	02	--	04
4	Community Liaison Officer (CLO)	01	01	--	02
<b>Total</b>					<b>97</b>

**Compliance with legal requirement for employment**

Project Legal Agreement/Contract	Conditions/Requirements	Compliance Status
As per condition Environmental approval issued by AJK EPA	<p>“As far as possible, the local people shall be given preference for all unskilled jobs.</p> <p>Preference may also be given to them for all semiskilled and skilled jobs as well;”</p>	Employment opportunities were disclosed to the local communities through different avenues such as newspapers advertisement, public notice on prominent locations and through community coordinators and local project staff. Preference has been given to the locals subject to availability of skilled and unskilled human resources.

## ENVIRONMENTAL AND SOCIAL CAPACITY

### **i. Staff capacities in environmental and social management**

The Project is being managed with a balanced team of HSE staff in O&M team comprising of HSE Manager, Environmentalist, HSE Officer along with two CLOs and being supervised by the Senior Manager Civil-E&S of the Company.

An orientation to environmental management, health and safety during operations work is part of induction for all the staff and workers hired. Furthermore, daily HSE monitoring, toolbox meeting programs and other related activities raise the awareness level among all staff and workers. The organizational Chart is attached as **Annex-5**.

### **ii. HSE Weekly Meetings:**

Weekly internal meetings are conducted regularly and compliance with HSE standards have always been main agenda items during the meetings.

### **iii. Environmental laws and regulations**

EIA study of the project was completed in light of following laws and regulations. EMP as part of EIA is in implementation under the same laws and regulations;

- Pakistan Environmental Protection Act 1997
- National Environmental Quality Standards (NEQS)
- AJK Environmental Protection Act 2000
- Land Acquisition Act 1894
- Draft National Resettlement Policy 2002
- ADB Safeguard Policy Statement 2009
- IFC Handbook (Resettlement Action Plan)

### **iv. Safety Training and Campaign**

Capacity building activities coupled with effective supervision is always result oriented. HSE trainings were conducted for O&M employees on different subjects. These trainings were conducted in the light of standards guidelines and procedures developed by O&M with site specific modifications.

### **v. Induction Training**

As part of ESMP, all staff and workers before starting their respective jobs have been given induction training.



#### **vi. Tool Box Meetings**

Daily safety message is conveyed to all staff before start of every shift.

#### **vii. Needs assessment of environmental and social management capacity**

As ongoing activity, continuous capacity building initiatives including more specific trainings on environment and social management are required for staff. Furthermore, daily HSE monitoring, toolbox meeting programs and other related activities have raised the awareness level among all employees.

### **STAKEHOLDER CONSULTATION/CSR ACTIVITIES**

To initiate and sustain constructive external relationships with Project stakeholders particularly with adjacent /local communities, consultation is an important tool to enhance the social performance of the Project.

#### **Details of community programs involving civil society/NGOs in implementation:**

Some professional services on quarterly basis are being hired by O&M from locally based individuals and organizations during the quarter. Following organizations have been engaged to undertake activities under ESMP and CSR activities.

HSE sign board preparation and printing activity requirements of the Project is being undertaken by local vender (Chaudhary Steels), resident of Muzaffarabad.

Flora and Fauna Study by local Fisheries and wildlife expert Mr. Yousaf Qureshi who is also retired Director Fisheries Government of AJK.

#### **Collaboration with EPA-AJK enforce “Plastic Bags Regulation 2013”**

During the reporting quarter, EPA-AJK initiated an awareness campaign to enforce the regulation “Plastic Bags Regulation, 2013” that imposes a ban on 'manufacture, sale and usage' of Non-Degradable Plastic bags in AJ&K. AJK-EPA in this respect, introduced OXO-BIODEGRADABLE Plastic

Bags, which are environment & health friendly.

For effective enforcement of ban against Non-Degradable Plastic Bags, EPA-AJK initiated an AWARENESS CAMPAIGN for general public across AJ&K through print & electronic media, displaying hoardings and developing brochures & handouts and awareness walks etc. in all major cities.

Star Hydro Power Limited joined hands with EPA-AJK and committed for financial support for the cause. The contribution was made by the Company in order to make the project area free from Non-Degradable Plastic Bags' and 'Saying No to Plastic Bags'.



## COMPLIANCE AND IMPLEMENTATION ESMP

Compliance monitoring of ESMP has been an on-going activity undertaken by O&M's HSE staff and SHPL on both sites. Non compliances with recommended standards and regulations will be recorded and reported. ESMP compliance status is attached as **Annex-2**.

### a. Environmental monitoring under EMP:

Internal Environmental and Inspection checklist was developed and filled on daily basis. Besides this following activities have been undertaken as part of environmental monitoring.

**i. Flora Study Monitoring:**

Quarterly Study/monitoring was undertaken at both (Power house & weir) sites in March, 2018. Detailed report is annexed as **Annex-3**.



**Vegetation Monitoring for the 1<sup>st</sup> Quarter, 2018**

**ii. Fish fauna Study Monitoring:**

Quarterly Study/monitoring was undertaken in Kunhar River (Up & down stream of Project site) during the month of March, 2018. Sampling was done on six study points. Detailed report is annexed as **Annex-4**.



**Fish Monitoring for the 1<sup>st</sup> Quarter, 2018**

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**Table: Compliance with NEQ's**

<b>Envrn. component</b>	<b>Standards (NEQS)</b>	<b>Compliance/Mitigation measure</b>	<b>Remarks</b>
<b>Air Quality</b>	EPA ambient air quality (EPAs standards for each Parameter )	NEQS: To ensure dust suppression due to transportation activity, unpaved roads are being sprinkled with water at least twice a day. The EPC is taking all necessary measures to limit pollution from dust and any wind-blown materials during construction.	Since major construction works were already completed, dust control has improved significantly during the quarter.
<b>Water quality</b>	WHO Guidelines (EPAs standards for each Parameter)	Waste water from tunnel is treated through sedimentation tanks. Waste water discharged from HRT is being measured	Biannual quality monitoring of waste and drinking water was undertaken in the quarter.
<b>Noise levels /Vibration</b>	EPA ambient noise standards and worldwide vibration standards.	Noise: Noise prone activities were avoided during night time. No open blasting was done during quiet hours. Excavators and all heavy machines were lubricated in a routine matter to minimize the noise and to increase the life of equipment  Vibration: More concern regarding factors of human comfort and structural damage was given and always tried to comply with allowable vibration standards. Blasting checklist was used by HSE staff.	Noise level and vibration record is maintained
<b>Soil quality</b>	EPA quality standard (Different standards for each Parameter)	No environmental incident observed	Construction works completed in first quarter
<b>Flora</b>	Visual observations by relevant Forest professional during EIA study.	Study /monitoring during last quarter undertaken	Study undertaken in Mar-18 ( <b>Annex-02</b> )
<b>Fish Fauna</b>	Observation by relevant wildlife & Fisheries professional during EIA study.	Study /monitoring for last quarter undertaken	Study undertaken in Mar-18 ( <b>Annex-03</b> )

**b. Occupational health and safety**

Health and safety of staff/workers has been a prime consideration during the operations of the Project. In accordance with the safety standards, all the relevant staff are provided with the Personal Protective Equipment (PPE) comprising of hard hats, safety shoes, and jacket and dust masks depending upon the job specification to prevent injuries. Morning physical exercise has also been undertaken regularly.

1. Waste management training sessions were held for supervisors and relevant personnel. Furthermore, waste segregation methods were practically taught to site workers and staff to adopt appropriate mechanism.
2. During quarter, coordination meetings, monitoring and inspections were undertaken by O&M's HSE staff with regard to site HSE status.
3. Waste segregation, collection, transportation and disposal mechanism has been implemented and full time waste collectors were placed on both sites. Waste management training sessions were held for supervisors and relevant personnel.

**ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN**

To manage the environmental and social issue appropriately, following detailed plans developed by O&M operator have been in implementation to fulfill the environmental and social compliance requirements of the project;

- a) Plan for Waste Management
- b) Plan for Traffic Management
- c) Plan for Reservoir Management

**a. Plan for Waste Management**

O&M contractor have hired waste collectors on both sites to maintain housekeeping and timely segregation /collection of waste. All the waste generated at sites is being managed in accordance with ESMP & Waste Management Plan. O&M made contract with private company to collect the waste on weekly basis. The quantity of waste is being recorded on the waste consignment note.

Daily environmental performance regarding potential environmental impacts has been prepared and monitoring at site is being done regularly by direct observation and inspection. Waste management plan is attached as **Annex-6**.

**b. Plan for Traffic Management:**

Safety precautions, warning sign boards have been placed at different locations to protect staff/workers and the general public. All the vehicles are equipped with directional control signage and are being inspected prior to use. Traffic Management Plan is attached as **Annex-7**.

**RESETTLEMENT PLAN IMPLEMENTATION**

**i. Scope of Land Acquisition and Resettlement Impacts**

The land identified by the EPC Contractor on the basis of basic design of the Project measuring 872.65 Kanal (601.4 Kanal on AJK and 188.7 Kanal on KP side) was acquired by the Company in 2012 through Land Acquisition Act (LAA) 1894 applicable in both AJ&K and KPK. The land acquired in 2012 was owned by 94 land owners which was detailed in the approved resettlement plan.

In 2014, during the construction on the weir site, it was noticed that the land area of 3.7 Kanal “Additional Land” is further required on AJ&K side which is to be submerged due to the head pond of the Project. The land is owned by three (03) land owners.

Due to the change in the design and location of weir downstream in late 2014, it was confirmed through survey that the land area of 10.3 Kanal is further required on AJ&K side the slope stabilization in the stilling basin area downstream of the weir. The land is owned by six (06) land owners. The process of acquisition on AJK side completed in December 2015.

Furthermore, in 2015 on the complaint of the local Mr. Khalid who also raised the same issue during the Lenders’ E&S mission in November 2015, on the head pond area a survey was conducted to confirm whether his land is affected or otherwise. EPCC conducted the survey on November 13, 2015 and it was confirmed that his land measuring 5.45 Kanal was being affected due to submergence in the head pond. The process of acquisition started by contacting the relevant revenue department. Section-4 was issued on April 01, 2016. Initial assessed value of the land by the revenue department was deposited by the Company in November 2016. The detail of compensation is given in subsequent section.

During the reporting period, it was brought in to notice of the revenue department/district administration by one of the locals (Mr. Fareed) in Shoran village AJK that his land and house is right on the bank of river Kunhar and the area was prone to sliding in the past as well and asked the revenue department/district administration to acquire his land. The revenue started the procedure of acquisition of land in February 2017 and the land award was issued on October 31, 2017 for the land measuring 4.66 Kanal.

In addition to above, when reservoir impounding was being done, the local community of Deedal and Dalola villages (KP area) asked the district administration/revenue department to conduct a survey through revenue staff to confirm whether their land was being submerged. After the detailed survey by the revenue staff it was communicated to the Company that additional land will be submerged.

The Company along with the revenue staff again visited the site to confirm the additional land acquisition matter. It was found that land measuring 65.45 Kanal was already destroyed by the landslide well before the project started. According to revenue staff, its status in revenue record is not updated as slid area which means Company has to acquire the same. In addition to this about 17.7 Kanal land in Dalola was also being affected.

The Company approached the district administration/revenue department and apprised the situation. The revenue department started the process and issued section-4 for the areas (65.45 & 17.7 Kanal) on July 25, 2017. After the issuance of section-4, the Company was asked by the revenue department to execute an Agreement U/S-41 of LAA 1894 with GoKP. The draft agreement was shared with the office of Commissioner Hazara Division but till date there is no further development on the issue. The acquisition process will formally start after the execution of Agreement U/S-41.

### SUMMARY OF THE LAND TO BE ACQUIRED ON AJK AND KPK

PERMANENT LAND						
Sr.	Project Component	Affected Land (Kanal)				
		State owned Land/ Riverbed	Farmland	Wasteland	House land	Total
1	Reservoir Impounding	87.3	282.05	231.9	9.1	610.35
2	Weir Structures	0	1.5	48.7	0	50.2
3	Powerhouse	13.6	30.1	32.85	5.25	81.8
4	Surge Tank	-	-	47.75	-	47.75
5	Additional Land-Patrand	0.3	3.75	15.4		19.45
6	Additional Land-Shoran	-	-	3.52	1.14	4.66
7	Additional Land-Deedal		1.95	63.5		65.45
8	Additional Land-Dalola			1.4		1.4
9	Additional Land-Naroka		1.65	14.65		16.3
<b>Total Permanent Land Acquisition (Kanal)</b>		<b>101.2</b>	<b>321</b>	<b>459.67</b>	<b>15.49</b>	<b>897.36</b>
TEMPORARY LAND						
	Colony of Expatriate construction staff, Switchyard, labor camp, access road, bridge, batching plant at Powerhouse Site	54.75	0	27.8	0	82.55
<b>Total Temporary Land Acquisition (Kanal)</b>		<b>54.75</b>	<b>0</b>	<b>27.8</b>	<b>0</b>	<b>82.55</b>
<b>Total Land Acquisition (Kanal)</b>		<b>155.95</b>	<b>321</b>	<b>487.47</b>	<b>15.49</b>	<b>979.91</b>

#### ii. Status of Land Acquisition, Progress on Compensation Payments and Assistance Delivery

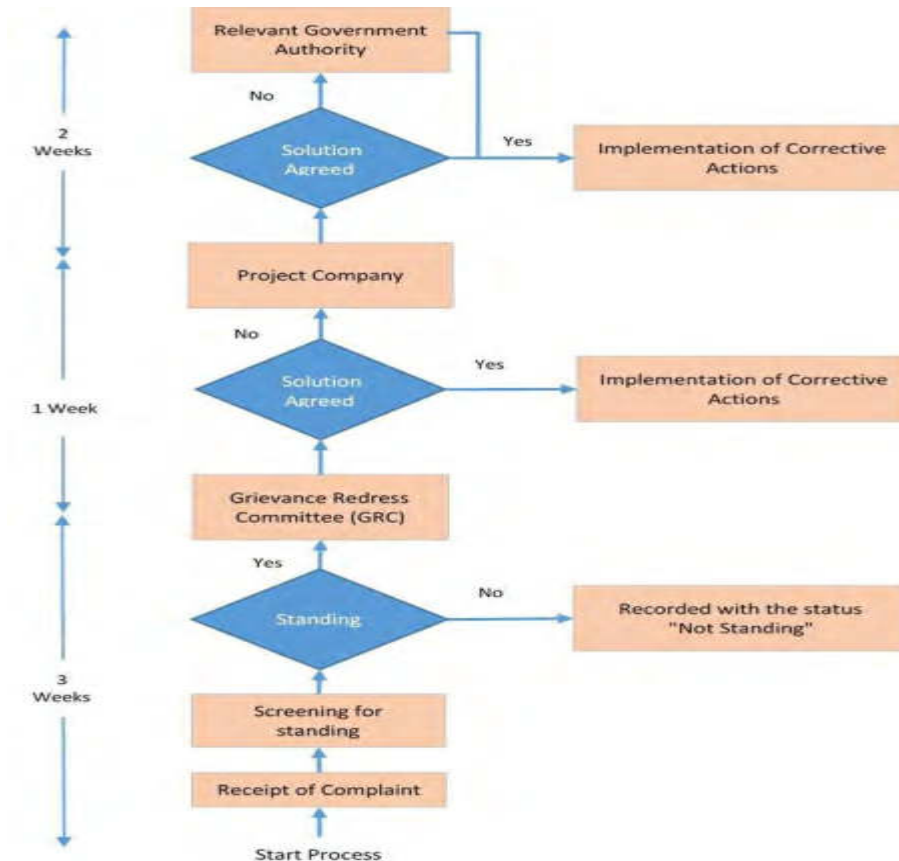
Payment for land acquisition on both sides of the project is in process. The Company has deposited the assessed cost (100%) even for additional land whose cost has been finalized by the revenue department into Government treasuries for subsequent payment to APs. For the additional land acquired for the head pond about 97% payment has been made which is reflected in the below table. However, there is delay in the payment of compensation due to (i) unavailability of entitled land owners who are working or based in other cities or (ii) an existing shareholding dispute among the families. Status of the land acquisition is as follows;

**Summary of Land Acquisition Progress and compensation payments including additional land**

Village	Area	Award Amount	Disbursed	%age	No. of Persons	Persons received payment
<b>1. AJ&amp;K</b>						
<b>A. Land/Property</b>						
Powerhouse (Alda Village AJ&K)	81.8	92,479,824	87,593,842	94.72%	196	561
Headpond (Shoran Village AJ&K)	130.75	75,181,250	73,283,741	97.48%	611	200
Weir + Headpond (Patrind Village AJ&K)	341.1	204,037,798	195,911,948	96.02%		353
Forest land for Surge Tank (Alda village)	47.75					
<b>Additional Land/Property</b>						
Headpond (Patrind Village AJ&K)	3.7	2,127,500	1,955,000	91.89%	3	19
Weir (Patrind Village AJ&K)	10.3	6,076,540	5,562,233	91.54%	3	19
Headpond (Shoran Village AJ&K)	4.66	6,054,188				
<b>B. Trees</b>						
Alda		1,815,089	1,804,318	99.41%		19
Alda		75,546	75,546	100.00%		
Shoran		757,391	685,073	90.45%		58
Shoran		106,053	106,053	100.00%	1	1
Patrind		837,882	829,515	99.00%		32
<b>Sub-Total</b>	<b>620.06</b>	<b>383,494,873</b>	<b>367,807,269</b>	<b>95.91%</b>	<b>814</b>	<b>1262</b>
<b>2. KPK</b>						
<b>Land/Property/Trees</b>						
Weir + Headpond (Sarati Village KPK)	188.7	128,557,081	114,613,320	89.15%	196	Detail Yet to receive
Headpond (Deedal Village KPK)	5.45					The acquisition process is still at initial stage
Headpond (Deedal Village KPK)	65.45					
Headpond (Dalola Village KPK)	1.4					
Headpond (Naroka Village KPK)	16.3					
<b>Sub-Total</b>	<b>277.3</b>	<b>128,557,081</b>	<b>114,613,320</b>	<b>89.15%</b>	<b>196</b>	

## GRIEVANCE PROCEDURES

GRC would be a forum for raising objections and holding discussions to resolve conflicts. Moreover, consultation with the local community and concerned public representatives and officials of the relevant line departments is an ongoing process. Relevant information to the stakeholders has always been provided in a timely manner and in a form and language that are understandable and accessible to them. A grievance mechanism has been proposed in the Environmental & Social Management Plan (ESMP) for operational phase of the project.



Complaint boxes are placed at prominent locations on both sides of the project. Furthermore, the CLOs are also engaged for community consultation and coordination and have key role in the grievance redress mechanism. The community/APs complaints are being addressed very diligently and carefully at all levels, i.e. district and at project level.

Issues related to land acquisition and compensation requires involvement of District administration/Revenue department. For land related grievances, the land owners contact the relevant revenue department/district administration or the courts. The Company has to respond to relevant government departments since the land was acquired through LAA by the Govts.

# Annexures

# **ANNEX-1**

## **ENVIRONMENTAL FLOW DATA**

<b>Environmental Flow Data- 1st Quarter-2018</b>					
<b>January-18</b>		<b>February-18</b>		<b>March-18</b>	
<b>Day / Sensor</b>	<b>Water Flow (m3/s)</b>	<b>Day / Sensor</b>	<b>Water Flow (m3/s)</b>	<b>Day / Sensor</b>	<b>Water Flow (m3/s)</b>
1 Day	18.03	1 Day	2.37	1 Day	2.14
2 Day	17.66	2 Day	2.39	2 Day	
3 Day	17.98	3 Day	2.34	3 Day	
4 Day	17.29	4 Day	2.36	4 Day	
5 Day	17.66	5 Day	2.34	5 Day	2.23
6 Day	17.79	6 Day	2.34	6 Day	2.25
7 Day	17.24	7 Day	2.32	7 Day	2.27
8 Day	16.46	8 Day	2.32	8 Day	2.28
9 Day	17.25	9 Day	2.31	9 Day	2.28
10 Day	17.22	10 Day	2.27	10 Day	2.29
11 Day	17.35	11 Day	2.18	11 Day	2.26
12 Day	17.52	12 Day	2.39	12 Day	2.28
13 Day	15.71	13 Day	2.29	13 Day	2.29
14 Day	17.27	14 Day	2.34	14 Day	2.84
15 Day	16.88	15 Day	3.03	15 Day	2.27
16 Day	16.54	16 Day	4.72	16 Day	2.27
17 Day	16.03	17 Day	2.51	17 Day	2.28
18 Day	17.22	18 Day	2.35	18 Day	2.27
19 Day	11.16	19 Day	2.36	19 Day	2.22
20 Day	5.53	20 Day	2.36	20 Day	2.25
21 Day	2.39	21 Day	2.35	21 Day	2.28
22 Day	2.38	22 Day	3.44	22 Day	2.34
23 Day	2.37	23 Day	2.37	23 Day	2.31
24 Day	2.37	24 Day	2.36	24 Day	2.31
25 Day	2.37	25 Day	2.37	25 Day	2.31
26 Day	2.38	26 Day	2.47	26 Day	2.32
27 Day	2.4	27 Day	2.28	27 Day	2.33
28 Day	2.39	28 Day	2.26	28 Day	2.32
29 Day	2.06			29 Day	2.32
30 Day	2.4			30 Day	2.33
31 Day	2.33			31 Day	2.29

## **ANNEX-2**

# **EMP COMPLIANCE STATUS**

**Environmental & Social Monitoring Report (Jan-Mar 2018)**

Sr. No	Environmental Management Plan (Compliance Status)		
	Feature/Issue	Parameters/monitoring	Compliance Status/Action taken by EPCC
1.	Statutory Requirements	Compliance with approval conditions	<ul style="list-style-type: none"> <li>Compliance with the conditions of approval by EPA-AJ&amp;K, ADB's Safeguard Policy and IFC's Performance Standards is being ensured.</li> </ul>
2.	Hydrology	River flow volume	<ul style="list-style-type: none"> <li>Flow measuring gauges have been installed upstream and downstream of Kunhar river. The flow is being measured continuously.</li> </ul>
3.	Headpond stability	Banks stability	<ul style="list-style-type: none"> <li>The stability of river banks will be monitored according to the reservoir management plan throughout the project operations.</li> </ul>
4.	Aquatic Ecology	Habitat availability and seasonal fish species and populations	<ul style="list-style-type: none"> <li>Fish study was undertaken in 1st Quarter, 2018.</li> <li>Fishing &amp; hunting prohibited on project sites. No endanger species found.</li> </ul>
5.	Water Quality	Wastewater treated prior to river discharge (Temperature, dissolved oxygen, pH, conductivity, turbidity, total phosphorous, inorganic phosphorous, total nitrogen, ammonia nitrogen, nitrogen oxides, biochemical oxygen demand and fecal coli forms)	<ul style="list-style-type: none"> <li>Biannual monitoring was undertaken during the month of March, 2018</li> <li>The results of analysis show that at location downstream of Jhelum river the turbidity value was on higher side. The reason for the higher turbidity is the addition of Kunhar river flow which is more turbid used for project operations and few rains in the upper reaches of Jhelum river. Kunhar river is very fast flowing river and river flow is mainly from snow melt. Kunhar river contains huge sediment load in the high flow season.</li> </ul>
6.	Hazards/Risk	<ul style="list-style-type: none"> <li>Monitor landslides</li> <li>Structural soundness</li> </ul>	<ul style="list-style-type: none"> <li>Landslide monitoring shall be done on biannual basis</li> <li>Structural soundness shall also be monitored during the operational phase.</li> </ul>
7.	Noise	Noise levels	<ul style="list-style-type: none"> <li>Shall be monitored according to the agreed frequencies</li> </ul>
8.	Solid waste disposal	Visit disposal sites	<ul style="list-style-type: none"> <li>Waste management plan is formulated. For waste collection and its disposal, O&amp;M operator has executed an agreement with third party contractor.</li> </ul>
9.	Waste water discharge	Waste water quality in accordance with NEQS	<ul style="list-style-type: none"> <li>Study/monitoring undertaken in 1st Quarter, 2018, removal undertaken as indicated in EIA.</li> </ul>
10.	Workers' health & safety	WAPDA safety codes for powerhouse	<ul style="list-style-type: none"> <li>HSE plan has been developed keeping in view the safety codes and is under implementation on both sides of the project i.e. powerhouse and weir</li> </ul>

## **ANNEX-3 VEGETATION STUDY**

## **Vegetation Study on the Patrind Hydro Project Area**



**January-March 2018**

**Submitted By**

**Dr. Mohammad Yousaf Qureshi**

**Country Director Edinburgh Direct Aid (EDA)**

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## **VEGETATION STUDY OF PATRIND HYDRO POWER PROJECT**

### **1. Background**

There are three components of a run-off- river project impacts on the vegetation of the Project area. One due to the blockage of water by the construction of weir and other due to the construction of powerhouse by the water diversion through the tunnel and third due to the placement of high voltage transmission line.

The environmental impact of reservoirs comes under ever-increasing scrutiny as the global demand for water and energy increases and the number and size of reservoirs increases.

Dams and reservoirs can be used to supply drinking water, generate hydroelectric power, increase the water supply for irrigation, provide recreational opportunities, and flood control. The construction of dams and other similar projects throughout the world including Pakistan have generated considerable environmental and political debate. The construction of a weir on the river flow obstructs the water impacting downstream and upstream ecology.

Pakistan has large below the required area under productive forests. It has about 4.5% of its area as compared to a minimum requirement of 25%. This again is threatened due to such activities that damage the tree cover. Damming, road construction, huge transmission lines, housing schemes and such other activities are alarming issues. Reduction in forest cover means shortage of underground water storage, warming up the atmosphere and creation of more environmental disaster risks.

Planners have to take care while designing the mega projects of dams, highways, construction of concrete buildings. There is a very high demand of irrigation water and energy in the country for agriculture and industry. Dams and reservoirs can be used to supply drinking water, generate hydroelectric power, increase the water supply for irrigation, provide recreational opportunities, and flood control. All this is true but it is required to take care of the natural balance as well. In constructing these dams, one must be conscious of the losses we face and the quality of life we scarify. The scoring will tell us the importance of having such facilities or otherwise.

## 2. Introduction

Patrind Hydropower Generation project has been installed on River Kunhar to produce 147 MW of electric Power. The River Kunhar has been obstructed by the construction of weir at Patrind with a provision of about 2.5 km water diverting tunnel passing under the mountain system and draining water at Alda in Muzaffarabad. The powerhouse has been established here. The sides of the intake and draining sites have been concreted to control landslide or erosion risks. Green belt on both the sides is affected with this type of construction though it is in the limited area.

	
Concrete area behind powerhouse site	Concrete work at weir point Patrind

The study area is about 10 km up and downstream of river Kunhar from the weir point at Patrind ( $34^{\circ} 20' 36''$  N and  $73^{\circ} 25' 10''$  E) at an elevation of 2516-3123 ft a.m.s.l) and around the powerhouse at Alda ( $34^{\circ} 20' 06.05''$  N,  $73^{\circ} 27' 18.6''$  E) in AJK. It covers both the eastern aspects on the left bank of river Kunhar and right bank of river Jhelum in AJK.

Agricultural production on the terraced fields depends on runoff water harvesting and soil moisture conservation. These terraced fields were created by leveling with bulldozers/manual labor during the last 3-4 decades. Subsidized machinery encouraged the farmers to level the hillsides without considering the requirements for water harvesting and safe disposal of surplus runoff during high rain storms. The area always suffers by deliberate forest fires on both the sites at Patrind and at Alda almost every year for the better growth of grasses.

### 3. Forest Types (Ecological Zonation):

The Patrind project area lies in the sub-tropical ecological zone of the country. This zone is again classified in:

- a) Subtropical Scrub forest with broad leave tree species in the foot hills and
- b) Subtropical Chirp pine Forest with a major tree species of Chirp Pine.

### 4. Vegetation Cover

Vegetative cover exists of all three stages i.e., Tree cover, bush canopy and herbs and grasses as understory. Project site vegetation does not contain any species listed as endangered or threatened by the Government of Pakistan or IUCN. Only two species *Celtis austarlus* (Batcud) and *Ficus carica* (Enjeer) were found rare in Pakistan but they are listed as common for the rest of the world. Some of these trees have been submerged in the reservoir water but most of the trees were cut by the affected communities of the area before the rise of water. The presence of these two species above the highest water level will not be disturbed as they were found above the submerged area and away from the affected land area. Other vegetation species were found protected and common in Pakistan and for the rest of the world. So, it is concluded that there will be no negative impacts of Patrind Hydropower Project on the conservation status of the high hill vegetation of the area. The area around the Powerhouse at Alda is mostly dominated by the Chirpine species on the mountain slopes. The transmission line connecting the project with grid station at Rampura in Muzaffarabad and other supplying power to Hazara in KPK pass through the forest and for the safety of line and proper installation of the poles, the tree canopy coming under this line has been cleared by the forest department on the requirement of power purchaser.

Following are the tree species in the project area both in Patrind and in Alda villages:

<u>Common Name</u>	<u>Botanical Name</u>	<u>Type of Tree</u>	<u>Status</u>
Akhrot (Wallnut)	<i>Juglans regia</i>	Fruit	Common
Anjeer	<i>Ficus carica</i>	Fruit	Rare

Batang	<i>Pyrus patia</i>	Fruit	Common
Batculd	<i>Celtis australis</i>	Soil binder	Rare
Beence	<i>salix spp</i>	Firewood	Common
Ber	<i>Zizyphus mauritiana</i>	Fruit	Common
Chir	<i>Pinus roxburglii</i>	Timber	Common
Dhaman	<i>Grewia oppositifolia</i>	Fodder	Common
Drawa	<i>Ailanthus anus</i>	Firewood	Common
Drek	<i>Melia azadrach</i>	firewood	Common
Kangarr	<i>Pistacia khunjak</i>	Soil binder	Rare
Kau	<i>Olea cuspidate</i>	Agri tools,	Common
Kiker	<i>Acacia nilotica</i>	Firewood	Common
Nim	<i>Azadirachata indica</i>	Firewood	Common
Phagwarr	<i>Ficus Palmata</i>	Soil binder	Common
Phulai	<i>Acacia modesta</i>	Firewood	Common
Pipal	<i>Ficus religiosa</i>	Firewood	Common
Robinia	<i>Robinia pseudoacacia</i>	Firewood	Common
Shahtoot	<i>Morus Alba</i>	Fruit	Common
Sherol	<i>Alnus nitida</i>	Firewood	Common
Snatha	<i>Dodonaea viscosa</i>	Soil binder	Common
Talli (shisham)	<i>Dalbergia sisso</i>	Furniture wood	Common

The main contributor grass species are *Heteropogon contortus* (Sariala), *Cenchrus ciliaris* (Dhaman), *Desmostachya bipinnata* (Dab ghaas), and *Cynodon dactylon* (Khabbal).

Comparatively low vegetation cover was recorded in the flat area and highest from steep slope areas (74.29%) followed by gentle slope and gully bed areas.

## **5. Impact of the Project on Vegetation**

The impacts of dam are summarized below

- **Upstream Impacts**
- **River Fragmentation**

The natural river flow manages a set ecosystem around it. Flooding, water temperature, riparian vegetation and other natural factors due to damming fragmentation alter the ecosystem and this changes the species composition both in the aquatic and side ecology. These factors may invite the invasive species in the area.

- **Reservoir sedimentation**

Rivers carry sediment down their riverbeds, allowing for the formation of depositional features such as river deltas, alluvial fans, braided rivers, oxbow lakes, levees and coastal shores. The construction of a dam blocks the flow of sediment downstream, leading to downstream erosion of these sedimentary depositional environments, and increased sediment build-up in the reservoir. While the rate of sedimentation varies for each dam and each river, eventually all reservoirs develop a reduced water-storage capacity due to the exchange of "live storage" space for sediment. Diminished storage capacity results in decreased ability to produce hydroelectric power, reduced availability of water. The project has a provision of "flushing tunnel" at Patrind on the right bank of Kunhar River to flush out the sedimentation. This will change the natural and gradual process of sedimentation downstream and will impact the aquatic flora and fauna for both lacustrine and riparian nature.

- **Downstream Impact**

- **River line and coastal erosion**

As all dams result in reduced sediment load downstream, a dammed river is greatly demanding for sediment as it will not have enough sediment. This is because the rate of deposition of sediment is greatly reduced since there is less

to deposit but the rate of erosion remains nearly constant, the water flow erodes the river shores and riverbed, threatening shoreline ecosystems, deepening the riverbed, and narrowing the river over time. This leads to a compromised water table, reduced water levels, homogenization of the river flow and thus reduced ecosystem variability, reduced support for wildlife, and reduced amount of sediment reaching coastal plains and deltas. This prompts coastal erosion, as beaches are unable to replenish what waves erode without the sediment deposition of supporting river systems. Downstream channel erosion of dammed rivers is related to the morphology of the riverbed, which is different from directly studying the amounts of sedimentation because it is subject to specific long term conditions for each river system.

- **Water temperature**

The water of a deep reservoir in temperate climates typically stratifies with a large volume of cold, oxygen poor water in the hypolimnion. Patrind reservoir represents this situation at some points adjacent to the weir. Analysis of temperature profiles from 11 large dams indicated differences between surface water and bottom water temperatures up to 16.7 degrees Celsius. If this water is released to maintain river flow, it can cause adverse impacts on the downstream ecosystem including fish populations. Under worse case conditions (such as when the reservoir is full or near full), the stored water is strongly stratified and large volumes of water are being released to the downstream river channel via bottom level outlets, depressed temperatures can be detected 250 - 350 kilometers downstream. The operators usually attempt to address thermal suppression by hanging a geotextile curtain around the existing outlet tower to force the selective release of surface water.

- **Natural ecosystems destroyed by agriculture**

Many dams are built for irrigation and although there is an existing dry ecosystem downstream, it is deliberately destroyed in favor of irrigated farming. The Patrind Project is installed on the runoff water and is meant only for the power production. So, it can safely be said that it will have no impact on the agricultural crops.

- **Effects on flood-dependent ecology and agriculture**

The areas downstream depending on the seasonal floods are affected as the ecology disturbs due to the absence of the flood water. This is applied in the areas where forest and agriculture ecology depends on the flood water. In case of Patrind Project, there will be very less impact since, it will only divert the water of 153 cumecs for power generation and rest of the discharge will be released downstream which can maintain the river ecology during the flood season. However, low water quantity in dry period may impact the riparian species up to a distance of about 13 km downstream.
- **Potential for disaster**

Dams occasionally break causing catastrophic damage to communities downstream. Dams break due to engineering errors, attack or natural disaster. In this case, beside human losses, the whole river ecology is destroyed. This is true in almost all the cases of dam construction. China and America are the two examples where 200,000 and 65,000 people, respectively, died due to this disaster.
- **Flood control**

The dams are able to store several cubic kilometers of floodwaters on the rivers. The floods of 1992, 2010 and 2012 in Pakistan have damaged the property and lives. Dams can hold surplus water or divert as in case of Patrind, to make the downstream area safer from these floods.
- **Effects beyond reservoir**
  - **Effects on humans**
    - **Diseases:**

Whilst reservoirs are helpful to humans, they can also be harmful as well. One negative effect is that the reservoirs can become breeding grounds for disease vectors. This holds true especially in tropical and subtropical area like, Patrind where mosquitoes (which are vectors for malaria) and snails (which are vectors for Schistosomiasis) can take advantage of this slow flowing water. There is one good solution for that is to introduce trout fish in the lake so that mosquitoes and snail can serve as food for the fish.

➤ **Resettlement:**

Dams and the creation of reservoirs also require relocation of potentially large human populations if they are constructed close to residential areas. The Patrind reservoir submerged very less area of land and also involved some people to relocate which is minimal as compared to other large hydropower projects. Compensation in terms of money is not the alternate source of satisfaction for the affected people. "Dam related relocation affects society in three ways: an economic disaster, human trauma, and social catastrophe", states Dr. Michael Cornea of the World Bank, as well as, in case of resettlement of communities, care must also be taken not to irreparably damage sites of historical or cultural value. The Patrind Project involved resettlement of the people of two villages Patrind village on weir side and Alda village on powerhouse side.

• **Greenhouse gases**

Reservoirs may contribute to changes in the Earth's climate. Warm climate reservoirs generate methane, a greenhouse gas when the reservoirs are stratified, in which the bottom layers are anoxic (i.e. they lack oxygen), leading to degradation of biomass through anaerobic processes. At a dam in Brazil, where the flooded basin is wide and the biomass volume is high the methane produced results in a pollution potential 3.5 times more than an oil-fired power plant would be. A theoretical study has indicated that globally hydroelectric reservoirs may emit 104 million metric tons of methane gas annually. Methane gas is a significant contributor to global climate change.

The following table indicates reservoir emissions in milligrams per square meter per day for different bodies of water.

Location	Carbon Dioxide	Methane
Lakes	700	9
Temperate reservoirs	1500	20
Tropical reservoirs	3000	100

- **Impact of the Construction of Diversion Tunnel & Transmission Line**

- **Construction of Water Diversion Tunnel**

Construction of water diversion tunnel impacts the area in two ways. The water ducts above the tunnel are destroyed and natural flow of water is affected by this. The vegetation depending on these water flow ducts and natural springs above the area are also. In case of Patrind Project, this impact has been compensated by the project authorities through the provision of three underground water pumps in the area for the communities. The slide adjacent to the powerhouse expanded which has been stabilized mostly by engineering solutions i.e. shotcreting, step walls and concreting. This would still be better to apply biological, Bioengineering and engineering technology to stabilize this slide. This intervention can be done under the supervision of an expert.

- **Tree removal under the High Transmission Line**

Trees were removed under the High Voltage Transmission Line (HTL). This will impact in the reduction of biomass of the area. Total Volume of Chir pine wood removed is 6045 cubic feet. There are 35 trees harvested either under the transmission line or area coming under the outlet of the tunnel. Some slope and flant land has been treated by planting the trees but the tree species recommended for planting should also be considered in future campaigns.

- **Radiation impact on the vegetation under the line**

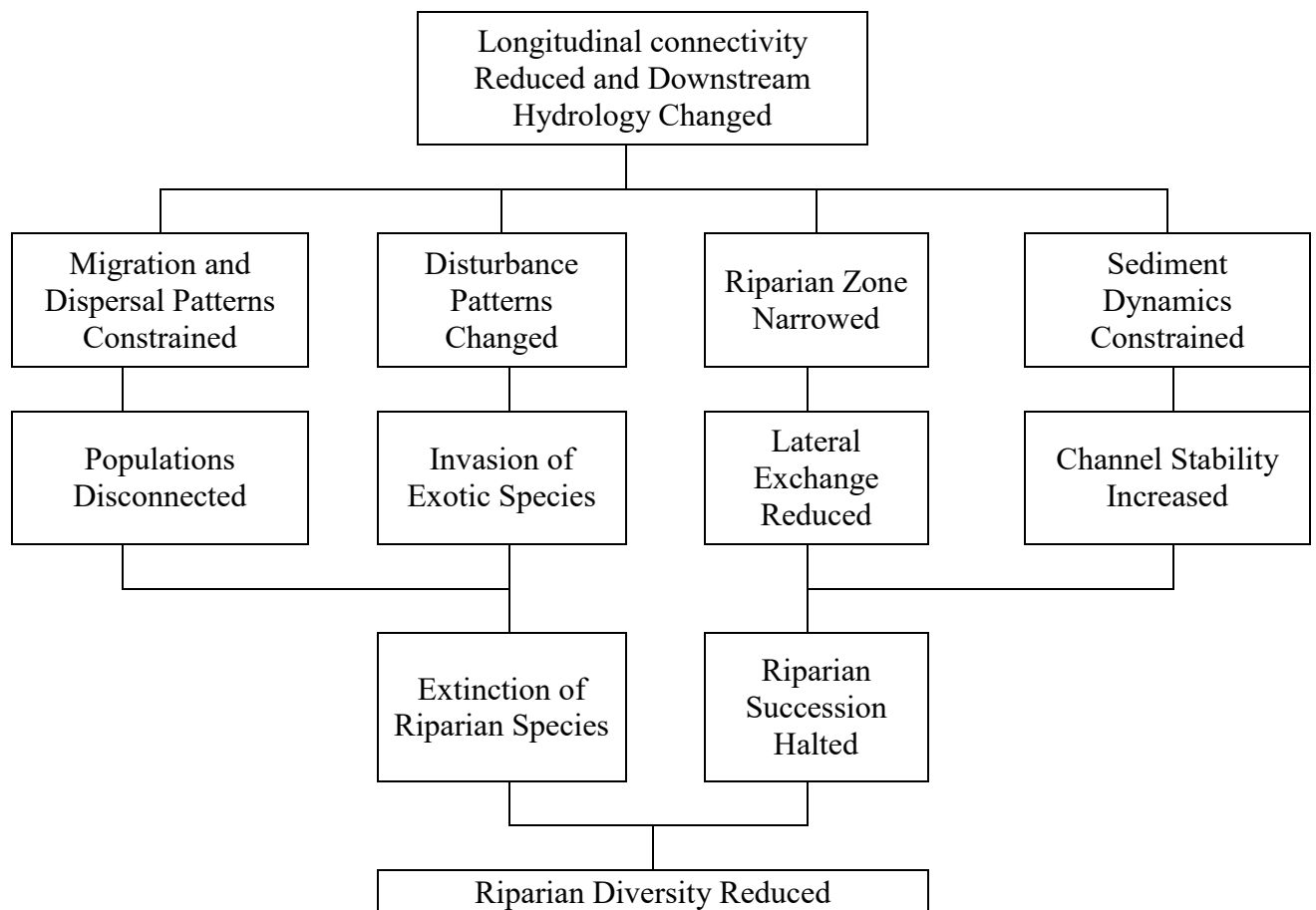
High Transmission Lines always have a very serious impact of radiation under them. In developed countries the area coming under these lines are cleared up to avoid such bad impact on the vegetation or the lines are covered with an effective insulation material. Same treatment will be ideal in case of lines of the Patrind Project if feasible.

## **6. Impact assessment**

Impact is assessed in several ways: the benefits to human society arising from the dam (agriculture, water, damage prevention and power), harm or benefit to nature and wildlife, impact on the geology of an area (whether the change to water flow and levels will increase or decrease stability), and the disruption to human lives (relocation, loss of [archeological](#) or cultural matters underwater). Initial Impact

Assessment of the Patrind Hydro Power Project had been carried out to spell out the possible environmental and social benefits or harms. Subsequent studies are also carried out to assess the impacts during and after the construction phase of the project.

Table showing the impact of dams:



Patrind dam lacks the fish ladder, which keeps many fish from moving upstream to their natural breeding grounds, causing failure of breeding cycles or blocking of migration paths. Even the presence of a fish ladder does not always prevent a reduction in fish reaching the spawning grounds upstream. Turbine and power-plant designs that have a lower impact upon aquatic life are an active area of research.



Wood and garbage accumulation due to the dam at Patrind

Comparatively large dam can cause the loss of entire ecospheres, including endangered and undiscovered species in the area, and the replacement of the original environment by a new inland lake.

Large reservoirs formed behind dams have been indicated in the contribution of seismic activity, due to changes in water load and/or the height of the water table.

Dams are also found to have a role in the increase/decrease of global warming. The changing water levels in reservoirs are a source for greenhouse gases like methane. The sides of the river Kunhar have a higher temperature as compared to one year back due to lower water level and low flowing speed of the water. While dams and the water behind them cover only a small portion of earth's surface, they harbour biological activity that can produce large amounts of greenhouse gases.

## **7. Side Erosions**

The dam construction in the mountain areas also impacts the slope of the hills either due to water inundation or due to thrill created by the use of explosives. If the slopes are fragile and consist of shingle, shale and gravels of immature rock, in that case the chances of the destabilization of the slopes are very high. This situation prevails in the case of Patrind Project. The area of work had a problem of landslides. Slope stabilization has been done through engineering techniques i.e. step walls, concrete supports and shotcrete. This area needs more attention of having treated with biological, engineering and bioengineering means.



During construction phase the drainage pattern was constructed to avoid soil erosion and slope stabilization at surge shaft area

## **8. Biomass Losses**

Biomass losses for the Patrind area had been calculated by the experts of the Pakistan Forest Institute as an initial study of the area. The losses due to water inundations were found out.



Area submerged behind the weir at Patrind

Losses on the Alda side were not studied at that time. The biomass losses (foliage, branches and stems) are calculated on the basis of area covered by the vegetation. The trees removed from the Alda side during the construction phase were found on the private land, but as the project working progressed, trees from the forest land were also removed/damaged.



Plantation during the construction phase

After the completion of the work, high power transmission line was placed and 28 mature trees of Chir pine were harvested by the forest department and seven pine trees were damaged during the working time.



Transmission Line passing through the Alda forest

Average volume of a tree has been calculated by a formula:

$$V = \pi r^2 * L$$

When V is the volume of a tree, r is the radius at stump height and L is the height of the bole. Average height of the mature pine tree here at Alda is 55 feet, so the volume of one tree is:

$V = 3.241 \times 12 \times 55 = 172.755$  and for 28 trees it would be 6,045ft<sup>3</sup>.

Total affected area is about five acres including the concreted area. Total plants required as a replacement of the damaged trees is 3000 (600 per acre). This includes the old gaps inside the forest area.



Plantation during the construction phase

## **9. OUTCOME OF THIS STUDY**

There has been observed a great change from the 1st study. Both the areas, at Alda and at Patrind have been affected by the forest fire, removal of forest, creation of reservoir, reduction in the flow regime of river Kunhar and increase in the atmospheric temperature at the local level. There is still the danger of forest fire every year. This needs special attention otherwise the tree and other vegetation cover will be destroyed, area will be exposed and will become prone to erosion which may become detrimental for the Project.

The slide area around Alda may affect the power house area in future. Engineering structures alone cannot control the slides and again this will require a huge amount of funds for engineering structures. Treating with shortcreating instead of treating it with plantation and bioengineering will not be a permanent solution to it. The Project is mostly looked after by the Engineers and to them, it is the easiest and permanent solution for treating the slides. The loss of biomass quantum is not as significant as there has been a low vegetative cover in this area.

Most of the Chirpine trees in the area to be submerged were found in Pole stage (age 20-30 years) with few at tree stage. The same is the case with other broadleaved

species. Not much cutting was found involved due to the implementation of the project.

Project site vegetation does not contain any species listed as endangered or threatened by the Government of Pakistan or IUCN. Only two species *Celtis austarlus* (Butculd) and *Ficus carica* (Enjeer) were found rare in Pakistan but they are listed as common for the rest of the world. The presence of these two species will not be disturbed as they were found above the submerged area and away from the area where trees needed to be felled down. The rest of the vegetation species were found protected and common in Pakistan and for the rest of the world. So, it is concluded that there will be no negative impacts of Patrind Hydropower Project on conservation status of the vegetation of the area except to a limited extent for which suggestions have been given below.

The present status of vegetation on Patrind side does not depend upon the water of river Kunhar but it depends on natural precipitation or water channels taken out of the side nallahs. So, reduction in water regime downstream will not affect the vegetation of the area. The average biomass for forage that will be submerged under water after the construction of weir was calculated as 3,468 Kg/ha. The total biomass to be inundated is estimated to about 200 tons. (farmer PFI Study Report for Patrind project)

The area affected on the weir site due to inundation is 57.2 ha and on the powerhouse site is 5.5 ha which came under construction.

## **10. Possible Effects on the environment of the Area**

The result indicates that landscape, the nature of the rock and the redistribution of rainfall water by run-off are the main sources of spatial variation in the study area. The construction of the dams will positively affect the groundwater at the upstream and negatively at the downstream of Patrind. Downstream the riparian vegetation composition will make a huge difference as some area which is under river water will have no more water and some invasive species may appear on the tract. Water retention capacity of the soil above the tunnel will reduce as the percolation rate will increase and drain out from the tunnel. Ground water will be affected downstream of the Patrind, but the dependence on that water is not existing. Water temperature will increase downstream effecting the environment of the area.

## 11. Recommendations

Since the area close to the tunnel and inlet and outlet of the tunnel where working concentration remained high, the impact on the vegetation and water courses will have negative impact. The lake has submerged some of the vegetation due to rise in water level. Similarly, downstream the water flow has reduced resulting into the change of micro-ecology, so new species may appear along the banks of the river course in a period of time. There is a need to compensate this loss by some possible means listed below:

- 1) Tree species of alternate requirement of water and soil should be planted in these area like Shrole, Salix be replaced by Robinia, Walnut.
- 2) Areas of high working concentration (in-let and outlet of the tunnel) are facing the problem of soil erosion and these have been treated by concreting. It was suggested in the first study to initiate the Bio-engineering technology to control these slides effectively which include vegetated soft gabions, vegetated loose stone walls, gabion check dams, live brush wood check dams, planting, sowing and tufting, dry seeding, hydro seeding, hay seeding, grass sodding, sowing with geo- textile sheets, brush wattles, brush layering, hedge layering, semi-dead fences with live hedges. Total engineering treatment has caused a loss for growing vegetative cover. This adverse effect should be compensated by treating the adjacent slides with biological and Bio-engineering measures along with some engineering works which will not only treat the soil but will also improve the environmental status. Patrind Hydropower agency should use this technology with a team of experts and should begin with small erosional features on small slopes before working on large slopes.

	
<p><i>A slope after two years of stabilization by the use of soft gabions</i></p>	<p><i>Planting Pine saplings in the gaps</i></p>

- 3) Forest fires in future may damage the areas inside the fence if it went beyond the control of any one. So, it is recommended that;
- Fire control path of 4-5 feet width should be prepared inside the fence and they should be regularly cleared during the dry spell of the year.
  - Another way of controlling the fire is that controlled burning should be carried out on the project sites to avoid the fire spread from outside.
  - There is a need of awareness campaign for the community residing around the project sites to avoid burning the forest instead they can grow some useful trees giving them good economic return.
  - Deep rooted and web rooted species should be planted inside and outside the project site to avoid the exposure of the soil as they are the fire-resistant species like, Anjeer, Phagwarr, Dhaman, Kahu etc.

# **ANNEX-4**

## **FISH STUDY - PATRIND HPP**

# **Impact of Patrind Hydropower Project on biodiversity of Kunhar River**



**Study Report for January to March 2018**

**By**

**Dr. Mohammad Yousaf Qureshi**

**Country Director Edinburgh Direct Aid (EDA)**

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## **1. Objectives of the Study:**

- a) To find out the impact of Patrind Hydro Power Project on the biodiversity of River Kunhar in, above and below the Dam of the project.
- b) Suggest technical measures to minimize the impact on the aquatic life of River Kunhar by the Patrind Hydro Power Project.

## **2. Background**

Hydropower generation is the cheapest way of energy needed by a state. These interventions have many benefits on one hand but on the other hand it needs the sacrifice of environmental and social aspects of the local areas. Environmental and social impact studies have been carried out before the inception of the Patrind Hydropower Project on River Kunhar. Mitigation measures were suggested in the study reports carried out during the construction and then operational phases of the project. Many issues have already been addressed during the construction phase but still there are various shortcomings which need to be resolved during this time to minimize the impact of damming on the river. Special attention has to be paid on the downstream as the impact of the dam is higher in this area. Fisheries management capacity and information base requirements are reviewed for the six phases of the dam project cycle:

- i) dam identification;
- ii) dam design;
- iii) dam project appraisal;
- iv) dam construction;
- v) dam operation; and
- vi) dam decommissioning.

Fisheries management as applied to dams is perceived to be problematic and difficult due to the severe changes in hydrology and the impacts on fish that occur. The impact of damming on the Kunhar River is now very conspicuous as a result of fresh impact assessment study. Some new fish species are appearing downstream with changes in the river ecology. Similarly, the aquatic vegetation is also changing hence the food chain for a particular fish will have a change. Some other aquatic animals like amphibians are getting established in the downstream with the changed hydrological flow, less quantity of water and change in the water quality, especially the water temperature.

### **3. INTRODUCTION**

Ichthyofauna is a field which relies on human properties. Human interventions in blocking, diverting or changing course of the water of streams, rivers, creeks etc. will definitely change the ecology downstream as well as upstream to a certain limit. The biodiversity demonstrates variety in the structure, environment and their method of life. In spite of the other efficient vertebrates, fish is having extraordinary differences. Kunhar River originates from the glacial waters of the mountains and originates from Gitidas, flows through Kaghan valley in Khyber Pakhtunkhwa. It has a length of 129 km up to weir site (755 m amsl). It is spread over a catchment area of 2,429 Km<sup>2</sup>. The 13 Km reach of the Kunhar River from weir site to its confluence with Jhelum River at Domishi has a catchment area of 256 Km<sup>2</sup>. Temperatures prevailing at Muzaffarabad are more relevant to the Project area. At Muzaffarabad the months of May to August are the hottest months with temperature ranging between 26°C to 40°C while December to February are coldest with temperature varying between 6°C to 11°C. Fish study was undertaken in the Kunhar River reach of the Project area. Fish fauna survey was conducted at six selected sites to find out the kind, number and quantity of fish available. Fishes consisted of Schizothorax plagiostomus (Swati), Snow trout Schizothorax curvifrons and Schizothorax labiatus. The number found was between 0-5 and the weight was less than one Kg in each case. Nature of Impact as shown by the IUCN Report on Dams in AJK.

<b>HPP</b>	<b>Installed Capacity (MW)</b>	<b>Project Status</b>	<b>Executing Agency</b>	<b>Sensitivity of Ecological Zone</b>	<b>Nature of Impact in the Ecological Zone</b>
Patrind	147	Complete	PPIB	Least	Extremely Critical

The Patrind Project is in its operational phase. E-flow of 2.2 cumecs is observed now strictly. The catches of fish during the study period show that one new species, Schizothorax labiatus has also established its presence along with two species, Schizothorax plagiostomus and S. curvifrons. Exotic trout fish can be introduced in the reservoir initially on experimental basis and then, depending on the positive results, on permanent basis, as recreational/sport fishery has been steadily increasing in the upper reaches with cold water.

There is another very positive impact of dam has appeared as recreational and entertainment activities have started upstream in and around the lake. The recreational

park developed at the disposal point has become a good place for families to visit. Two colorful water boats have been introduced in the lake near the village Shoran and soon will in full bloom of operation.

#### **4. Environmental Impacts of Dams**

The environmental consequences of large dams are numerous and varied, and includes direct impacts to the biological, chemical and physical properties of rivers and riparian (or "stream-side") environments.

The dam wall itself blocks fish migrations, which in some cases and with some species completely separate spawning habitats from rearing habitats. The dam also traps sediments, which are critical for maintaining physical processes and habitats downstream of the dam (include the maintenance of productive deltas, barrier islands, fertile floodplains and coastal wetlands).

Another significant and obvious impact is the transformation upstream of the dam from a free-flowing river ecosystem to an artificial slack-water reservoir habitat. Changes in temperature, chemical composition, dissolved oxygen levels and the physical properties of a reservoir are often not suitable to the aquatic plants and animals that evolved with a given river system. Indeed, reservoirs often host non-native and invasive species (e.g. snails, algae, predatory fish) that further undermine the river's natural communities of plants and animals.

The alteration of a river's flow and sediment transport downstream of a dam often causes the greatest sustained environmental impacts. Life in and around a river evolves and is conditioned on the timing and quantities of river flow. Disrupted and altered water flows can be as severe as completely de-watering river reaches and the life they contain. Yet even subtle changes in the quantity and timing of water flows impact aquatic and riparian life, which can unravel the ecological web of a river system.

A dam also holds back sediments that would naturally replenish downstream ecosystems. When a river is deprived of its sediment load, it seeks to recapture it by eroding the downstream river bed and banks (which can undermine bridges and other riverbank structures, as well as riverside woodlands). Riverbeds downstream of dams are typically eroded by several meters within the decade of first closing a dam; the damage can extend for tens or even hundreds of kilometers below a dam.

Riverbed deepening (or "incising") will also lower groundwater tables along a river, lowering the water table accessible to plant roots (and to human communities drawing water from wells). Altering the riverbed also reduces habitat for fish that spawn in river bottoms, and for invertebrates.

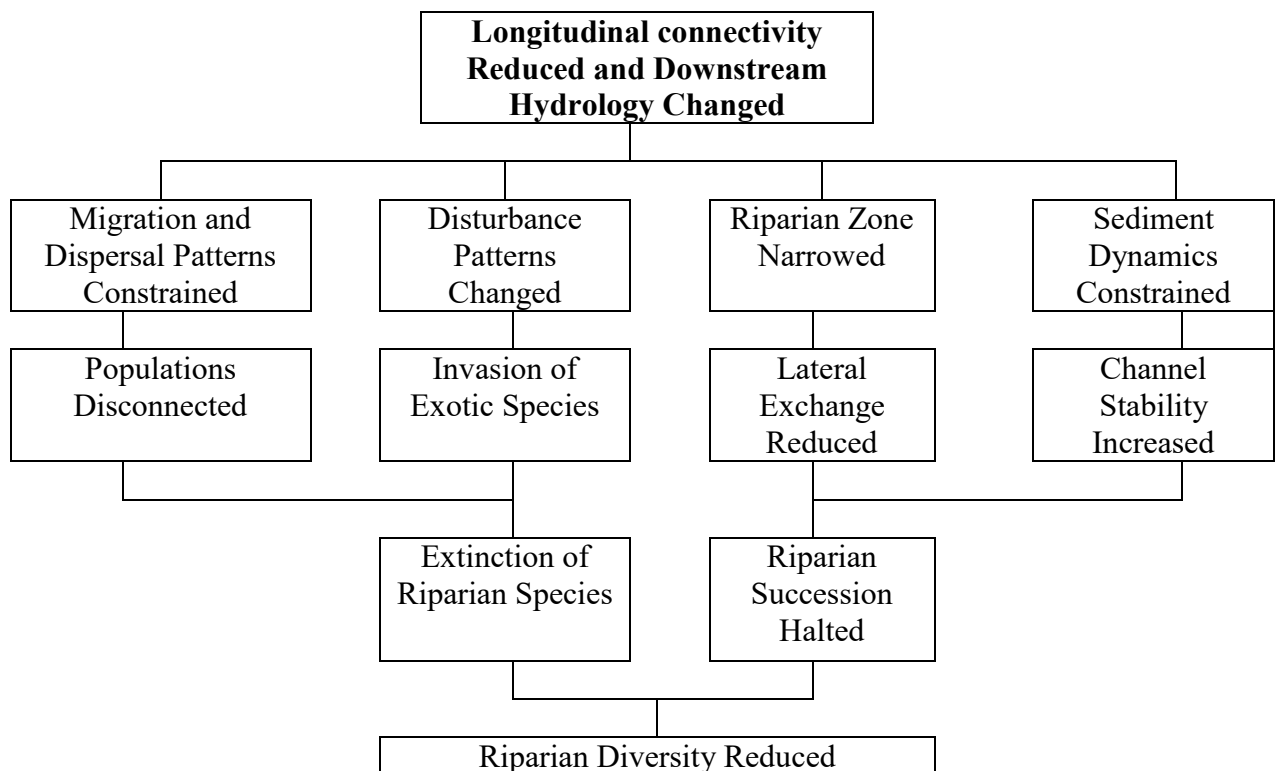
In aggregate, dammed rivers have also impacted processes in the broader biosphere.

Large dams have led to the extinction of many fish and other aquatic species, the disappearance of birds in floodplains, huge losses of forest, wetland and farmland, erosion of coastal deltas, and many other immitigable impacts.

Very prominent impact was noticed during this time of the study. Several colonies of frogs were found in the stagnant water beside the river at the sampling point one and point two, similarly one more species of *Schizothorax labiata* was caught at the outlet point with the use of Gill net, Lichens and Algae production has increased and air temperature on the sides of the river is comparatively warmer impacting the side vegetation as well.

The fish presence in the lake has no evidence. Even the start point at Shoran has no fish.

The following diagram shows the downstream impact of river damming



## **5. Impact on fish Migration from River Jhelum**

The fish migration from Jhelum River to Kunhar River at the point of confluence at Raaraa would have been taking place for Mahsher (*Tor putitora*), Snow Trout (*Schizothoranae*) and other migratory species. The water level has gone downstream in River Kunhar so if any migration existed before the Patrind Project will not be taking place now. The lack of long term data on water quality, plankton concentrations and fish populations limits the conclusions that can be made about the aquatic ecology in the Project area. The scope of present study does not require covering of fish fauna present in Jhelum River along with its migration status. There is almost no possibility of upstream migration of fish fauna above Mangla Dam to the Project area as authenticated by the study results and supported by the local information recorded through the interviews. Thus, it can be safely concluded that the proposed Project will have an impact of river ecology in the stretch of 13 kilometers below the weir point due to shortage of water and 8 kilometers above due to increase in water level. There will be no impact on the available fish fauna as well as the migration of fish species above Mangla dam.

## **6. The Fish**

River Kunhar has a rich potential in supporting a diversity of fish resources. Past history shows that the project area had a rich biodiversity in river Kunhar but present picture of the area is not that encouraging as most of the reported fish has disappeared altogether. This is, most probably, due to hydrological changes, stream flow pattern, very high and devastating floods of 1992 and beyond that, illicit hunting of fish by the use of destructive means like explosives, poisoning, electric currents etc. Common Otter (*Lutra lutra*) used to be very common once in the area, but now this has disappeared and most probably it is no more existing in River Kunhar. The departments of Fisheries of Khyber Pakhtunkhwa and AJK have not been able to protect the river Kunhar below the town of Gharri Habibullah most probably due to the shortage of conservation staff with them.

Probably the Fisheries Department of KPK has met the Hydropower project authorities for the management of reservoir at Patrind. First right of fish management is for the affected community of the area. They must be involved in any commercial activity of fisheries management of the reservoir.

The main natural factors which influence fish life in the Himalayan streams are: (i) current of velocity; (ii) fluctuation in water discharge; (iii) water temperature and dissolved oxygen level; (iv) substratum; (v) shelter from the current; and (vi) food availability represented mostly by organisms clinging to and growing on rock and stone surfaces in fast current.

Snow trout, a cold water riverine and medium migratory fish, is locally known as Malli or Swati. It belongs to the family Cyprinidae and sub-family Schizothoracinae which are widely distributed in the Himalayan and sub-Himalayan region and much of the rest of Asia. Altogether 28 species of Schizoranae are reported in Himalayan river waters but only three of genus Schizothorax are recorded this time in the study area of river Kunhar i.e., Schizothorax curvifrons, Schizothorax labiatus and Schizothorax plagiostomus and two of them are common in river Kunhar. All the species are phytophagous fish and have developed a special mouth to scrape the algae attached on stones. They spawn twice a year during September/October and March/April, but September/October is the best season for spawning. Clear water, stony bottom of creeks composed of fine pebbles and gravel, and water flow of 2.8-4 m/sec, pH 6-7 and dissolved oxygen concentrations of 8-15 mg/L form good spawning conditions in the natural environment. Present study shows that the fish has migrated from downstream to possible upper reaches up to the outlet of the weir for spawning purposes as the catch percentage is higher than the last many periodic studies.

To cope with the steep, fall in temperature in winter months, schizothoracines migrate from headwaters to lower altitudes where they represent a sizeable part in fish catches in large rivers and their tributaries. The rise in temperature in Kashmir and Kunhar streams from near-freezing level to 10-20°C during May-June induces *S. plagiostomus*, *S. longipinnis*, *S. kasmiriensis* and *S. curvifrons* to spawn. During the upstream migration the fish still finds itself in waters of low temperature of 8.0-9.5°C, owing to the steady influx of snow-melt water. This induces the species to migrate to and spawn in side streams or point of warm and cold-water confluence, which receive warmer ground water of 17.5-21.5°C. In the same drainage, *S. plagiostomus* and *S. curvifrons* migrate downstream to the lowermost reaches where it spawns from September to October at 15.0 to 21°C. These observations indicate that in some schizothoracines multiple spawning is determined by temperatures and flow rates optimal for egg laying. The eggs are large-sized (3.0-4.0 mm diameter) and sticky in

nature. They are laid in shallow pools (50-70 cm depth) and remain adhered to the substratum until the hatching of fry.

The absence of minimum E-flow in the stream, fluctuating discharge of water and drying out of streams, leaving only isolated pools or no water at all, is another important factor for the species and population decline in river Kunhar. A general observation during the last studies on seasonal fluctuation in river discharge in Kunhar river system indicate that the range of mean flow from October to March (winter months) represents only 8-10% of the total annual flow. There are also variations from year to year depending on the winter and monsoon precipitation. Reduction of torrential streams to stagnant pools exposes the fish to terrestrial predators and to depletion in dissolved oxygen concentrations, especially when autumn leaf fall takes place. However, due to low temperature, the level of dissolved oxygen may not fall below the optimum requirement of Coldwater fish (7.0-8.0 mg l). As soon as the flow is restored with spring rains and snow-melt water, a rapid re-colonization of the stream takes place.

Schizothorax and Schizothoracichthys spp are dominant among the cold-water fish in river Kunhar in terms of catch and abundance in all seasons. The substratum consists of boulders, stones, gravel and patches of aquatic vegetation in the pools with lichens on the shallow sides of the river.

As a result of this study in river Kunhar it came out that a gradual increase in water temperature and pH corresponds to a decrease in dissolved oxygen, decline in the density of nymphs of mayflies and stoneflies, but in an increase in larval and adult aquatic beetles. The information collected during expeditions is based on spot measurements and it does not represent average values. The following parameter ranges for the Kunhar River were recorded at six sampling points during the study. Following table shows the result; transparency; pH; water temperature (oC); dissolved oxygen;

Table-1 showing water parameters

Sample Points	Water Temp °C	pH	Total suspended particles (mg/l)	Inorganic Suspended solids (mg/l)	Organic Suspended solids (mg/l)	Rate of Flow (cu.m/sec)
1. Boi	15	6.5	88.71	59.95	23.42	2.8 m/s
2. Domail (nalla Boi)	15	6.7	90.33	66.45	26.35	
3. Padri	15	6.5	86.21	58.65	22.54	1.03 /s
4. Weir Outlet	15	6.5	79.32	54.56	19.21	2.9m/s
5. Disposal Area	16	6.5	88.52	67.41	26.41	0.6m/s
6. Shorran	16	6.5	89.43	68.12	27.21	1.3 m/s

## 7. Fish catches and species composition

One professional fisherman, Sajid Mehmood, was engaged for fishing in the river Kunhar at six sampling points. Two types of nets, Gill nets and Cast net were used at the sampling points in the Kunhar River. The river flow is very slow and at minimum water level. The fishermen could cross the river at various places and used the cast net while standing in the middle of the river. The impact of the dam construction has appeared on the aquatic life in the river Kunhar. Catch in the deep lake behind the weir has become impossible due to the depth of the lake and fish survival probability has also become near to impossible as the river ecology has changed altogether. The appearance of one new fish species and frogs on the riverside is a clear evidence of impact of the project on the aquatic ecology of the Kunhar River downstream.



1. Fisherman Mr. Sajid Mehmood

### 7.1 : Reported Fish species of River Kunhar in the past:

#### Family: Salmonidae

Oncorhynchus mykiss {Salmo gairdneri } (Rainbow Trout

Salmo trutta (Brown Trout)

#### Family: Cyprinidae

Schizothorax esomus

Schizothorax plagiostomus

Schizothorax micropogon

Schizothorax curvifrons (Snow Trout)

Schizothorax labiatus

Tor putitora

Tor tor

Labeo spp

Cyprinus carpio

**Family: Sisoridae**

Glyptothorax kashmiriensis

**8. Potential of Sports and recreational fishery**

**Trout**

The trout fish once introduced in upper reaches of River Kunhar is now acclimatized in the area (upstream of Jared in Kaghan). It is legally permitted to be caught by rod and line using both artificial and live baits. Special bylaws have been formulated under the Fisheries Act in the Khyber Pakhtunkhwa province. They regulate the fishing season, bag limit and prescribed baits.

A quite large reservoir has appeared behind the weir at Patrind and this water is very much suitable for growing trout fish species (*Salmo gairdarii*, *salmo trutta*) here. This has to be experimented and planned very well by the expert to develop such facility. This could become a major income generation activity for the surrounding community and will be great reward from the project authority to the affected community.

KPK fisheries Department is now showing the interest in the management of the reservoir at Patrind. This reservoir has great potential of trout fish culture in it and the benefit must go to the local affected communities of the project.

**9. Fisheries Status of River Kunhar in view of locals**

During this study, few locals were interviewed randomly as usual. Among them were Mr. Dilpazir and Sayed Zaid Ali Shah. Both of them stated that after the closure of water from the dam, the use of cross and gill nets has increased several times more than before. The fish catch is also high. This use of cross net is very detrimental for the survival of the fish

as mature brooders are very likely get entangled in these nets so the spawning of fish can be affected. They further stated that no outsider comes here for fishing now all the locals are involved in it and the fish is sold in the market as well. On question they replied that if the minimum E-flow of 2 cumecs is not maintained, the riverine fishery will have no existence in downstream water except below the nallah Boi. The ecology of the river system will also change altogether and possibility of other fish species and other aquatic organism will replace the present composition of species survival.

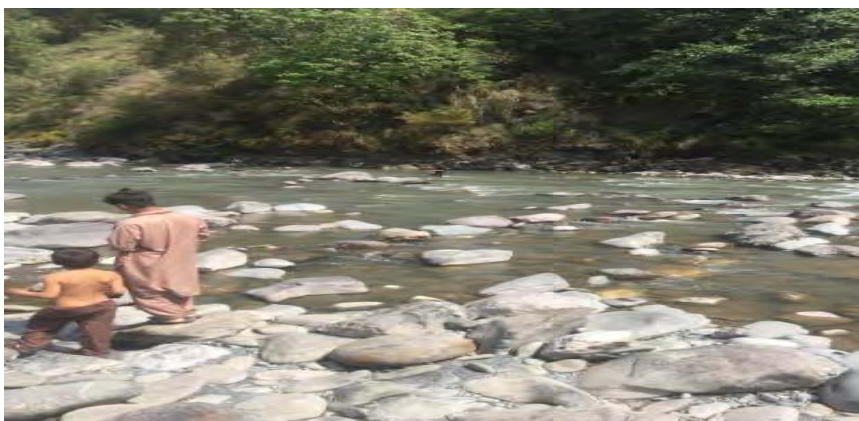


Fig: Children who catch fish with line and cross net

## **10. Field Results: (Sampling Points)**

### **10.1 Point-I (Boi)**

First sampling point of the study is situated at  $34^{\circ} 18' 19''$  N,  $73^{\circ} 26' 44''$  E at an elevation of 2422 ft above sea level. The water level is low as compared to the last study in December 2017. River sides are open with boulders and sand and stagnant water can be seen at various places. Lichens on the stones are abundant and the stone surfaces are very slippery. Extensive netting was noticed at this point on both the sides of the river. The visible nets found were 15 at the point. One fish species, Swati (*Schizothorax plagiostomus*) was caught here with a weight of 100 grams and length of 8.5 inches. The fish was very healthy and it can be predicted that the food is abundant but the population has decreased. The water is clear; change in flow has been noticed. Water depth is shallow and fisherman can be seen netting while standing in the middle of the river. The stagnant water at sides is warmer ( $21^{\circ}\text{C}$ ) and allowed the frogs to come in and breed. A chain of long rows of

existing of frog eggs can be seen in the photograph below. They are in mating condition and more eggs are expected to come every day.



Fig: Getting water parameters



Fig: Low water Level



Gill nets used by the locals at Point-1



Fisherman right in the middle of the river



Fig: Fish caught at point-1

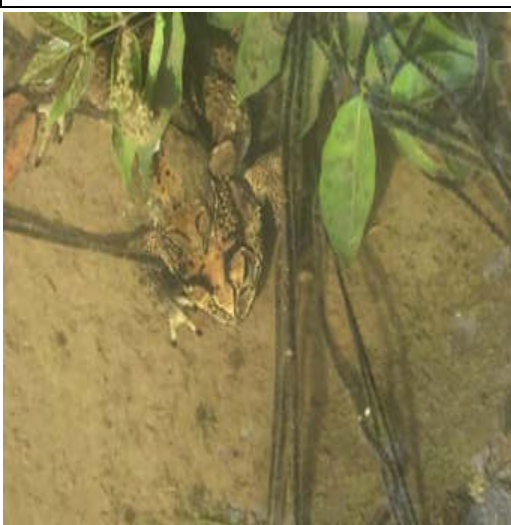


Fig: First time appearance of frogs at the side

## **10.2 Point-II (Domail Boi)**






This sampling point is situated at 34° 18' 36" N, 73° 26' 43" E at an elevation of 2398 ft above sea level. The nallah water was very clear as compared to the river water. The river flow is more centered at this time. No fish could be caught here even in the nallah. This is the only bigger source of water contributing in the river Kunhar down the Boi to Domeshi. Nallah temperature is 20°C as compared to the river temperature of 15°C.



## **10.3 Point-III: (Parri)**

This sampling point is situated at 34° 19' 47" N, 73° 25' 35" E at an elevation of 2475 ft above sea level. The small creek joins the river here. The river is squeezed to the center and flow is low. There is solid waste disposed of from the road into the river which will have very bad impact on the aquatic ecology of the area. One fish, Swati (*Schizothorax plagiostomus*) was caught here with a weight of 145 grams and length of 9 inches.

Boulders on the sides of the river can be seen now as a result of low flow of water. This condition alters the breeding ground and the conditions may not be conducive for the *Schizothorax* species to breed here. This impact can be reduced by making some artificial small pools through placing some boulders etc. in the flow of the river.

	
Sampling at point-III, Parri during May. 2017 and April 2018	
	
Garbage thrown in the river at Point-3	River Water level at its lowest level (E-flow)
<div data-bbox="488 1111 1110 1458"></div> <div data-bbox="659 1462 938 1496">Fig: fish caught at Point-3</div>	

#### 10.4 Point IV: Outlet

This point has become difficult to access. The fisherman erected a Gill net here one night before to assess the fish. The guards of the Hydropower Project told that local people catch the fish from this very point every day by using the cross net. The survival of the fish in the water coming out of the weir gates is impossible. This minimum E-flow water is coming out form the bottom of one gate. The fish found here must have come through migration from the downstream in search of a reasonable breeding ground. Astonishingly, 4 fish were caught and they were three

different species. Two *Schizothorax plagiostomus* and one each *Schizothorax curvifrons* and *Schizothorax labiatus*. They were very healthy with good size and weight. pH of the water is 6.5 and temperature 15°C.





	
Fig: Cast net erected at outflow of weir	Fig: minimum E-Flow from the Weir
	
Fig: Gabage collected behind the dam	Fig: The <i>S. curvifrons</i> species at Point-4



Fig: Three fish species. Clear Impact of appearance of new species

### 10.5 Material Dumping Area

The reservoir water is at maximum level. The area demarcated for the project is under water and many trees and bushes are dry now and many of them have been removed by the community. The cross nets are very few here. On a question with a local it is found the fish catch is zero here as compared to the past. Cast net was used by the fisherman but signs of any fish presence was not found. There are wire stone gabions in the side walls, netting was done at a safer place but no fish could be caught. Water temperature is 15°C with pH 6.5 showing the suitability for trout to grow here. Cage Culture is possible for intensive fish culture and easy feeding of the fish. If utilized carefully, the lake can produce several tons of trout fish annually

and area can be leased out or handed over to the affected local community for farming the trout fish and earning some money from here but under the supervision of an expert. The children park developed at the side is nice looking and few families were enjoying the play land provided here. This is nice intervention and can develop into a busy picnic point in summer.



Fig: Recreational Park Developed at Point-5



Fig: Lake view at disposal point

## **10.6 Shorran**

This is the tail of the reservoir. Flow of water is very low. The sides of the river are rich in vegetation. No fish was found here most probably due to migration of the fish to the upper reaches where suitable breeding ground is available with pebbles in the bottom. There were two colorful motor boats seen anchored at the left side of the lake. This is the beginning of the tourism intervention and more such facilities will come in the area to promote water sports and tourism. The water temperature was 15°C and pH 6.5.

While travelling for sampling we found a Dhaba at Dalola Village where local fried fish is sold for Rs. 700 per kilogram. This shows the trend of commercial aspect development of the river. The fish was caught from the river just opposite to Brarkot.

**Kunhar River fish sold at local Dhaba**



**Two motor boats anchored at the side of the lake**





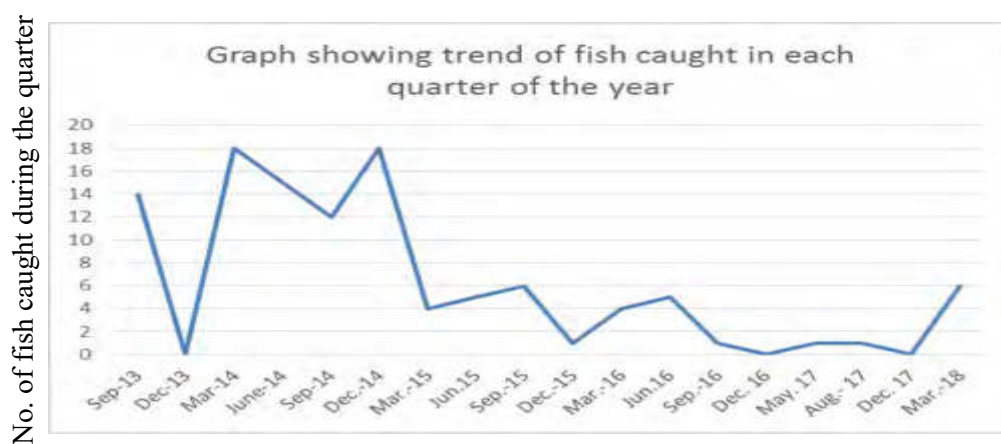
Table-2 Showing Data collection at each sampling point

Point-I							
S No.	Air temp. °C	Water temp. °C	pH	DO mg/l	Fish Species	Weight (gms)	Length (inch)
1	21	15	6.5	8.42	Shizothorax plagiostomus	100	8
Point-II							
2	21	15	6.5	8.25	No fish		
Point-III							
3	21	15	6.5	8.13	Shizothorax plagiostomus	145	9
Point-IV							
4	20.5	15	6.5	8.22	Shizothorax plagiostomus	404	13.5
					Shizothorax plagiostomus	156	10
					Shizothorax curvifrons	138	9
					Shizothorax labiatus	240	12
Point-V							
5	21	15	6.5	8.45	None		
Point-VI							
6	21	15	6.5	8.11	No fish		
Total Fish collected							
					Schizothorax plagiostomus	4	
					Schizothorax curvifrons	1	
					Schizothorax labiatus	1	

Species composition		Percentage
Schizothorax curvifrons	= 1	16.67%
Schizothorax plagiostomus	= 4	66.66%
Schizothorax labiatus	= 1	16.67%

## 11. Comparison

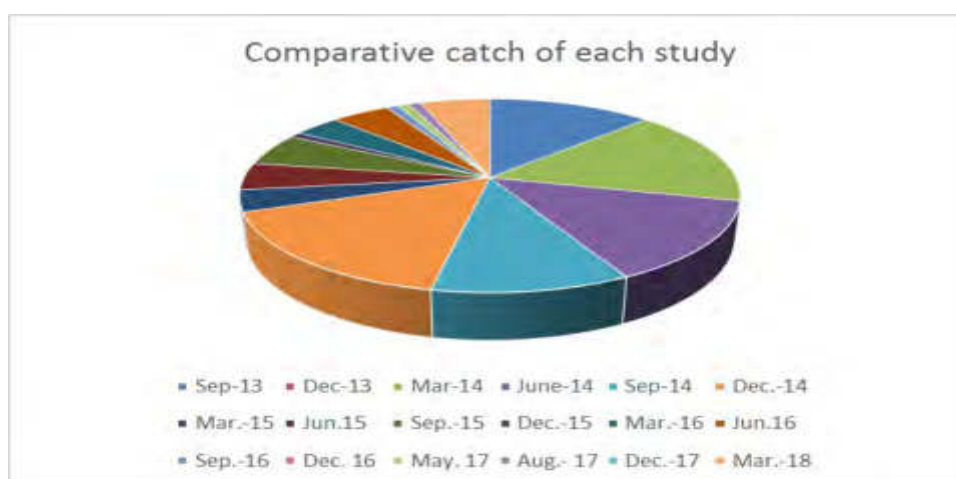
The fish composition is changing and other aquatic animals like amphibians are coming up at the sides of the river with a change in the water quality and air temperature. Vegetation differences also noted during the study as more algal and fungal plant communities are growing in the sides of the area. Graph below shows the trend of fish availability in the river Kunhar. Fish population remained higher in the early catches but it has decreased with the passage of the time. Six fish of three species were collected this time and that shows the migration aspect during the breeding season of the fish. Fish travelled up to the outlet and beyond that it could not go because of the barrier of dam. This migration may continue for more couple of years then the fish population will diminish because of low medium of water and less chances of migration. This shows that the impact on the fish. It is suspected that no more locally found fish will exist in this water system in the coming few years because of the change in ecology. Future studies during the operational phase will spell out more change and existence of the fish species in the river. The aquatic environment of the River Kunhar is changing as the project has completed and water release in the river has decreased. Similarly, appearance of the water pool behind the weir has also shown different results. The size and weight of fish in the pool will be higher and change in species composition is also expected as some other species may get better survival environment here. Migration of fish will stop due to nonexistence of safe paths. The major changes in ecology is appearing in the operational phase and obstruction on the river flow. This will affect the migration of the fish even upstream and all breeding grounds will highly be affected downstream.



Graph showing trend of fish availability as derived from the studies of the project area

**Table-3 Comparative number of fish Caught at sampling points**

Period	Point	No. of fish	Period	Point	No. of fish	Period	Point	No. of fish	Period	Point	No. of fish
July-September 2013	1	3	July-Sep. 2014	1	0	July-Sep. 2015	1	4	July-Sep. 2016	1	0
	2	6		2	4		2	1		2	0
	3	4		3	1		3	1		3	0
	4	0		4	2		4	0		4	0
	5	1		5	3		5	0		5	0
	6	0		6	2		6	0		6	1
<b>Total:</b>		<b>14</b>			<b>12</b>			<b>6</b>			
October-December 2013			October-December 2014	1	6	October-December 2015	1		October-December 2016	1	0
				2	5		2			2	0
				3	0		3			3	0
				4	4		4			4	0
				5	0		5			5	0
				6	3		6			6	0
<b>Total:</b>					<b>18</b>						
January-March 2014	1		January-March 2015	1	2	January-March 2016	1		January-March 2017	1	0
	2			2	0		2			2	0
	3			3	0		3	3		3	0
	4			4	0		4			4	0
	5			5	0		5	1		5	0
	6			6	2		6			6	0
<b>Total:</b>					<b>4</b>			<b>4</b>			<b>0</b>
April-June 2014	1	5	April-June 2015	1	3	April-June 2016	1	4	January-March 2018	1	1
	2	7		2	1		2			2	0
	3	4		3	1		3			3	1
	4	0		4	0		4			4	4
	5	No access		5	0		5			5	0
	6	2		6	2		6	1		6	0
<b>Total:</b>		<b>18</b>			<b>7</b>			<b>5</b>			<b>6</b>



The graph given below shows the comparative picture of the fish catches during each study

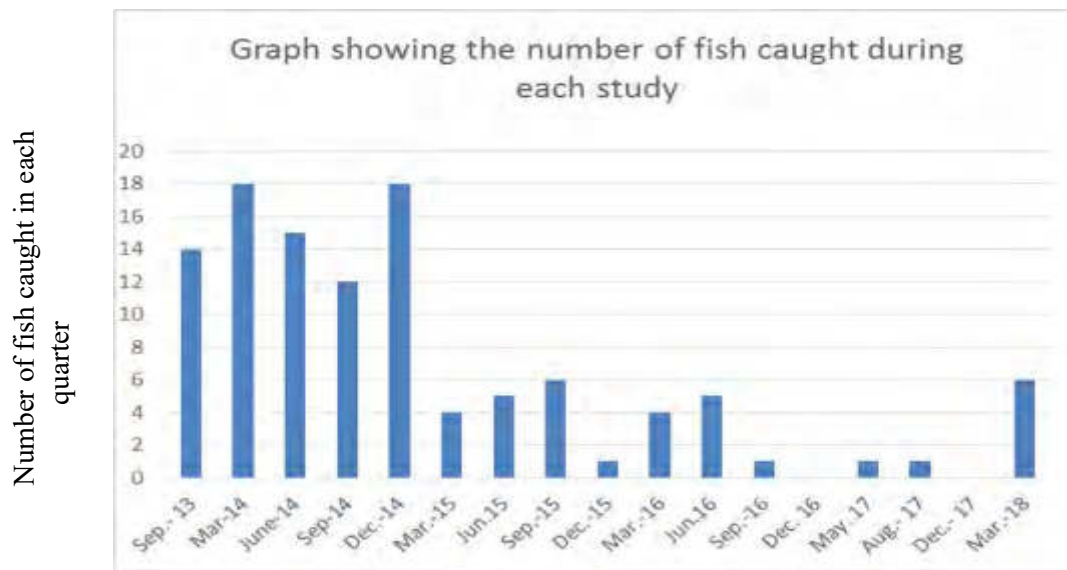


Fig: Showing comparative updated graph of fish catches during each study

## 12. Result

The fish of the river downstream has come up for breeding to the pool down of the weir point. Months of March and April is the breeding period when river water temperature rises and favours fish. This time fish migrates to the upper reaches to find the suitable breeding places. Due to obstacle of the weir at Patrind, it could go only up to the water of the outlet. The fish behind the weir will migrate towards the town of Gharri Habibullah and breed at suitable points in the river. The phytogenic condition of the area also shows changes due to low water flow and rise in the air temperature at the sides of the river. Algal and Lichen growth is quite higher than before. A new fish species has come in the catch and amphibians have appeared in the water accumulated at the sides of the river. The decrease in quantity and course of flow of water downstream have disturbed the breeding grounds of the river. If the breeding of the fish will not take place, then its existence will be threatened.

## 13. Recommendations

The impact of this study is visible. To mitigate these impacts at a minimum possible level, it is recommended that:

1. Reservoir fisheries management concerns focus on protecting spawning grounds in affluent inflow areas, stocking with indigenous and non-indigenous fish species

- to increase production, development of a small pelagic fishery, and management of the water level to prevent erratic behavior deleterious to fish stocks.
2. The overall impact of the absence of fish pass on reservoir fisheries and downstream river fisheries has been determined in the report. Further disturbance has to be controlled by developing fisheries release facilities in the reservoir and downstream water.
  3. Downstream river fisheries management concerns focus on aeration of anoxic discharge water from the dam. The release of artificial mini-floods and the provision of adequate dry season flow are crucial to maintaining a suitable environment for migratory fish species, especially endangered species.
  4. Fish catches in the Kunhar River have been declining because of the use of illegal fishing methods such as poisoning and use of electro-fishing gears. To preserve the fish stocks, controls should be imposed on illegal fishing practices and a fish sanctuary be established. The deep-water pools of the Kunhar and its feeder streams should be declared fish sanctuaries for the protection of brood stock. The Fisheries departments of KP and AJK should be taken on board to control the illegal fish catch.
  5. The Kunhar River catchment has been subject to deforestation, resulting in erosion and silting of streams and rivers. There is a need for land rehabilitation measures to be urgently implemented in the watershed. The incidence of water pollution is increasing in the lower reaches of the river due to the discharges of sewage waste, and the illegal use of insecticides, pesticides and piscicides. Control over such activities must be strictly enforced.
  6. Habitat improvement is an essential factor for fishery improvement. To avoid seasonal changes of water level, suitable pools should be created under the management of the local development authority. Such a practice will improve the fish habitat quality and avoid the winter desiccation.
  7. Protection of fish stocks and fishery regulation should be based on periodic assessments of fish stocks. It is high time to enforce the existing fishery law and to restrict the use of nets with less than 2 cm mesh size. Use of drag nets, cross nets and pocket nets should be not allowed and it is very important to develop an effective coordination with the Fisheries Departments of AJK and KPK.
  8. Trout culture could be a very economical and better option to be started at an experimental basis. This will not only become source of earning but the fish could

feed on the mosquitoes and snails which may get established their population with the rise in temperature and they can become the source of some chronic diseases.

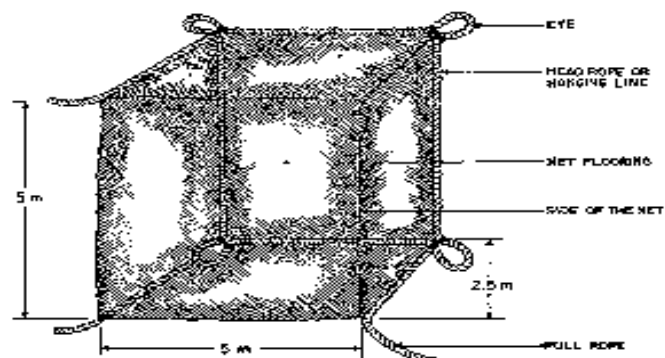


Trout Culture in a small cage in slow flowing river



A view of trout cage culture in a lake

Rainbow trout suitable for cage culture



A typical net thread cage for trout culture

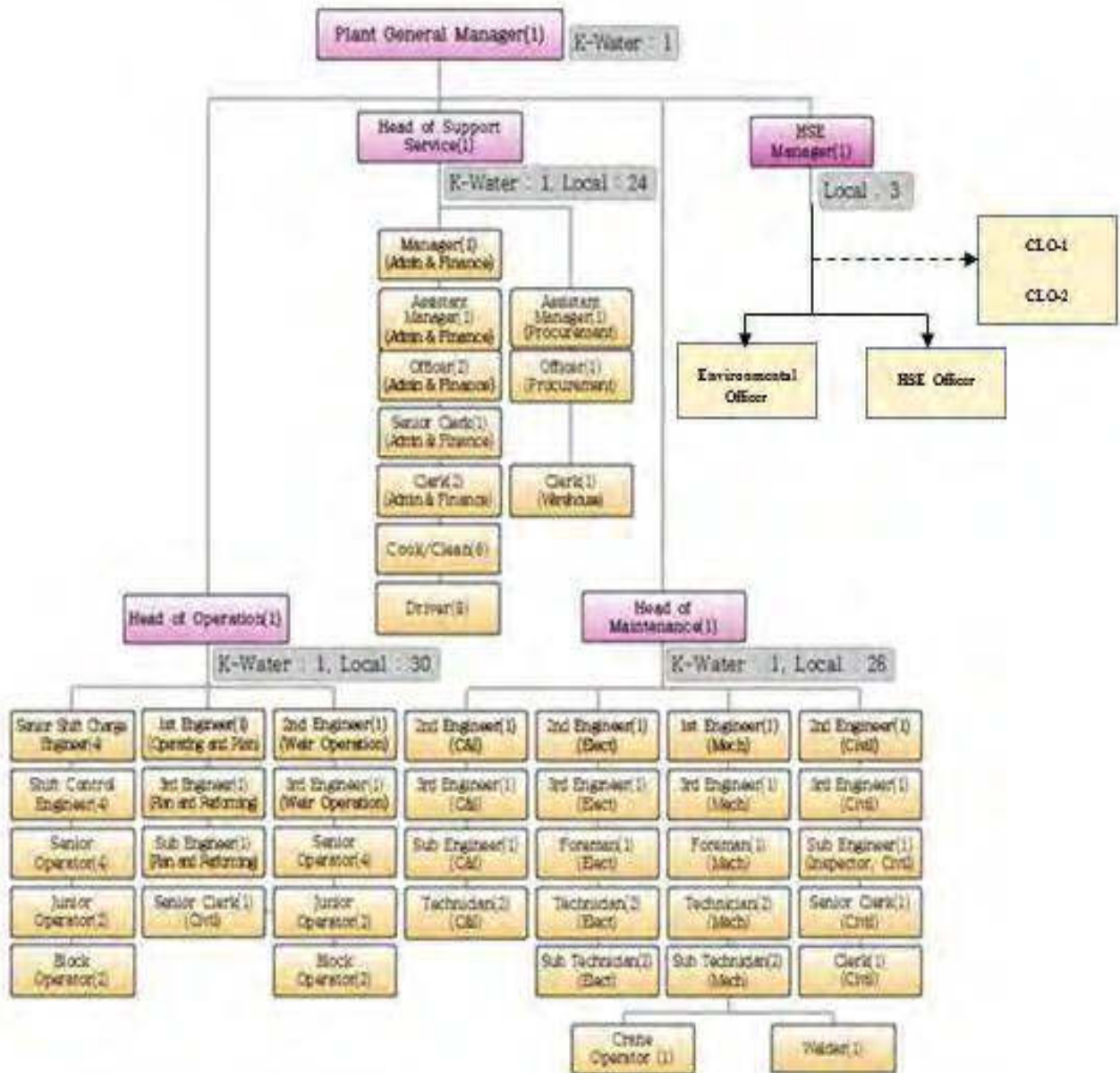
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# **ANNEX-5**

# **O&M ORGANOGRAM**



# **ANNEX-6**

# **WASTE MANAGEMENT**

# **PLAN**



The Best Water Partner

## **The Patrind Hydro Power Project**

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### **WASTE MANAGEMENT PLAN**

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**Pakistan Office**

**Korea Water Resources Corporation**

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## 1. PURPOSE

This waste management plan provides a practical guide designed to identify all the wastes that will be generated throughout the operation of Patrind hydropower and to define options for their reuse or management.

This plan has been developed to ensure adequate response to the potential environmental impacts of the wastes produced by the project. This plan is designed to achieve and maintain environmentally sound practices for sanitation and for conservation of the environment.

To achieve these goals, K-water will emphasize the following:

- Optimize the use and reuse of materials.
- Analyze the environmental implications of all works activities.
- Collect and dispose of waste promptly
- Stringent housekeeping standards
- Monitoring and inspection of all operational activities to ensure environmental compliance.
- Thorough record keeping
- Effective training

## 2. Definitions

<b>COMPANY:</b>	Star Hydro
<b>CONTRACTOR:</b>	K- Water Resources Corporation
<b>HAZARDOUS WASTE:</b>	This is any gaseous liquid or solid wastes, which due to its physical, chemical or infectious characteristics have the potentials to harm human health or the environment when improperly handled. They include paints, thinners, organic solvent, sewage, sludge, lead, acid, batteries, clinical waste, welding rods, blasting grit, empty oil / chemical drums and used oil (lube / engine).
<b>OHSAS</b>	Occupational Health and Safety Assessment Series
<b>PPE</b>	Personal Protective Equipment

<b>WASTE</b>	Any unavoidable/unwanted material resulting from an activity or process which has no immediate economic value to the producer and which must be disposed.
<b>DISPOSAL</b>	Discharge, deposit, injection, dumping, spilling, leaking or placing of waste material into or on any land, underground or water body so that such waste, or constituent thereof, may enter the environment.
<b>WASTE MANAGEMENT</b>	The discipline associated with the control, generation, storage, collection, transfer and transport, processing and disposal of solid waste in a manner that complies with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations.
<b>WASTE MANIFEST</b>	Duplicated form to record waste generation and transfer of that waste.
<b>RECYCLING</b>	The separation of certain materials suitable for reuse, reprocessing or remanufacture of these materials.
<b>BIODEGRADABLE</b>	Substances that can break down into simpler soluble or gaseous compounds by micro-organisms in the soil, water or atmosphere.
<b>WASTE HANDLING</b>	Activities associated with the management of the waste prior to storage, transfer and ultimate disposal route.
<b>NEUTRALIZATION /STABILIZATION</b>	Addition/dilution of waste to acceptable level of contaminants.
<b>GENERATOR</b>	In this context, Individual(s) who produce the waste stream and is responsible for placing the waste in the relevant segregation bin.
<b>WASTE REGISTER</b>	The inventory of the waste streams, both in terms of composition and quantity, produced at each of the facilities.
<b>WASTE MINIMIZATION</b>	Any technique process or activity which either avoids eliminates or reduces waste at its source or allows reuse or recycling of the waste
<b>WASTE HANDLER</b>	Person or corporate entity charged with the management of waste from generation to final disposal.
<b>BEST PRACTICABLE ENVIRONMENTAL OPTIONS (BEOP)</b>	Treatment option based on latest development in environmental science and technology, aimed at adverse environmental impact mitigation and having an established period of practical application taking into account economic and social factors.

### **3. INTRODUCTION**

Reduction of waste shall be implemented. Throughout the project, materials and technologies shall be chosen that minimize the hazards associated with waste and the quantity of waste generated. Materials that are difficult to dispose of and have environmentally sounder alternatives shall be avoided in favor of the latter. All waste impacts shall be taken into consideration, including e.g. packaging for transport to site and final disposal when the end-of-life has been reached.

- Re-use and recycling shall be the norm.
- Final disposal of land filling shall be limited to what is strictly necessary. It shall be carried out by approved waste management Sub-contractor to an approved facility/plant.
- Land filling shall be properly implemented at disposal area by taking proper measures for seepage and prevention of ground water contamination.

### **4. RESPONSIBILITIES**

#### **1.1 K-Water HSE Manager**

He ensures the:

- Waste Management is captured in the K-Water HSE audits program.
- Principle that only Pakistani Government approved waste Management Subcontractors are used in the project
- Monitor the overall implementation of the waste management procedure.
- Recommends and facilitate the implementation of recommended actions for improved waste management
- Ensure that the site personnel have been trained to the requirements of this plan.
- Ensure the accurate and up to date recordkeeping, including training records and reports.
- Ensure the implementation of all corrective actions from audits and inspection

#### **1.2 K-Water Environmentalist**

His responsibilities include:

- Implement the waste management plan on site and on locations, in particular, handling, Segregation, Storage and Disposal of hazardous waste
- Participate in the creation and / or improvement of training programs

- Collect data relating to site waste management and final destination and provide it to project HSE manager for reporting and maintaining the records.
- Perform inspection on waste management, tracking log and close out action items.

### **1.3 Supervisor/Foreman/Camp Boss**

Their responsibilities include:

- Supervisors / Foreman Subcontractor and Camp Boss shall ensure that all personnel are aware of the requirements of this plan and monitor its implementation

## **5. PROCEDURES**

### **5.1 General**

- The project is committed to manage the waste generated from operations in a responsible manner, comply with the local authorities' regulations and to a high standard of environmental and economic efficiency.
- Licenses / permits or any other approvals or contractual agreements required to meet the requirements of the local, regional, and other stake holders related to waste management shall be obtained.
- K-water shall approve waste water/sewage treatment facilities while Rivers State Ministry shall approve the waste pits for all disposable waste, both hazardous and non-hazardous.
- Shall use or procure Local authorities approved substances for the execution of project. Any banned substances by Local Authorities and Company, shall not be used in the project.
- Shall provide equipment and/or service contracts (if necessary) for the operations of the onsite waste handling facilities and for transportation of waste from its premises to ultimate disposal sites.
- Wastes that are not identified in this plan that may be generated during the project operations shall be treated as potentially hazardous and handled accordingly.
- All the wastes generated from operational activities should be identified, labeled, stored and transported as per its category. Each type of waste must be kept separated from other types. In particular, any mixing of hazardous waste with non-hazardous waste shall be avoided.

- Waste Storage areas shall be designed to contain spills and leaks. Material Safety Data sheets (MSDS) for all chemicals and hazardous substances must be placed and accessible for all personnel handling these materials. Employees shall be trained in the safe handling of hazardous substances. With the approval of local authorities, approved waste disposal sites shall be selected, used for permanent disposal off waste from operations & maintenance.
- Housekeeping on working areas, offices, and residential areas shall be organized as a part of day-to-day operations.

## **5.2 Waste Management Approach**

- Basic approach to the waste management is incorporation of a hierarchy of five best environmental operating practices. Such as Source reduction, Reuse, Recycle, Treatment and Ultimate disposal.
- Source reduction is the primary concern. Waste generation shall be reduced primarily at source by suitable operating practices rather than managing at later stages.
- Where waste generated is not avoidable, attempt to minimize it by reuse, recycle or recovery of wastes to the practicable extent. Treatment shall only be considered after reuse, recovery and recycling options have been completely exhausted. Ultimately, disposal is the last option and should be confined<sup>9</sup> to designated and approved areas.

## **5.3 Waste Classification**

In order to assess the potential impact on the environment and set priorities for waste management, wastes have been broadly classified into two categories.

1. Non Hazardous Waste
2. Hazardous Waste

Following are the common types of non-hazardous waste generated from the PPHPP Operations

- a) Timber (vegetation)
- b) Domestic Waste
- c) Food Waste
- d) Metal scrap
- e) Office Waste
- f) Non-hazardous chemical waste

Following are the common types of hazardous waste generated from PHPP operations:

- a) Waste lubricants (spent oil)
- b) Used filets, oily rags etc.
- c) Batteries
- d) Hazardous chemical waste
- e) Medical waste
- f) Oily sludge
- g) Contaminated sand (oily sand)
- h) Sewage sludge
- i) Tires

#### **5.4 Waste Segregation**

It shall be emphasized to practice waste segregation at all operational sites prior to disposal of any waste material. Waste segregation shall be practiced in accordance with hazard classification, physical and chemical properties, potential for reuse/recycle and ultimate disposal at all operational sites. Color coded waste storage bins shall be used. Segregation at source also facilitates easy collection, saves time, money and effort spent on sorting out waste materials at later stages. The intended contents of each container shall be clearly depicted in both script and pictorial representation of its use. The containers shall also be depicted by their color as listed below:

<b>Waste category</b>	<b>Color code of container</b>
Biodegradable waste (kitchen Waste)	Green
Combustible waste and Hazardous waste (Medical waste)	Yellow
Recyclable waste(Paper), Recyclable wastes (scrap metals and cans and Recycle waste (glass & plastic)	Blue

#### **5.5 Waste Storage Areas**

Wastes shall be stored in containers, drums, plastic bags and / or equipment that have been specially designed for such purpose. Waste storage areas shall be clearly demarcated, labeled or marked and the categories of waste, which may be stored, shall be identified with signboards. Storage areas shall be fenced and provided with multi language warning signs in accordance with applicable standards.

Sufficient number of waste collection containers/drums shall be provided at all operational, residential office and recreational areas. Waste storage areas shall:

- Comply with applicable requirements of local, regional and federal administrations
- Located away from the sensitive areas (surface water bodies, residential areas etc.)
- Clearly fenced (to prevent access to live stock and unauthorized personnel)
- Sufficient size to accommodate generated waste volumes
- Secondary containment walls shall be provided
- Proper shelter shall be provided in order to prevent nuisance by windblown rubbish.
- Hazardous waste shall be stored only in designated areas and proved with lockable gates to prevent unauthorized entry.
- Material Safety Data Sheets (MSDS) and Firefighting facilities shall be provided at all waste storage areas.

## **5.6 Waste Collection and Transport**

It is anticipated that this service will be given to a locally approved subcontractor from the local authorities. He is responsible for daily collection, segregation of waste from waste storage areas to recycle, reuse, treatment and disposal facility from fabrication operational sites. A subcontractor who has permit for hazardous waste management shall be responsible for recording waste streams as per the specified format. However, the following measures shall be taken in general:

- Wastes shall be transported in a safe and responsible manner.
- Hazardous waste and non-hazardous waste shall not be transported together.
- Prohibit the overloading of vehicles with waste loads.
- Provide containment and labeling for waste during transportation.
- Ensure drivers are trained and fully aware of any risk associated with the waste materials.
- Vehicles shall be provided with netting or tarpaulin to prevent flying of waste.

## **5.7 Waste Disposal**

Waste shall be finally disposed on two ways based on whether it has a value or not. Waste of “value” i.e. which can be sold to recyclers or handed over at free of cost. Waste of “no value” shall be disposed in line with local and international authority’s regulations.

All disposal options will be contracted out to waste subcontractor approved by the appropriate organizations and recognized by the client.

## **5.8 On Site Waste Management Practices**

The following are the common practices for management of wastes, which shall be implemented at all sites. In some cases, the concepts of Best Available Not Entailing Excessive Cost (BATNEEC) and Best Practicable Environmental Options (BEOP) should be explored and used as guidelines in managing different types of wastes.

## **5.9 Non - Hazardous Waste**

Domestic waste includes litter, paper, aluminum cans, glass, cartoons, and kitchen waste and timber and vegetation cuttings. Domestic waste may include some recyclable materials such as paper, steel and aluminum cans, printer toner cartridges and disused electronic and computers. These materials shall be segregated at source for recycling and transported to a dedicated licensed waste handling facility for recycling.

The remainder of the domestic waste shall be disposed of in an approved sanitary landfill site. Timber can be salvaged into small pieces and can be allowed to collect by the local residents as firewood.

### **Storage**

Waste shall be stored in dedicated containers with lid proof. Recyclable domestic waste shall be stored in separate containers. In sites where the waste generation is large, waste storage skips of suitable size shall be provided. Kitchen waste mainly contains excess food shall be collected in PVC bags separately.

### **Collection**

Compactor trucks of suitable size shall be used for the collection of domestic and kitchen waste from residential and office areas.

Camp boss is responsible for checking sure all the quantity of kitchen waste before transportation to disposal site on a daily basis.

### **5.9.1 Hazardous Wastes**

The following are main types of hazardous waste being generated from PPHPP operations.

### **1) Waste Lubricants**

Waste lubricants also called spent oil mainly generated from plant/equipment maintenance works. It shall be collected from operational sites as well as from workshops and stored in dedicated, metallic drums. Waste lubricants shall be transported to dedicated licensed waste facility for recycling.

### **2) Oily sand**

Contaminated oily sand including oil-spill cleanup material shall be collected and transferred to a licensed waste management facility capable of accepting this type of waste. The hydrocarbon-contaminated sand shall be treated by land farming

### **3) Paint and Paint Related materials**

Paint is a generic term covering all types of industrial coatings and most surface protective materials included in this classification would be oil and water - based paints, spent paint thinner, wood preservatives, rust preventatives, and their containers.

It is important to review product information to find out the presence heavy metals like lead, mercury, chromium, cadmium and methyl-ethylketone. Thinners and oil-based paints are generally considered as hazardous because of their ignitability.

#### **Examples:**

- Oil based paint Latex
- Water based paint Spent thinner
- Epoxies Paint cans
- Paint remover Handling and disposal Practices

As much as possible, projects requiring painting should be coordinated to reduce excess leftover paints. All painting materials should be completely used. Waste paints shall be collected in sellable drums for further removal. Paint/coating shall not be drained onto the ground or buried. Empty cans shall be punctured and disposed for land filling.

## **6. Compliance**

### **6.1 Awareness Training**

Before the commencement of any operational works, all personnel shall be informed about the contents of this waste management plan through HSE awareness meetings. Attendance will be taken at the end of such meetings. Suitable notices, posters, bulletins on environmental issues shall be displayed at all operational sites to remind the all project employees.

## **6.2 Monitoring**

Project HSE Manager shall carry out Environmental Audits regularly (not less than three monthly) on waste management plan including performance of waste handling sub-contractor. The results of such audits and corrective actions identified shall be communicated to the line management for compliance.

Environmental Engineer will regularly monitor waste storage, segregation, transfer and disposal facilities. He will also ensure a high standard of housekeeping and good material storage at all operational sites.

## **7. RECORD KEEPING**

Record Keeping shall be done for movements of all types of wastes such as non-hazardous, hazardous, reused and or recycled waste. The purpose of record keeping is to:

- Provide the design information on characteristics and volume of waste generated at each operational site.
- Provides a control mechanism for safe handling, transport, treatment and disposal of wastes streams in line with the waste management plan.
- To monitor waste generation on consist manner.
- Generally, waste log shall contain the following minimum details:
  - Date & Time
  - Source
  - Waste Type
  - Weight or estimated volume in m<sup>3</sup>.
  - Final Disposal
  - Uplift authorized by

The Consignment note will be maintained on and will be compiled on monthly basis.

# **ANNEX-7**

# **TRAFFIC MANAGEMENT**

# **PLAN**



The Best Water Partner

## **The Patrind Hydro Power Project**

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### **Traffic Management Plan**

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**Pakistan Office**

**Korea Water Resources Corporation**

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## **1. Introduction**

The TMP provides traffic management strategy to promote employees and community road safety awareness to ensure road environment where all people feel safe from traffic movements associated with operation of Patrind Hydropower Project.

## **2. Aims & Objectives**

The aims and objectives of TMP are:

- To minimize the potential hazards of traffic resulting from vehicle movements
- compliance with occupational health and safety standards
- implementation of the appropriate Occupational Health & Safety controls for traffic management
- To restrain traffic speeds and safeguard the environment
- To achieve safe movement by reducing accident levels
- To improve pedestrian safety, accessibility and convenience

## **3. Safety Precautions**

### **3.1 Installation of sign boards**

The traffic sign boards (Speed limits, School children crossing, tuck shop, heavy vehicle crossing, Pedestrian walkways, parking & No parking signs, vehicle turning signs) must be installed at access roads of both weir and power house sites.

### **3.2 Driver's safety induction**

Safety induction of all drivers must be conducted by HSE department; check their licenses and validity as well. Give them awareness about the traffic management plan.

### **3.3 Vehicles speed limit**

Drivers must be familiar with traffic rules and regulations, follow the speed restrictions, and observe the posted speed limits on sign boards. The maximum speed limit in project area is 20 Km/h.

### **3.4 Overtaking Restriction**

Overtaking cause serious accidents. Overtaking is strictly prohibited in project sites, schools, crowded public places and near pedestrian's access area to avoid accidents.

### **3.5 Driver Fatigue**

Fatigue is major cause of accidents. In condition of extreme tiredness resulting from physical or mental exertion, feeling drowsy or illness the driver will be not allowed to drive any vehicle.

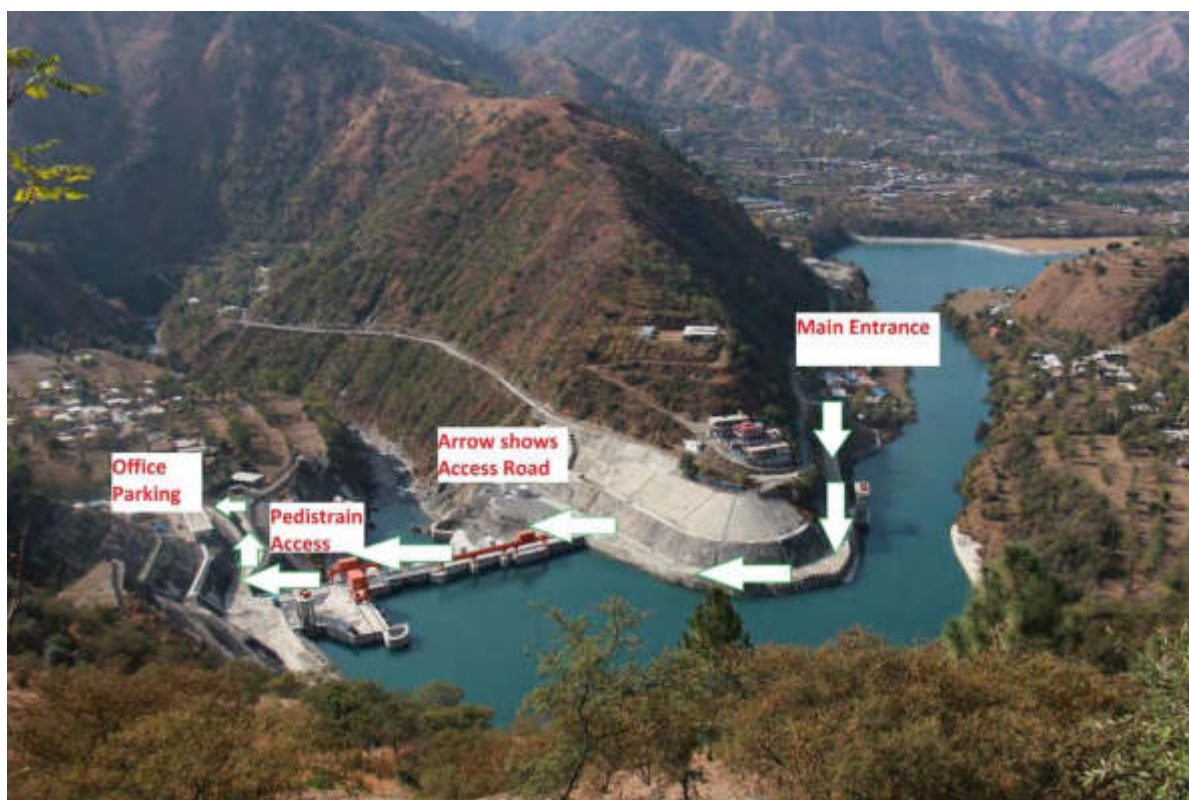
#### **4. Driver code of conduct**

- Complete the pre-start vehicle checks every day
- Keep your vehicle in a clean and tidy state at all times
- Always wear you seat belt and ensure all passengers wear their seat belt
- When reversing always check area behind is clear
- Use of illegal and non-prescriptive drugs is strictly prohibited
- Do not drive under the influence of alcohol
- Do not drive if you are taking medication that may cause drowsiness
- Plan your journey and take regular breaks when on long journeys, no more than two hours driving before taking a break
- Always drive defensively
- Drive very slowly through local villages and be aware of small children and livestock
- Always drive at speeds suitable to the road and weather conditions
- Do not exceed the speed limit
- Do not use mobile telephones while you are driving, pull over and stop to make or receive telephone calls

**Powerhouse & Weir site road access pictures are attached below:**



**Powerhouse site road access**



**Weir site road access**