Communication & Works Department Government of Gilgit-Baltistan

Construction of Tangir and Darel Expressway

Environment Impact Assessment (EIA) Report

May, 2025

MM Pakistan (Pvt) Ltd.

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List of Abbreviations

Acronym	Definition
ANFO	Ammonium Nitrate Fuel Oil
APs	Affected Persons
ASTM	American Society for Testing and Materials
BHU	Basic Health Unit
BOD	Biological Oxygen Demand
BOQ	Bill of Quantities
CITES	Convention on International Trade in Endangered Species
CO	Carbon Monoxide
COI	Corridor of Impact
CPEC	China Pakistan Economic Corridor
CSC	Construction Supervision Consultants
DSC	Design & Supervision Consultant
ECA	Employment of Child Act
EIA	Environmental Impact Assessment
ERP	Emergency Response Plan
EPRP	Emergency Preparedness and Response Plan
ESHP	Environmental, Social, Health & Safety
ESMP	Environmental and Social Management Plan
ESMMP	Environmental and Social Management and Monitoring Plan
ESMU	Environmental and Social Management Unit
FGD	Focus Group Discussion
GB-EPA	Gilgit-Baltistan Environmental Protection Agency
GB C&W	Gilgit Baltistan Communication & Works
GBV	Gender-Based Violence
GHG	Greenhouse Gases
GRC	Grievance Redress Committee
GOP	Government of Pakistan
GRM	Grievance Redress Mechanism
Ha	Hectare
H&S	Health and Safety
HKS	Hazara Kashmir Syntaxes
HFT	Himalayan Frontal Thrust
HSE	Health, Safety and Environment
HTV	Heavy Transport Vehicles
IEE	Initial Environmental Examination
ILO	International Labor Organization
IUCN	International Union for Conservation of Nature
KBT	Kashmir Boundary Thrust
KKH	Karakoram Highway
LAC	Land Acquisition Collector
LARP	Land Acquisition and Resettlement Plan
LLA	Land Acquisition Act
MBT	Main Boundary Thrust

MCT	Main Central Thrust
MKT	Main Karakorum Thrust
MMP	MM Pakistan (Private) Limited
MSDS	Material Safety Data Sheet
MVE	Motor Vehicle Examiner
NCS	National Conservation Strategy
NDMA	National Disaster Management Authority
NEQS	National Environmental Quality Standards
NGO	Non-governmental Organization
NHA	National Highway Authority
NOC	No Objection Certificate
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
Pak-EPA	Pakistan Environmental Protection Agency
PEPC	Pakistan Environmental Protection Council
PEPO	Pakistan Environmental Protection Ordinance
PM	Project Management
PM10	Respirable Particulate Matter (≤10µm)
PM2.5	Respirable Particulate Matter (≤2.5µm)
PMDC	Pakistan Meteorological Data Processing Center
PPE	Personal Protective Equipment
PPC	Pakistan Penal Code
PAP	Project Affected Persons
PD	Project Director
PGRC	Project Grievance Redress Committee
RAP	Resettlement Action Plan
ROW	Right of Way
SDS	Social Development Specialist
SOP	Standard Operating Procedure
SO_2	Sulphur Dioxide
SRT	Salt Range Thrust
TDS	Total Dissolved Solids
TL	Team Leader
TMP	Traffic Management Plan
UN	United Nations
WHC	World Heritage Convention
WHO	World Health Organization
WMP	Waste Management Plan
WWF	World Wildlife Fund for Nature

Executive Summary

i. Overview

Gilgit Baltistan Communication & Works Department, Gilgit (GB-C&W) as a client of the Project has engaged the Consultant - M/s MM Pakistan Pvt. Ltd. (MMP) to provide engineering consultancy services for the project" Construction of Tangir and Darel Expressway (59.6Km). An Environment Impact Assessment (EIA) report including an Environmental & Social Management Plan (ESMMP) has been prepared to provide a basis for the identification of environmental and social considerations and foresee the impacts of Project and set out the measures to be taken to manage them. The EIA report is prepared to comply with Gilgit-Baltistan Environment Protection Act, 2014.

ii. Need and Justification of the Project

Roads play a very vital role in the economic and social development of any area. Roads are important not only from a social-economic point of view but also from a strategic point of view. The human life is completely dependent on transportation that helps to move people and things from one place to another. The project envisioned construction of 59.6 km Expressways with widening/upgradation and realignment of present roads at some locations including construction of bridges and other aligned structures like culverts, side drains, retaining and breast walls etc. It is fundamentally intended at providing ease of communication within the two valleys Tangir and Darel. Construction of these Expressways has become an essential prerequisite for providing reliable communication, boosting local trade and solving traffic problems.

iii. Objectives of Environment Impact Assessment (EIA)

The main objective of the EIA report is to identify and assess potential impacts of the project on the environment (physical, biological and social) and make recommendations to offset or minimize the adverse impacts. The specific activities performed to prepare the report are:

- *Collection of baseline information on physical, biological and socio–economic conditions prevailing in the Project area;*
- *Stakeholder consultation for information disclosure and to elaborate environmental and social impacts*
- *Environmental and social impact assessment;*
- *Propose mitigation and enhancement measures; and*
- *Prepare an Environmental and Social Management Plan (ESMP) including Monitoring program;*

iv. Project Location and Salient Features

Gilgit-Baltistan is the northernmost administrative territory of Pakistan. It borders with Azad Kashmir, Khyber Pakhtunkhwa, Wakhan corridor of Afghanistan, China and the Indian Administrated state of disputed Jammu and Kashmir. The backbone of road connectivity is (Karakoram highway N35). The project comprises of two packages (I & II) for implementation purposes, whereas these packages have been further divided into sections, as under:

Package – I (Construction of Tangir Expressway - 33.6 Kms)

- *Section-1 KKH (N35) to Luruk (8.0 Kms)*
- *Section-2 Luruk to Tangir (11.5 Kms)*
- *Section-3 Tangir to Sateel (14.1 Kms)*

Package – II (Construction of Darel Expressway - 26 Kms)

- *Section-1 KKH (N35) to Darel (20.9 Kms)*
- *Section-2 Darel to Rajikot (5.1 Kms)*

v. Geometric Design Criteria

Tangir Expressway and Darel Expressway are situated entirely within hilly terrain therefore the scope of this project will focus exclusively on the parameters specific to such topography. Expressway and Design Criteria/ Technical Parameters of each package are as follows:

Horizontal Alignment

- *Design Speed = 30Kmph*
- *Number of lanes = 2*
- *Carriageway Width = 3.3m*
- *Shoulder Width = 1m*
- *Drain Width = 1m*
- *Rate of Superelevation = 4%*
- *Cross Slope Carriageway = 2%*
- *Cross Slope Shoulders = 4%*

Vertical Alignment

- *Maximum Gradient = 6-10%*
- *Minimum Gradient = 0.3%*
- *Minimum K Value: = Crest 2, Sag 6*

Road Pavement

- *Design Life of Carriageway =10 years*
- *Level of Service = B and C*
- *Design Standard Axle Load = 70 tons*
- *Pavement Design Methodology = AASHTO Guide for Design of*
- *Pavement Structure = 1993*

Foundation Design

Keeping in view the load from the structure and subsurface soil characteristics, the analysis for mat/raft foundations are considered on following criteria:

- *For the design purposes, the guidance was taken from "Foundation Analysis and Design" by Josephe E Bowles and AASHTO LRFD Bridge Design Specifications.*
- *The Allowable Bearing Capacity is calculated at shear failure and settlement analysis on the basis of subsurface profile of Borehole profile.*

- *Factor of Safety is taken as 3.0 for foundation analysis on rock strata as proposed by "Principles of Foundation Engineering" by Braja M. Das.*
- *The maximum allowable settlement of 25 mm is considered for strip/isolated footing and 50 mm for mat/raft footing. The angular distortion between two adjacent foundations should not exceed 1/500.*
- *For settlement analysis Boussinesq Equation, "Foundation Analysis and Design" by Josephe E Bowles is used. For shear failure analysis, Terzaghi bearing capacity formula used for calculation of net bearing capacity of foundation*

vi. Investigations

Geotechnical:

- *Fifteen (15) Boreholes were drilled up to the maximum depth of 20.0 m to confirm the strata and geotechnical parameters of the material.*
- *Standard Penetration Test (SPT), Cone Penetration Test (CPT) in the borehole were performed at interval up to the investigated depth.*
- *Undisturbed and Disturbed Soil samples collected from boreholes with appropriate sampling techniques, sample preservation and transportation to the testing laboratory.*
- *Laboratory tests including Sieve Analysis, Atterberg Limits, Point Load, Tri Axial, and Chemical Analysis of selected soil and water samples were carried out in accordance with the geotechnical investigation program.*
- *Classification of soil for seismic assessment was conducted.*
- *Assessment for liquefaction potential of the site was carried out.*
- *Evaluation of geotechnical parameters for geotechnical design of pile foundation.*

Subgrade Investigation

- *The subgrade investigation of the proposed site was carried out in following sequence.*
- *Drilling of two Boreholes up to the maximum depth of 20.0 m.*
- *Performing SPT, CPT Tests in Borehole.*
- *Determination of water table depth if encountered.*
- *Collection of undisturbed and composite soil samples for laboratory testing.*
- *Preparation of field log and record of information.*
- *Above field tests were carried out as per ASTM standards.*

Laboratory Testing

- *Soil samples were tested in the laboratory for index and strength properties of the material as per relevant ASTM standards. Following engineering properties were evaluated in lab:*
- *Grain Size Analysis (ASTM D422-63)*
- *Atterberg's Limits, (ASTM D4318-10)*

- *Natural Moisture Content (ASTM D-2216)*
- *Specific Gravity and Water Absorption Test (ASTM C-128)*
- *Unit Weight*
- *Bulk & Dry Density*
- *Point Load Test*
- *Direct Shear Test*
- *Chemical Analysis of Soil & Water*
- *California Bearing Ratio (CBR)*

vii. Nature of Interventions Involved

The Project Scope of Works covers construction of two Expressways, which include widening, relocation, surfacing/carpeting and provision of proper drainage and safety structure, such as side railing or Jersey barrier. The nature of interventions covers:

- *Earth Work,*
- *Masonry Work,*
- *Flexible Pavement (Subbase, Base Course and Wearing surface)*
- *Rigid Pavement*
- *RCC Culverts*
- *RCC Bridge*
- *RCC Causeways*
- *PCC Works*

viii. Machinery Required

Major machinery and equipment expected to be used during construction are:

1)	*Loader*	*10)*	*Transit Mixers*
2)	*Bulldozer*	*11)*	*Air Compressor*
3)	*Graders*	*12)*	*Power Broomer*
4)	*Water Bowser*	*13)*	*Bitumen Distributor*
5)	*Combination Rollers*	*14)*	*Asphalt Plant*
6)	*Dumper Truck*	*15)*	*Asphalt Pavers*
7)	*Concrete Mixer*	*16)*	*Tendon Roller*
8)	*Concrete Batching Plant*	*17)*	*Pneumatic Tire Roller*
9)	*Concrete Pump*		

ix. Interventions Detail

This project envisaged construction of 59.6 Km Road widening/up gradation and realignment of existing road at some locations including bridges and other allied structures (culverts, side drain, retaining & breast walls). The scope of work details is listed below:

Sr. No.	Scope of Work
1	Road Works
2	Retaining & Breast Walls
3	Culverts
4	Side Drains
5	Bridge Works
6	Land Compensation (Cultivated, Uncultivated Commercial land)
7	Damages of Structures
8	Shifting of Utilities

x. Environmental and Social Impact Assessment

The positive and adverse impacts identified are as under:

Potential Positive Impacts

- *Improvement of poor road infrastructure in the area*
- *Boost in tourism and growth in local economy*
- *Enhanced economic growth due to improved road connectivity*
- *Creation of jobs and employment opportunities*
- *There will be enhanced productivity, reduced travel times and less stress to road users.*
- *Reduced transport costs*
- *Economic and social value addition to the project's area of influence*
- *Appreciation of property value*
- *Improved living standards of communities*
- *Improved response to emergencies*

Potential Negative Impacts

Permanent

- *Acquisition of private properties*
- *Relocation of Public Utilities*

Temporary (During Construction Phase only)

- *Risk of Landslides*
- *Increased Soil Erosion and Degradation*
- *Degradation in Air Quality*
- *High Noise and Vibration*
- *High Dust Emission*
- *Contamination of Surface and groundwater*
- *Cutting of Trees and other Vegetation*
- *Loss of habitat and biodiversity*
- *Disruption to Public Life during Construction activities*

xi. Environmental Social Management & Monitoring Plan (ESMMP)

The ESMMP to mitigate identified environmental and social impacts of the project along with necessary mitigation measures has been prepared and is provided in the EIA report. Most of the adverse impacts relate to the construction phase of the project and mitigation measures require strict compliance. One purpose of the ESMMP is to record the procedure and methodology for management of mitigation identified for each adverse impact of the project. The ESMMP will clearly delineate the responsibility of various stakeholder involved in planning, implementation and operation of the project.

xii. Project Cost

The project cost is estimated as Pk Rs. ***6,030.729*** *million*

xiii. Economic Viability

Economic viability of the project has been established by showing its profitability in terms of excess of benefits to the economy over economic costs by using the discounted cash flow technique. The projected stream of economic benefits over the economic life of the project has been compared Following are the results of the Economic Analysis:

- *B/C Ratio = 2.41:1*
- *EIRR = 28.40%*
- *NPV = 4,294.78 million*

xiv. EIA Conclusion and Recommendations

- *The environmental and social study (EIA) of the Project has identified some potential adverse impacts; but all are not of serious nature and can be ameliorated or mitigated within normally acceptable levels through practicable control and management measures proposed in the ESMP.*
- *The overall findings of the EIA shows that the Project is environmentally and socially viable subject to the implementation of proposed ESMP.*

1 Introduction

1.1 Overview

Under Gilgit-Baltistan Environmental Protection Act, 2014 no proponent of any project shall commence construction or operation in Gilgit-Baltistan (GB) unless he has filed with the Gilgit-Baltistan Environmental Protection Agency (GB-EPA), an Initial Environmental Examination (IEE) for general cases and Environmental Impact Assessment (EIA) for sensitive cases.

Gilgit-Baltistan Communication & Works Department as a client of this Expressways Project has engaged the Consultant - M/s MM Pakistan Pvt. Ltd. (MMP) to provide engineering consultancy services for the project" Construction of Tangir and Darel Expressway. As per ToR the client requires Consultancy services for Detail Engineering Design including IEE/EIA and Construction Supervision of the proposed project. In addition to an Environment Impact Assessment (EIA) an Environmental & Social Management Plan (ESMMP) has been prepared for construction phase.

1.2 Project Objectives and Salient Features

GB is northernmost administrative territory of Pakistan. It borders with Azad Kashmir, Khyber Pakhtunkhwa, Afghanistan, China and the Indian Administrated state of disputed Jammu and Kashmir. The backbone of road connectivity is (Karakoram highway N35). The government of Gilgit-Baltistan has upgraded the Diamer district to division headquarters and all four tehsils to districts. Therefore, the connectivity of Tangir and Darel Districts with N35 (KKH) is being enhanced by upgrading their main roads to Expressways. Tangir Road starts from Karakorum Highway 67 km from Chillas and runs parallel to Tangir River. Its population lives mainly in the valley of the Tangir River, a right tributary of the Indus River. Darel is a newly formed District of the Division.

The main objective to launch the project is to achieve the purpose of comfortable, quick and safe movement of the traffic catering the needs of local residents. Expected benefits associated with the proposed project include:

- It will ease out the traffic of the both valleys and adjacent villages/areas.
- Massive impact of the project on Land Use will surely help in the progress of area and local people.
- Vehicle operating cost will be reduced and time will be saved.
- Employment opportunities for the local inhabitants will be created.
- The availability of bridges and approach road network will further facilitate rapid access of goods and services through heavy duty vehicles.
- Tourism will also boost up in these areas.
- Smooth flow of traffic.
- Saving of Vehicle Travel Time and Vehicle Operating Costs of commuters.
- Reduction of traffic accidents and casualties.
- It will also contribute to ensure efficient movement of trade, goods and traffic in relatively shorter time.

- Economic growth leading to provision of additional employment opportunities for the local residents.
- Quicker transports of products including perishable goods to final destination.

The salient features of the project are as under:

Sr. No	Feature	Detail
1.	Project Name	Construction of Tangir Valley and Darel Valley Expressway (59.6 km)
2.	Location	District Diamir - Gilgit Baltistan
3.	Project Cost	PKR 6,030.729 million
4.	Sector	Infrastructure (Transport & Communication)
5.	No. of Packages	2
6.	Package-I: Tangir Expressway (33.6 km)	Divided into 3 Sections, I, II & III Section-I: KKH to Luruk (8km) Section-II: Luruk to Tangir (11.5 km) Section-III Tangir to Kuranga Bridge (14.1 km)
7.	Package-II: Darel Expressway (26.0 Km)	Divided into 2 Sections, Section I & II Section-I: KKH to Darel (20.9 km) Section-II: Darel to Rajikot (5.1 km)
8.	No. of Lanes on each expressway	2
9.	Geotechnical Investigation boreholes drilled with depth	15 boreholes up to 20.0 m depth
10.	Traffic Design	20 years
11.	Estimated project completion time	3 years

1.3 Need and Justification for the Project

The project envisioned, widening/upgradation and realignment of selected roads including construction of bridges of medium to short span and other aligned structures like culverts, side drains, retaining and breast walls. It is fundamentally intended at providing ease of communication within the area. Population of the area is rising at a faster pace and construction of these roads has become an essential prerequisite for providing reliable all-weather roads, boosting up local trade and solving traffic problems. One of the aspects of this development has been the construction of bridges with state-of-the-art latest techniques that are used as transportation links for various transportation modes and connect mountains, valleys and rivers.

1.4 Project Screening/Categorization for Environmental Assessment

Screening of the project is made whether or not a full EIA is required. The Pakistan Environmental Protection Agency (PEPA) in its review of Initial Environmental Examinations (IEE) and EIA regulations, 2000 (adopted by GB Environmental Protection Agency during 2024) describes those projects, which require an IEE and EIA as Schedule I and Schedule II respectively. Projects are categorized on the basis of expected degree of adverse environmental impacts. Project listed in Schedule II are designated as potentially seriously damaging to the environment and require EIAs. Those listed in Schedule I are seen to have potentially less serious effects and require IEEs, unless the projects are located in environmentally sensitive areas.

Gilgit-Baltistan Environmental Protection Act 2014 states that: “No proponent of a Project shall commence construction or operation unless he has filed with the GB-EPA an initial environmental examination (IEE) or, where the Project is likely to cause significant adverse environmental effect, an environmental impact assessment (EIA), and has obtained approval from the agency in respect thereof.”

The project “Construction of Tangir and Darel Expressway”, falls under Category-D (Other projects) specified in Schedule II of GB-EPA Review of IEE and EIA Regulations 2024. It therefore requires EIA before implementation.

1.5 Objectives of Environment Impact Assessment (EIA)

The main objective of the EIA is to identify and assess potential impacts of the project on the environment (physical, biological and social) and make recommendations to offset or minimize the adverse impacts. The specific objectives are:

- Collection of baseline information on physical, biological and socio–economic conditions prevailing in the Project area;
- Stakeholder consultation for information disclosure and to elaborate environmental and social impacts;
- Environmental and social impact assessments;
- Propose mitigation and enhancement measures; and
- Prepare an Environmental and Social Management Plan (ESMP) including Monitoring program;

1.6 Approach and Methodology

The key steps followed while conducting the EIA are briefly described below.

1.6.1 Review of Literature

Available documents related to the project and to the assignment, were acquired and reviewed. This included Environmental Impact Assessment (EIA) of similar projects of the area, Pak-EPA guidelines for the preparation of IEE/EIAs, National / GB Environmental Quality Standards etc.

1.6.2 Reconnaissance Survey

The consultant teams visited the project area and collected field data from line departments and also consulted wide range of road users and roadside dwellers, officials of the concerned government departments, NGOs and local persons. The main purpose of this approach was to obtain a fair impression on the people’s perceptions of the project and its environmental impacts.

1.6.3 Scoping before Preparation of the EIA Report

Scoping is a critical, early step in the Environmental Assessment (EA), which provides an opportunity for the proponents, consultants, relevant authorities and interested and affected parties to exchange information and express their views and concerns regarding a proposal before an assessment is undertaken. The scoping process identifies the issues that are likely to be of most importance during the assessment and eliminates those that are of little concern. In this way, scoping ensures that assessment studies are focused on the significant effects and time and money are not wasted on

unnecessary investigations. Scoping was completed through field visits of project area and by interactions with the key stakeholders. Both the positive and negative impacts identified in scoping phase

1.6.4 Collection of Primary Data

Field visits to the project area were arranged for collection of primary data. The purpose was to get an acquaintance with the prevailing conditions both visually and technically. Baseline study was carried out during these visits and information gathered is provided in baseline. The aim of the baseline study was to assess the existing site environment, conduct initial impact analysis required to propose mitigation measure to make the project sustainable.

1.6.5 Physical Resources Data and Surveys

Physical parameters for which necessary information was collected, include; metrological data (temperature, rainfall, humidity, and wind velocity and wind direction), air quality, water quality, land-use, and existing road network etc.

1.6.6 Biological Resources Data

An ecological resources survey of the area has been conducted and various biological parameters were recorded through secondary sources including terrestrial flora (plants and vegetative species) and fauna (native animals, birds, wildlife and other species).

1.6.7 Social and Cultural Resources Data

As a tool for collecting social and cultural data, social survey was conducted by consultant's sociologists using comprehensive social questionnaires. The social survey covered information regarding households, income and livelihood, educational and health facilities available within the project area.

1.6.8 Stakeholders Consultation

Apart from social surveys, information about environmental and social conditions were also collected by conducting stakeholder consultation (with both primary and secondary stakeholders). A strategy was developed for consultation and to manage the consultative events for constructive outcome. The process of stakeholder consultation helped in assessment of adverse impacts and understanding of stakeholder's views and ambitions. One to one meetings/ interviews with key informants, focus group discussions (FGDs) were also arranged.

1.6.9 Impact Assessment

The detail of project interventions, environmental and socioeconomic data collected were used to determine the potential impacts of the proposed project. Subsequent to this, the potential impacts were characterized in order to determine their nature, magnitude, extent and timing.

1.6.10 Mitigation Measures

Mitigation measures for each adverse impact are proposed to offset or to reduce impacts. Proposed mitigation measures are based on good environmental practice and experience of EIA team.

1.6.11 Environmental Social Management & Monitoring Plan (ESMMP)

The proposed ESMMP for the Construction of Tangir and Darel Expressway Project consists of a combination of operational policies, procedures, practices, actions to address identified impacts and risks. It favors the avoidance and prevention of impacts over minimization, mitigation, or compensation, wherever technically and financially feasible. Where risks and impacts cannot be avoided or prevented, mitigation measures and actions are in compliance with applicable laws and regulations. The ESMMP for the construction and operation phases defines desired outcomes as measurable events to the extent possible, with elements such as performance indicators, targets, or acceptance criteria that can be tracked over defined time periods, and with estimates of the resources and responsibilities for implementation.

1.7 Organization of EIA Report

The report is divided into eleven chapters and few Annexes as follows:

- Executive Summary
- Chapter 1: Introduction
- Chapter 2: Project Description
- Chapter 3: Analysis of Alternatives
- Chapter 4: Policy, Legal & Administrative Framework
- Chapter 5: Environmental and Social Baseline Conditions
- Chapter 6: Consultation and Information Disclosure
- Chapter 7: Impact Assessment and Mitigation Measures
- Chapter 8: Environmental Social Management & Monitoring Plan (ESMMP)
- Chapter 9: Grievance Redress Mechanism
- Chapter 10: Land Acquisition and Resettlement Aspects
- Chapter 11: Findings, Conclusions and Recommendations
- Annexes

1.8 EIA Team

The EIA team comprises of following:

Name	Designation
Azmat Beg	Principal Environment
Ihsan-ul-Haq Farooqi	Senior Sociologist
Malik Pervaiz Akhtar	Land Acquisition & Resettlement Expert
Muhammad Hanif	Sr. Environmentalist
Muhammad Hannan Yousaf	Assistant Environmentalist

2 Project Description

2.1 Overview

The Roads network makes a crucial contribution to economic development and growth of any area and brings important social uplift / benefits. Gilgit-Baltistan covers an area of over 72,971 km^2 (28,174 sq. mile) and is predominately mountainous. Gilgit-Baltistan is home to more than fifty peaks above 7,000 meters (23,000 ft.). Three of the world's largest glaciers outside the Polar Regions are found in Gilgit-Baltistan. Being one of the regions in High Asia, Gilgit-Baltistan, has historically attracted travelers, preachers, soldiers, traders and writers. The economy of the region is primarily based on a traditional route of trade, the historic Silk Road.

Gilgit-Baltistan lies between longitude 73 degree and latitude 35 degree, topographically the region is mountainous and hilly surrounded by the ranges of Karakoram, Himalayas and Hindu Kush with deep gorges and narrow valleys. The climate is cold to severe cold in winter and warm in summer with temperature variations from 20 to 40 degrees Celsius. Gilgit-Baltistan is the north most administrative territory in Pakistan. It borders with Azad Kashmir to the South, the province of Khyber Pakhtunkhwa to the West, the Wakhan Corridor of Afghanistan to the North, the Xinjiang region of China to the East and Northeast, and the Indian-administered state of Jammu and Kashmir to the Southeast.

Chillas is the headquarters of Diamer Division. The weather is hot and dry in the summer and cold in the winter. It can be reached through the Karakoram highway and also from the Kaghan valley passing over the Babusar Pass. Chillas is situated on the left bank of the mighty Indus River. The beautiful fairy meadows and Nanga Parbat, the seventh-highest peak in the world is also located in Chilas district. The Karakoram Highway connects Gilgit-Baltistan to Tashkurgan Town, Kashgar, China via Sust and the Khunjerab Pass, the highest paved international border crossing in the world at 4,693 meters (15,397 ft.). Increased accessibility and awareness of previously remote communities of Gilgit-Baltistan, has led to an improvement in education and healthcare facilities. Construction of new road network has led communities become integrated with the outside world that were once isolated. There has been a transformation in income, employment, access to transport, education, healthcare, and availability of goods and services in the recent past.

Despite the historical significance and natural beauty of Diamer Division, it has faced numerous development challenges, including inadequate infrastructure, limited access to healthcare and education and economic disparities. The lack of modern road network has hindered socio-economic progress and disregarded remote communities, growing poverty and isolation. The project will eliminate the glitches to the development challenges of Diamer Region, it will reduce the poor infrastructure of roads, easy access to healthcare and quality of education and will attract the tourist traffic from Pakistan as well as all over the World.

2.2 Project Location and Authorities Responsible

Location:
District Diamer – Gilgit Baltistan
Authorities Responsible for Execution
Communication and Works (C&W) Department, Gilgit-Baltistan through Project Management Unit (PMU)

Operation and Maintenance: C & W Department Gilgit Baltistan

2.3 The Project

Gilgit-Baltistan's strategic location plays a key role in regional socio-economic development. The construction of all-weather roads is crucial for enhancing local trade, resolving traffic issues and ensuring safe access to District Diamer, thus reducing accidents and improving traffic flow. The project also addresses District Diamer's current challenges, such as inadequate infrastructure, limited healthcare and education and economic disparities, by improving road networks, creating job opportunities and reducing poverty & isolation.

Construction of Tangir and Darel Expressways is aimed at providing easy communication in the area. Chillas district population is growing day by day at a faster rate and thus construction of these roads has become an essential need for providing all-weather roads, boosting up local trade and solving traffic problems. Better road sections will be available not only for the people of the area but also for trade in neighboring areas. The project comprises of two main valley roads called as Packages I & II, for implementation purposes, shown in **Figure 2-1** details as under:

Package – I – Construction of Tangir Expressway – 33.6 Km
Package – II – Construction of Darel Expressway – 26.0 Km
Both Packages – 59.6 Km

This project envisaged construction of two Expressways covering widening, up-gradation and realignment of existing road at some locations, including construction of bridges and other allied structures like culverts, side drains, retaining & breast walls. The detail of culverts, causeways and bridges of both Packages is provided in **Table 2-1**.

2.4 The Project Objectives

The main objectives of the project area:

- To provide all weather roads boosting up local trade and solving traffic problems of valleys.
- To have safe access to district Diamer thus providing a smooth traffic resulting in reduction of accidents to a greater extent.
- To reduce travel time and vehicle operating cost.
- To connect Karakoram Highway with Islamabad, Gilgit and Skardu, serving as the main route to major mountaineering hubs in Gilgit-Baltistan. This project will enhance both national and international tourism by providing easier access to the region.
- District Diamer faces inadequate infrastructure, limited access to healthcare and education, economic disparities and poor road networks, leading to poverty and isolation. This project aims to address and facilitate improvements in these areas by creating job opportunities and better road network/infrastructure.

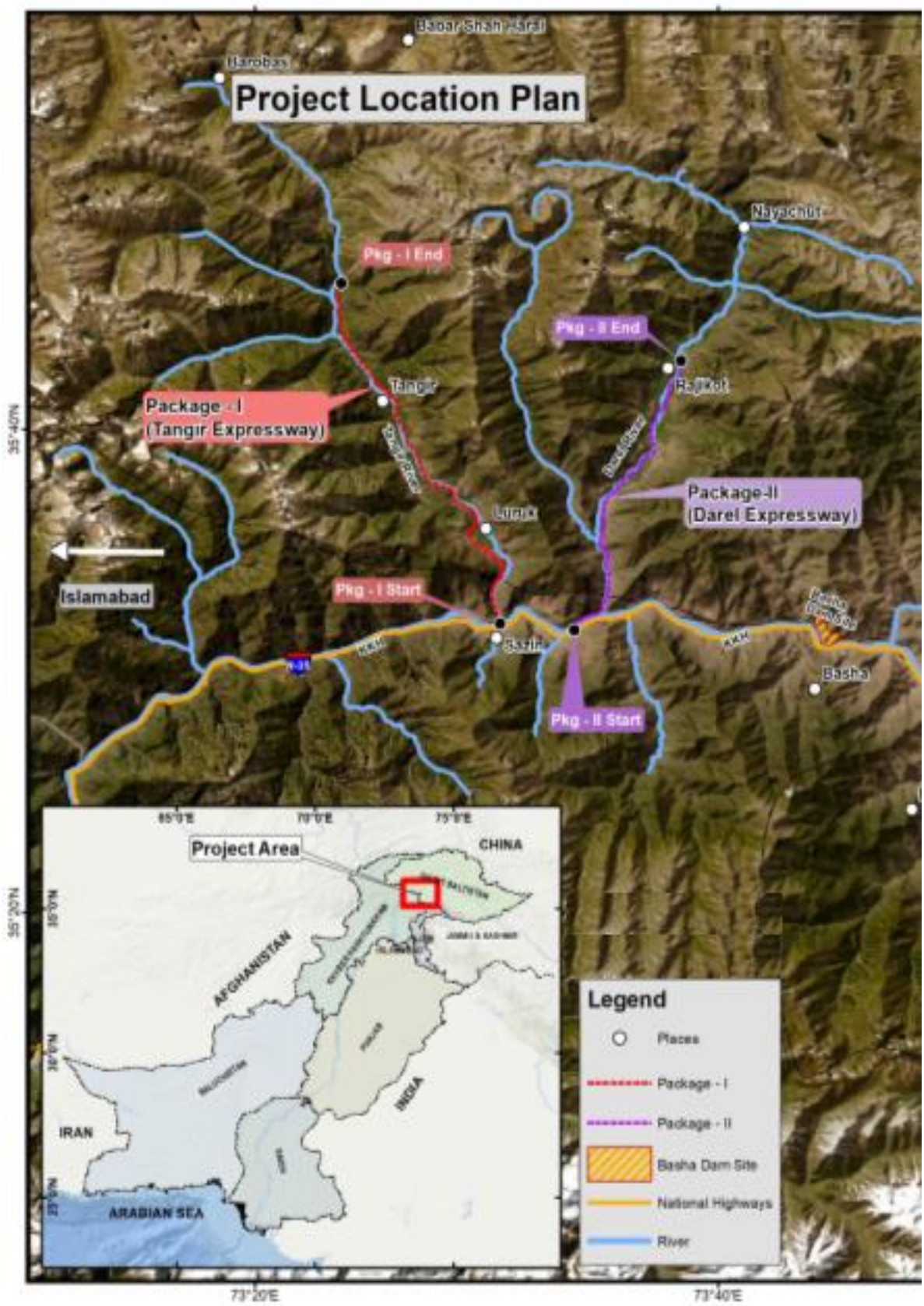


Figure 2-1: Project Location

2.5 Geometric Design Criteria

Tangir Expressway and Darel Expressway-Package are situated entirely within hilly terrain therefore the scope of this project will focus exclusively on the parameters specific to such topography.

2.5.1 Horizontal Alignment

- Design Speed = 30Kph
- Number of lanes = 2
- Carriageway Width = 3.3m
- Shoulder Width = 1m
- Drain Width = 1m
- Rate of Super elevation = 4%
- Cross Slope Carriageway = 2%
- Cross Slope Shoulders = 4%

2.5.2 Vertical Alignment

- Maximum Gradient = 6-10%
- Minimum Gradient = 0.3%
- Minimum K Value: = Crest 2
  = Sag6

2.5.3 Road Pavement

- Design Life of Carriageway = 10 years
- Level of Service = B and C
- Design Standard Axle Load = 70 tons
- Pavement Design Methodology= AASHTO Guide for Design of Pavement Structures - 1993

2.5.4 Foundation Design

Keeping in view the load from the structure and subsurface soil characteristics, the analysis for foundations is considered on following criteria:

- For the design purposes, the guidance was taken from “Foundation Analysis and Design” by Josephe E Bowles and AASHTO LRFD Bridge Design Specifications.
- The Allowable Bearing Capacity is calculated at shear failure and settlement analysis on the basis of subsurface profile of Borehole profile.
- Factor of Safety is taken as 3.0 for foundation analysis on rock strata as proposed by “Principles of Foundation Engineering” by Braja M. Das.
- The maximum allowable settlement of 25 mm is considered for strip/isolated footing and 50 mm for mat/raft footing. The angular distortion between two adjacent foundations should not exceed 1/500.

- For settlement analysis Boussinesq Equation, “Foundation Analysis and Design” by Josephe E Bowles is used. For shear failure analysis, Terzaghi bearing capacity formula used for calculation of net bearing capacity of foundation

2.6 Investigations

2.6.1 Geotechnical

- Fifteen (15) Boreholes were drilled up to the maximum depth of 20.0 m to confirm the strata and geotechnical parameters of the material.
- Standard Penetration Test (SPT), Cone Penetration Test (CPT) in the borehole were performed at interval up to the investigated depth.
- Undisturbed and Disturbed Soil samples collected from boreholes with appropriate sampling techniques, sample preservation and transportation to the testing laboratory.
- Laboratory tests including Sieve Analysis, Atterberg Limits, Point Load, Tri Axial, and Chemical Analysis of selected soil and water samples were carried out in accordance with the geotechnical investigation program.
- Classification of soil for seismic assessment was conducted.
- Assessment for liquefaction potential of the site was carried out.
- Evaluation of geotechnical parameters for geotechnical design of pile foundation.

2.6.2 Subgrade Investigation

The subgrade investigation of the proposed site was carried out in following sequence:

- Drilling of two Boreholes up to the maximum depth of 20.0 m.
- Performing SPT, CPT Tests in Borehole.
- Determination of water table depth if encountered.
- Collection of undisturbed and composite soil samples for laboratory testing.
- Preparation of field log and record of information.
- Above field tests were carried out as per ASTM standards.

2.6.3 Laboratory Testing

Soil samples were tested in the laboratory for index and strength properties of the material as per relevant ASTM standards. Following engineering properties were evaluated in lab:

- Grain Size Analysis (ASTM D422-63)
- Atterberg’s Limits, (ASTM D4318-10)
- Natural Moisture Content (ASTM D-2216)
- Specific Gravity and Water Absorption Test (ASTM C-128)
- Unit Weight

- Bulk & Dry Density
- Point Load Test
- Direct Shear Test
- Chemical Analysis of Soil & Water
- California Bearing Ratio (CBR)

2.7 Nature of Interventions Involved

The Project Scope of Works covers construction of two Expressways, which include widening, relocation, surfacing/carpeting and provision of proper drainage and safety structure, such as side railing or New Jersey barriers. The nature of interventions covers:

- Earth Work,
- Masonry Work,
- Flexible Pavement (Subbase, Base Course and Wearing surface)
- Rigid Pavement
- RCC Culverts
- RCC Bridge
- RCC Causeways
- PCC Works

2.8 Project Packages and Sections

Package-I (Tangir) and Package-II (Darel) are further divided into three and two sections respectively for construction purpose and number of major structures proposed in each Package are given in **Table 2-1**. The detail Scope of work in each package is discussed in Sections 0& 2.8.2.

Table 2-1: Detail of Culverts, Causeways and Bridges of all the Packages

Description		Culverts	Causeways	Bridges
Package No.	Section No.			
Package 1	Section 1	9	16	0
	Section 2	23	6	0
	Section 3	24	1	2
Package 2	Section 1	47	3	0
	Section 2	9	1	0
	All Packages	**112**	**27**	**2**

2.8.1 Package -1 (Construction of Tangir Expressway – 33.6 km)

The Tangir valley starts from KHH at a distance of 67 km from Chillas city, whereas population mostly lives along the Tangir River, which is a right tributary of the Indus River. Location Plan of Package-1 is given in **Figure *2-2*** and typical planned cross-section of the proposed expressway is shown in **Figure *2-3***, which shows lane width of 3.3 m with shoulder of 1.0 m on each side. A ditch for side drain

is also proposed along the road on hill side. A breast wall on hill side and parapet wall on river side as a safety measure. Typical cross-sections of Tangir Expressway (Package -I Section-1 & Section-3) are shown in **Figure 2-3** and **Figure 2-4** respectively.

The road is divided into three sections for construction purpose as under:

- Section-1: KKH to Luruk (8.0 km)
- Section-2: Luruk to Tangir (11.5 km)
- Section-3: Tangir to Kuranga Bridge (14.1 km)
- **All Sections 33.6 km**

The Package-I Road runs along Tangir River and from KKH to existing bridge at km 16+300, the road travels along left bank of Tangir River. After that the road travels along right bank of river up to end of project. The detail of proposed interventions is as under:

- The existing road width varies from 3.5m to 4.5m and available ROW is 5m to 10m essentially requiring widening mostly towards hill side.
- Cross drainage structure and side drains will be constructed at most of the locations to avoid future damages to road and distress to pavement structure.
- Breast wall will be constructed on the hill side where required to protect from loose boulders / loose soil as barrier / guard rail and parapet wall will be constructed on river side as a safety measure.

2.8.2 Package – II (Construction of Darel Expressway - 26 Km)

The Darel valley is located towards south-west of Chillas city; population lives mainly along Darel River another right tributary of the Indus River. The Location Plan of the Package-II (Darel Expressway) is given in **Figure *2-6***. The proposed Expressway starts from KKH 60 km from Chillas and runs parallel to Darel River. The existing road width varies from 4 – 5 m and essentially requiring widening mostly towards hill side. As this road is on very high level from river flowing along edge of the road, a breast wall will be constructed on the hill side to protect from loose boulders / loose soil on hill side where as barrier / guard rail or parapet wall will be constructed on river side of road as a safety measure. Cross drainage structure and side drains will be constructed at most of the locations to avoid damaging of road and distress to pavement structure.

A 2-lane proposed typical cross section of Darel Express Way (Package -II Section-2) is shown in **Figure 2-5**, showing lane width of 3.3 m with shoulder of 1.0 m on each side. A ditch for side drain is also proposed along the road on hill side. A breast wall on hill side and parapet wall on river side as a safety measure.

This Package is divided in two following sections.

- Section-1: KKH to Darel (20.9 km)
- Section-2: Darel to Rajikot (5.1 km)
- **All Sections 26.0 km**

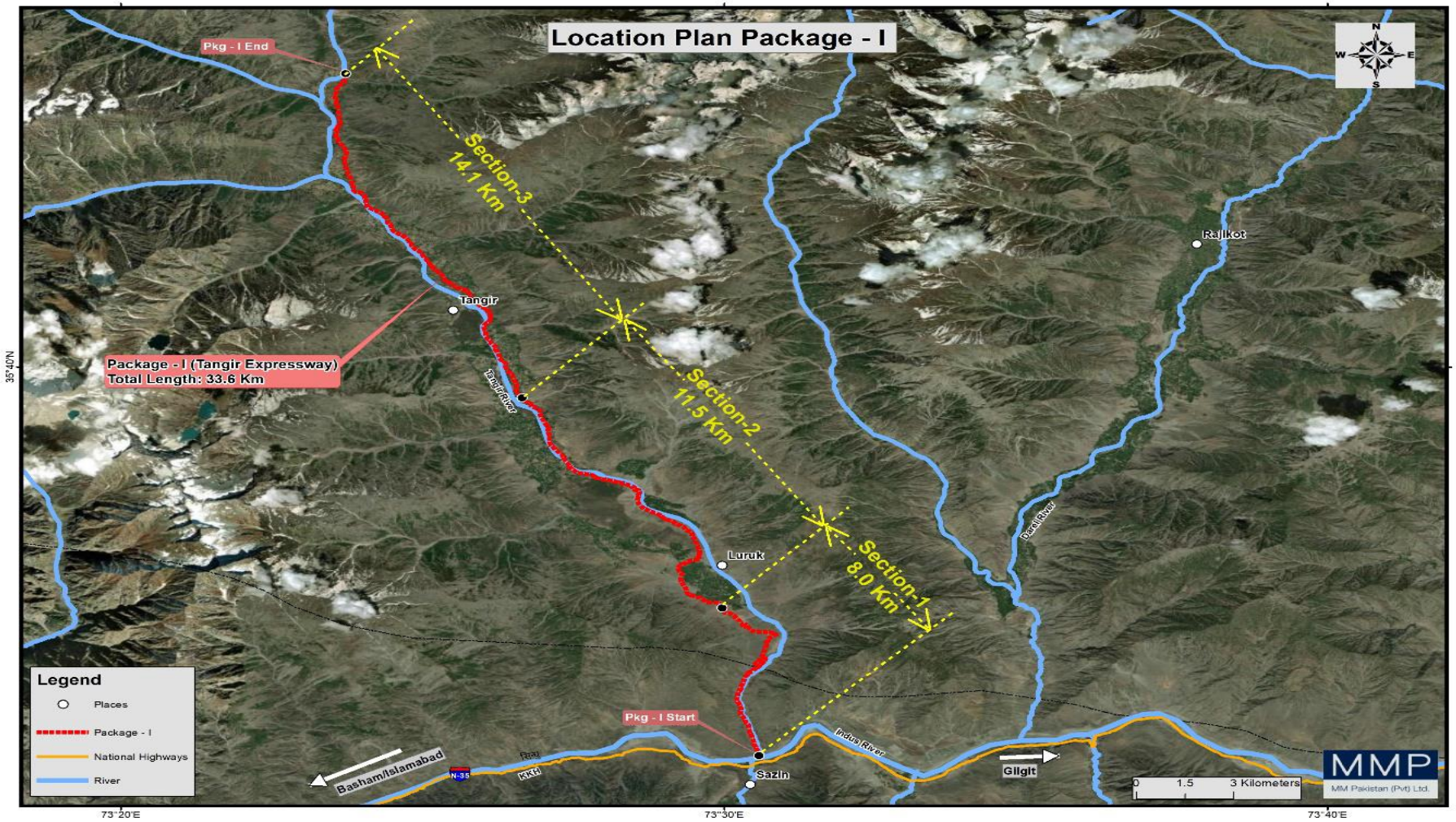


Figure 2-2: Location Plan of Sections 1 to 3 of Package – I

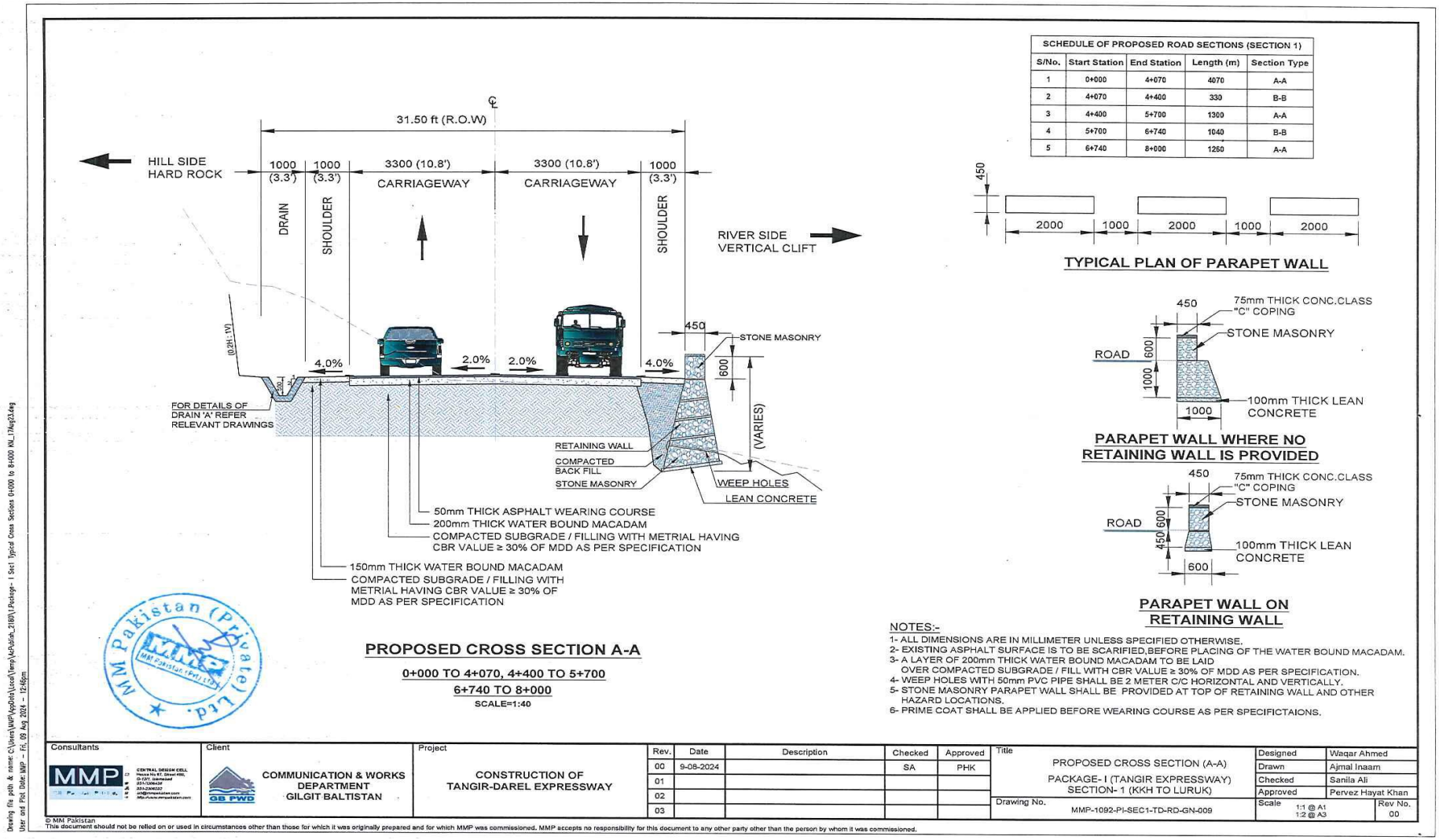


Figure 2-3: Typical Cross-section of Tangir Expressway (Package -I Section-1)

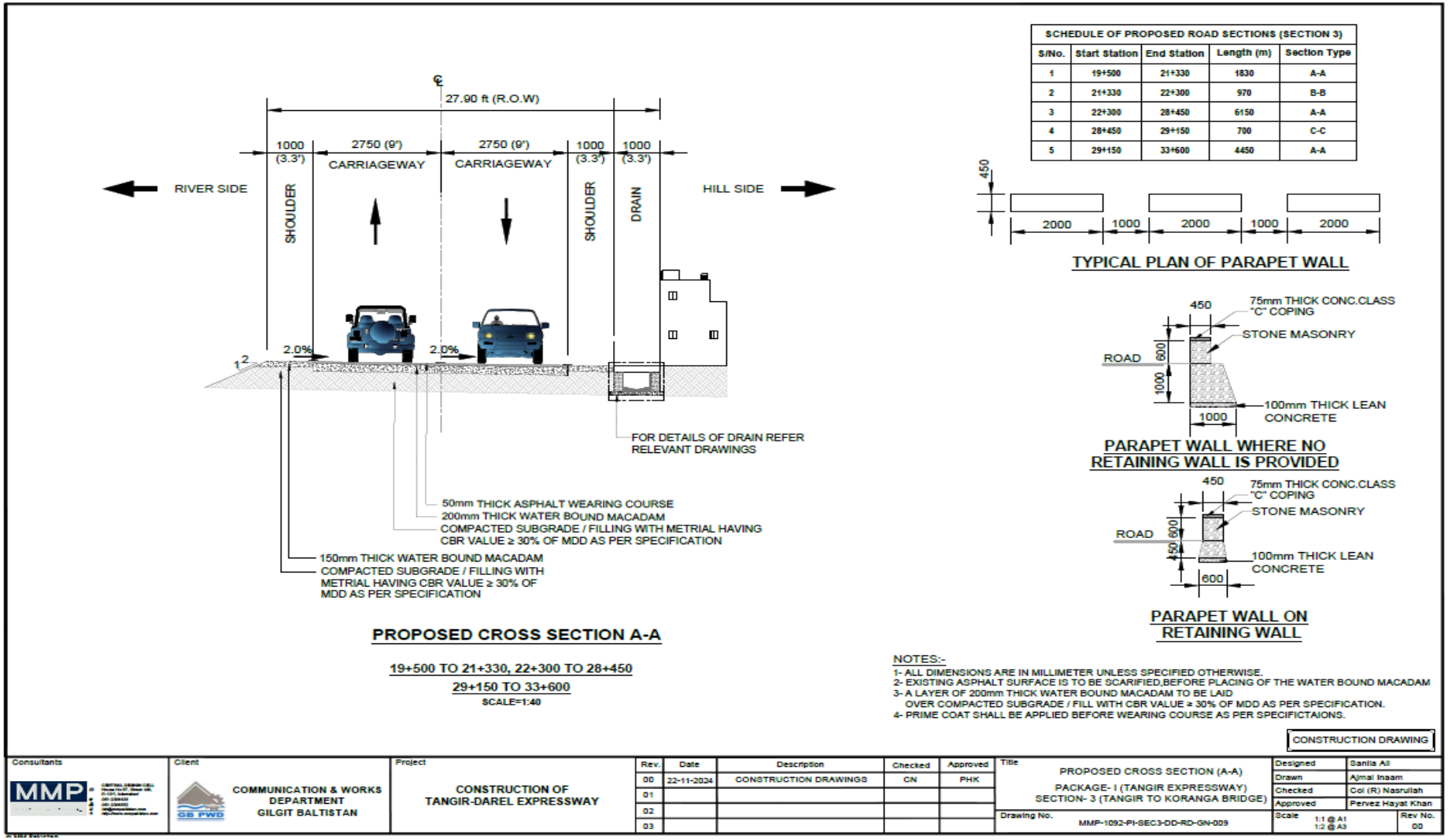


Figure 2-4: Typical Cross-section of Tangir Expressway (Package -I Section-3)

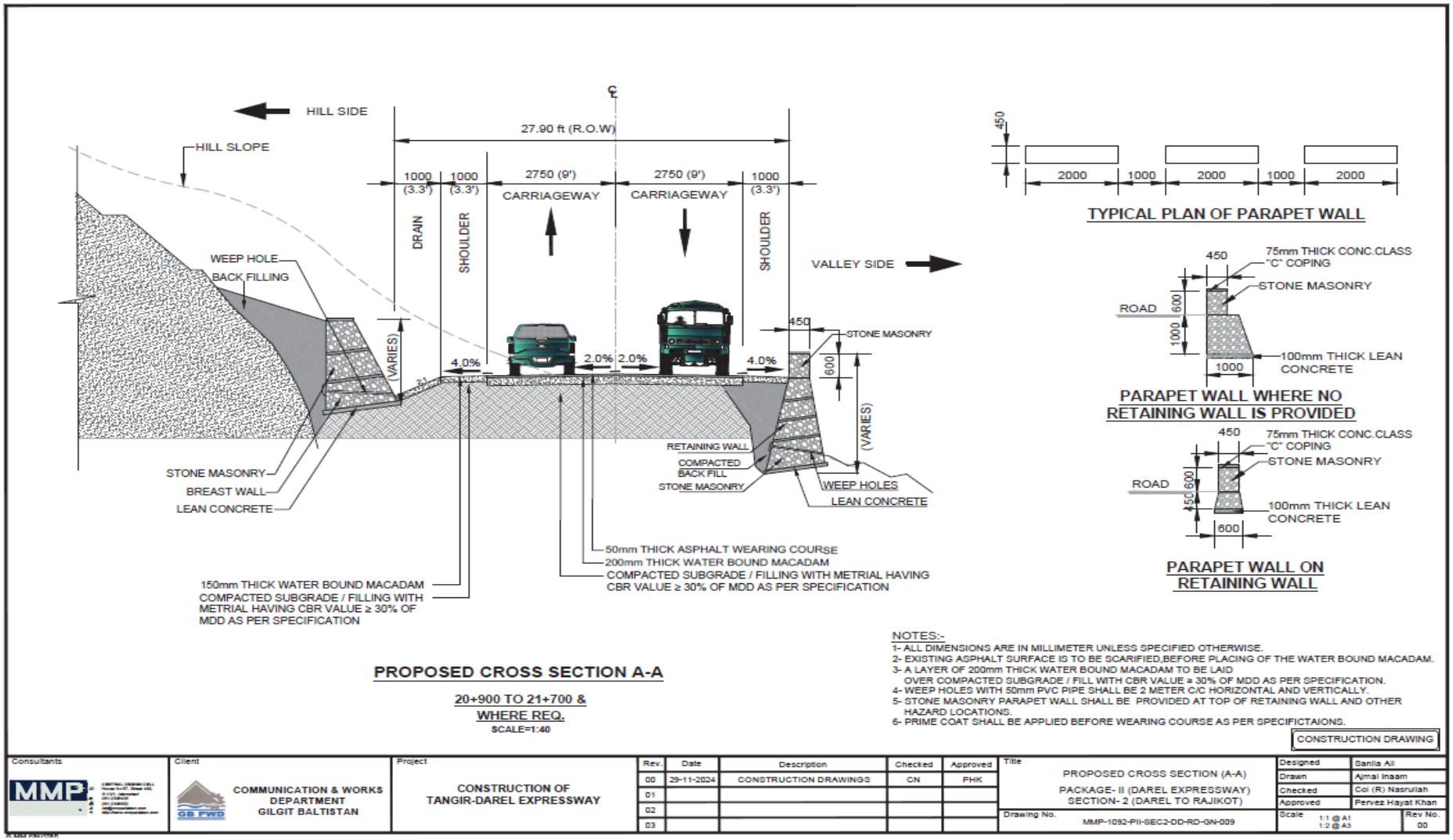


Figure 2-5: Typical Cross-section of Darel Expressway (Package -II Section-2)

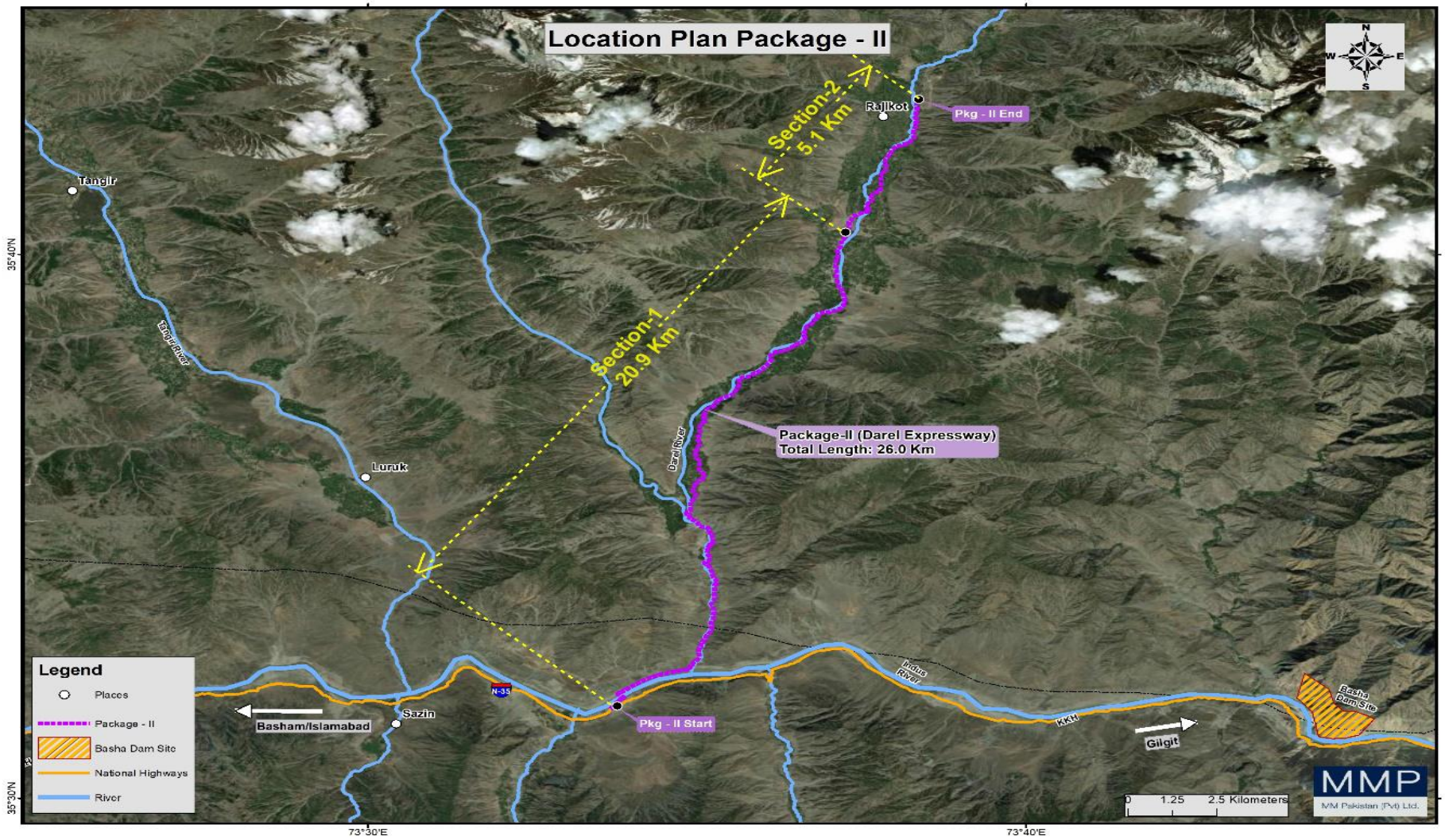


Figure 2-6: Location Plan Package – II (Sections 1 and 2)

2.9 Construction Works Arrangements

2.9.1 Machinery to be used

Major machinery and equipment expected to be used during construction are:

1)	Loader	2)	Bulldozer
3)	Graders	4)	Water Bowser
5)	Combination Rollers	6)	Dumper Truck
7)	Concrete Mixer	8)	Concrete Batching Plant
9)	Concrete Pump	10)	Transit Mixers
11)	Air Compressor	12)	Power Broomer
13)	Bitumen Distributor	14)	Asphalt Plant
15)	Asphalt Pavers	16)	Tendon Roller
17)	Pneumatic Tyre Roller		

2.9.2 Work base and Camp Site

The camp site location will be decided by the contractor and will be bound to establish camp site at an appropriate place keeping in view the minimum disturbance to the local residences, it is recommended to fix camp at 500 meters away from the population along the roadside.

2.9.3 Supply of Labor

The contractor should be bound to hire maximum local people except for those jobs where the local expertise is not available or not willing to work. All the labor wages must be according to the prevailing labor law.

2.9.4 Security Arrangements

Coordination with security agencies is important and necessary security staff need to be in place at the camp site, material stores, equipment yards and other sensitive points.

2.9.5 Health Care

Since, there would a large number of workers and employees at the project therefore, small accidents and other health issues are expected which needs to be taken care. A first aid treatment facility will be established by the contractor while major cases will be shifted to the nearest basic health unit or district hospital in both the districts.

2.9.6 Work Uniform and Health Safety Equipment

Road construction is a special job and the labor working on such work requires special protective uniforms and special Environmental, Health, and Safety (EHS) measures. It will be ensured that the labor engaged in breaking of stones, handling bricks, mixing concrete or mixing and laying asphalt will have long safety boots, overall dresses, goggles and safety helmets. As an overall EHS measure anyone going into the construction area will also wear safety hat and safety boots. The training on basic

First Aid will be provided to the workers in order to help the onsite injuries. Work safety measures and good workmanship practices are to be followed by the contractor to ensure no health risks for laborers. Personal Protective Equipment (PPEs) will be provided to the workers operating in the vicinity of high-risk area. Provision will be made for adequate sanitation, washing, cooking and dormitory facilities including light up to satisfaction. The contractor will ensure the use of wearing these protective clothing during work activities.

2.9.7 Signage and Diversion Roads

During execution on construction site in particular and on the entire road length in general, suitable signboards and traffic signs will be displayed at all along the length of the project road. This will help in forestalling any possible accidents. During the construction or where the construction will under process the diversion paths will also be provided, if required, for continuous flow of the traffic.

2.10 Traffic Count Survey

2.10.1 Existing Trend

The Consultant conducted 12 hrs. / 7 days classified and directional traffic count surveys to ascertain the existing trend and estimate the projected traffic volume expected to use the proposed facilities. The Annual Average Daily Traffic (AADT) for base year (2023) as estimated from survey results is presented in **Table 2-2**. The table also illustrates directional distribution of traffic in AADT along with percentage of each vehicular composition in traffic mix.

Table 2-2: Annual Average Daily Traffic on Project Roads for Base Year (2023)

Description	Vehicle Classification														Total	Directional Distribution (%age)
	Animal Drawn	Bicycle	Motor cycle/ Scooters	Rickshaw / Qinggi	Car / Jeep / Pajero	Passenger Vans / Hiace /	Mazda / Coaster / Minibus	1-Large Bus	2- Axle Truck	3-Axle Truck	4- Axle Truck	5- Axle Truck	6- Axle Truck	Others		
PACKAGE I																
Towards KKH	0	0	348	8	371	278	222	1	148	0	0	0	0	324	1700	50.42
Towards Tangir	4	0	318	8	354	278	227	4	135	0	0	0	0	343	1671	49.58
Total Traffic	4	0	666	16	725	556	449	5	283	0	0	0	0	667	3371	
%age of Vehicular Composition	0.12	0	19.73	0.50	21.50	16.52	13.31	0.16	8.41	0	0	0	0	19.7		
PACKAGE II																
Towards KKH	0	0	198	11	200	162	165	5	5	0	0	0	0	189	935	56.15
Towards Darel	0	0	145	4	168	122	147	0	0	0	0	0	0	144	730	43.85
Total Traffic	0	0	343	15	368	284	312	5	5	0	0	0	0	333	1665	
%age of Vehicular Composition	0	0	20.63	0.88	22.15	17.03	18.74	0.32	0.32	0	0	0	0	19.9		

2.10.2 Future Projection

The construction of project roads is expected to be completed in 3 years and the facilities will be opened for traffic in 2028. After construction of project roads, it is anticipated that 10% additional vehicular traffic will be generated. Additionally, being important route in the project area, it is expected that Package I and Package II will facilitate 3 Axle trucks too after widening and up-gradation as per international standards. The percentage of 3 Axle trucks are estimated using NTRC Axle Load Study 2020. The annual average daily motorized traffic has been projected up to the year 2046 i.e., 20 years from 2026. Assuming Growth Rate Factor of 3%, the projected traffic up to the year is presented in **Table 2-3**.

Table 2-3: Projected Traffic Volume up to 30 years on Project Roads

Years	Vehicle Classification												Total
	Motor cycle / Scooters	Rickshaw / Qinggi	Car/ Jeep / Pajero / 4WD/ Taxi	Passenger Vans / Hiace/ Pickups	Mazda / Minibus	Large Bus	2- Axle Truck	3-Axle Truck	4- Axle Truck	5- Axle Truck	6- Axle Truck	Others	
PACKAGE I													
2026	801	19	871	668	540	6	340	266	0	0	0	802	4313
2036	1077	29	1170	898	726	6	457	357	0	0	0	1079	5799
2046	1446	39	1571	1206	976	6	614	480	0	0	0	1448	7786
PACKAGE II													
2026	412	18	442	342	375	6	6	5	0	0	0	400	2006
2036	554	28	593	460	504	6	6	5	0	0	0	538	2694
2046	745	38	797	620	679	6	6	5	0	0	0	723	3619

2.10.3 Level of Service

The capacity analysis which is based on Highway Capacity Manual (HCM 2000) of American Transport Research Board has been carried out in context of project facilities. According to analysis, road facilities envisaged for construction under the project will match demand at different levels of service in years ahead as per following details **Table 2-4**.

Table 2-4: Level of Service of Project Roads

Year	LOS
PACKAGE I	
2026-2030	B
2031-2046	C
PACKAGE II	
2026-2046	A

2.11 Project Cost

The project cost is estimated as Pk R. **6,030.729** Million details as under:

Item	Description	PKR Million
1	Road Work	2,819.232

Item	Description	PKR Million
2	Retaining & Breast Walls	185.207
3	Culverts	571.872
4	Side Drains	681.584
5	Bridge Works	203.785
	Total Construction Cost:	**4,461.679**
6	Commercial Land Including 15% Compulsory Charge	121.440
7	Agricultural / Cultivated Land	367.480
8	Uncultivated Land	176.880
9	Damages of Structures	120.224
10	Cutting Charges of Trees	8.064
11	Barren / Rock Land	30.475
	Total Land Acquisition Cost:	**824.563**
12	PMU Charges	247.657
13	Contingencies @ 2% of Total Construction Cost	89.234
14	Escalation Cost @ 6.5% for 2nd Year	145.005
15	Design Fee Charges & Construction Supervision	257.651
16	Shifting of Utilities	4.940
	Grand Total:	**6,030.729**

2.12 Economic Viability

Economic viability of the project has been established by showing its profitability in terms of excess of benefits to the economy over economic costs by using the discounted cash flow technique. The projected stream of economic benefits over the economic life of the project has been compared Following are the results of the Economic Analysis:

- B/C Ratio = 2.41:1
- EIRR = 28.40%
- NPV = 4,294.78 million

3 Analysis of Alternatives

3.1 Overview

Analysis of alternatives in an EIA is very important and it takes into account practicable strategies that can advance the elimination or minimize negative environmental and social impacts if identified. The main purpose of the Alternatives Analysis is to compare feasible alternatives to the proposed project and its components including without project scenario. Since the major aim of this report is identification of major impacts regarding all aspects of the projects, the findings can be utilized for analysis of all possible options for final development. The Project passes through mixed land uses, agricultural land, hilly and bed of Nullahs. Efforts have been made using all appropriate and available options of engineering design in identifying the road alignment to minimize the resettlement impacts. This chapter presents the analysis of various alternatives considered during planning and design of the Tangir and Darel Expressways.

3.2 Project Alternatives

The following alternatives have been identified for the project:

I. No project option.

II. Construction of New roads on new alignment.

III. Project roads to follow the existing route.

An analysis of all above alternatives is as follows:

3.2.1 Option I: No Project Option

The “No project option” considers continuation of utilizing existing road and no further development would be done. It reflects no apparent change to the physical, cultural and social environment. The present Tangir and Darel roads are single lane and in very poor condition, which makes the track risky for people and vehicles as well. In do nothing case, the bottleneck in terms of existing dilapidated pavement condition, drainage, and traffic congestion due to narrow Tangir and Darel roads width and bridges would continue to impede vehicle flow/movement, causing significant delays in journey time and rise in environmental pollution. Besides, road safety would continue to be compromised due to existing sharp curves/bends, deteriorated slope protection structure /retaining walls, and occurrence of landslides etc. It is therefore planned to undertake improvement and widening of the Tangir and Darel roads project. No project option may result in difficulties in connecting two districts with a short time and safe travel. The existing Tangir and Darel roads will cause degradation of air, dust and noise pollution due to unpaved shoulders, bumpy road and deteriorated road conditions etc. The deplorable conditions of road will result in wear and tear of vehicle and increased probability of accidents.

Due to the hilly terrain, approach to the main cities of GB and Pakistan by nearby villages will remain difficult and access to better educational and health facilities will also remain limited. In case of emergencies, rescue services will also not reach easily to the affected areas or safe areas if needs evacuation. Improvement in tourism, trade and development will also remain slow. The existing tracks comprise of steep curvatures, a situation that poses travel hazards for traffic using this track. Continued use of the existing road section would not only mean an increase in travel risks but will also result in higher transportation costs and more travel time. Additionally, the maintenance costs due to wear and tear on vehicle that would occur due to travel on depreciated road conditions. The “No Project’’ option

would result in lack of efficient transportation, discourage local trade and tourism that is requisite for economic development and growth for the vicinity as well as in entire Tangir and Darel valleys. Hence, no project option will further deteriorate the condition and people of the area will continue to suffer socially, economically and environmentally.

Conclusion

For the No-project option, the analysis reveals that the weaknesses and threats far outweigh the potential strengths and opportunities. Therefore, the “No project option” is not recommended.

3.2.2 Option II: Construction of New Expressways on new alignment

Hilly and mountainous areas have several features which complicate the construction of roads and the operation of vehicles; they include:

(1) High gradients;

(2) Sharp curves;

(3) High elevation differences; and

(4) Differential climatic conditions.

Building new roads on new alignment are very expensive due to exceedingly difficult mountainous terrain and severe weather conditions prevailing in the project area. This option involves not only colossal amount of money but also an exorbitant amount of time, thus rendering it a highly unlikely alternative, thus this option is not considered.

3.2.3 Option III: Expressways to follow the existing routes

This option envisioned construction of Tangir and Darel Expressways with widening/upgradation and realignment of present roads at some locations including bridges of medium to short span and other aligned structures like culverts, side drains, retaining and breast walls etc. This option is adopted considering relatively less expensive because of less amount required for construction of roads and less amount required for land acquisition, having less environmental and social impacts and less time required to complete the project.

This option will allow the tourists to explore new areas in Tangir and Darel valleys which is full of natural beauty. It will provide the communication links between inhabitants of Tangir and Darel and will directly help in enriching the cultures. This option will provide access to dozens of villages to main cities which will help in improving the educational and health facilities available in the cities. These villages will also be able to avail better business opportunities improving trade and development, as well as, farmers can easily transport their products to other cities. There will be enhanced productivity, reduced travel times, less stress to road users and reduced transport costs. The cost of the project will be very less because Tangir and Darel roads already exist.

Conclusion

This alternative is envisaged to be most environmentally, socially and economically viable as it provides a safe and short distance travel between Tangir, Darel and Baltistan on less cost. Construction of these roads will bring prosperity in the area making it feasible for fast and safe trade, attacking millions of tourists every year, and being most feasible for construction.

3.3 Selected Option

After analyzing all the considered alternatives, the most environmentally sound, socially acceptable and economically beneficial alternative considered is Option-III (Construction of Tangir and Darel Expressway on existing routes) as it involves lesser land acquisition, weather wise suitable, short and safe travel distance, and connecting area with Karakoram Highway (N35). Therefore, Option III is considered as most feasible therefore recommended for construction.

4 Policy, Legal & Administrative Framework

4.1 General

This section deals with the relevant policies, legal and administrative frameworks instituted by the Government of Gilgit Baltistan for the protection of environment. All the relevant provisions of legal frameworks have been duly considered in this impacts assessment study. In addition to this, the roles and responsibilities of the proponent as well as the Gilgit- Baltistan Environmental Protection Agency (GB-EPA) have been mentioned in this section.

4.2 Existing Legislative Framework

Government of Gilgit-Baltistan have promulgated laws/ acts, regulations and standards for the protection, conservation, rehabilitation and improvement of the environment. Gilgit Baltistan assembly under Schedule 4 of "Gilgit-Baltistan (Empowerment and Self- Governance) Order 2009" can make laws under 18th amendment made in the constitution of Islamic Republic of Pakistan. Gilgit Baltistan has its own Environmental Protection Agency (GB-EPA), who is the responsible authority for policy making on environmental protection according to the GB-Environmental Protection Act, 2014. Following are the excerpts of the laws and procedures relevant to the proposed project as enacted/adopted by the Government of GB.

4.3 Policy Framework

The Federal Ministry of Climate Change and Environmental Coordination (MoCC & EC) has been devolved under 18th amendment in the constitution of Islamic Republic of Pakistan. The provinces were enabled to legislate on the subject of environment, therefore Gilgit Baltistan assembly under schedule 4 of "Gilgit- Baltistan (Empowerment and Self-Governance) Order 2009" can make laws on the list of subjects provided in it. In that context, Gilgit Baltistan has its own Environmental Protection Act (2014) and hence the Gilgit Baltistan Environmental Protection Agency (GB-EPA) is the responsible authority for policy making on environmental protection in Gilgit Baltistan. The proposed project will be financed by Govt. of GB which requires compliance to the Environmental Policy and Guidelines, so it is obligatory on the part of the proponent to follow these for environmental assessment.

4.4 Pakistan's Environment Regulatory Authorities

The Pakistan Environmental Protection Ordinance (PEPO 1983) was the first legislation designed specifically for the protection of the environment in the country. The promulgation of this ordinance was followed, in 1984 by the creation of Pakistan Environmental Protection Council (PEPC) headed by the Chief Executive of the country as the highest inter-ministerial and multi-stake holder decision making body and establishment of the Pakistan Environmental Protection Agency (Pak-EPA), the federal level government institution dealing with environmental issues. At national level the MoCC & EC is responsible for policy making and planning in respect of environmental aspects.

4.4.1 Pakistan Environmental Protection Council (PEPC)

PEPC is the highest inter-ministerial statuary body in the country headed by Chief Executive for formulation of national environmental policy, enforcement of PEPA 1997, approval of the NEQS, incorporation of environmental considerations into national development plans and policies and to provide guidelines for the protection and conservation of biodiversity in general and for the conservation of renewable and non-renewable resources.

4.4.2 Ministry of Climate Change and Environmental Coordination (MoCC & EC)

Headed by a federal minister it is the main federal level government organization responsible for protection of environment and resource conservation in the country. The Ministry works in collaboration with the Pakistan Environment Protection Council (PEPC), federal EPA and provincial Environment Protection Agencies (EPAs).

4.4.3 Pakistan Environmental Protection Agency (Pak-EPA):

Pak-EPA is headed by a Director General and has wide ranging functions as given in PEPA 1997. These include preparation and co-ordination of national environmental policy for approval by PEPC, administering and implementing PEPA 1997 and preparation, revision or establishment of NEQS. The Pak-EPA had issued a regulation regarding the environmental assessment procedures in known as Review of IEE and EIA Regulations, 2000 to give firm legal status to the IEE and EIA. The jurisdiction of PAK-EPA is applicable to the projects as under;

- On federal land;
- Military projects;
- Involving trans-country impacts; and
- Bearing trans-province impacts.

4.4.4 Provincial Level Institutions

Each provincial government of Pakistan has its own provincial EPAs/EPDs, which are the provincial level counterparts of the Pak-EPA. The Provincial EPAs are formed by the respective provincial governments headed by a Director General who exercises powers delegated to him by the concerned provincial government. A separate EPA for Gilgit-Baltistan at Gilgit has also been established and GB-EPA has recently got its notified review of IEE and EIA Regulation, 2024 approved by Gilgit-Biltistan Cabinet. This EIA Report has been drafted under the said regulations and submitted to Gilgit-Baltistan EPA for approval.

4.5 The Pakistan National Conservation Strategy (NCS)

The Pakistan NCS is the principal policy document for environmental issues in the country that was developed and approved by the Government of Pakistan on March 01, 1992. The NCS works on a ten-year planning and implementation cycle. It deals with fourteen (14) core areas, which are listed hereunder:

i. maintaining soils in cropland;
ii. increasing irrigation efficiency;
iii. protecting watersheds;
iv. supporting forestry and plantations;
v. restoring rangelands and improving livestock;
vi. protecting water bodies and sustaining fisheries;
vii. conserving biodiversity;
viii. increasing energy efficiency;
ix. developing and deploying material and energy renewables;

x. preventing/abating pollution;
xi. managing urban wastes;
xii. supporting institutions for common resources;
xiii. integrating population and environmental programs; and
xiv. Preserving the cultural heritage.

4.6 Environmental Legislation

4.6.1 Gilgit-Baltistan Environmental Protection Act, 2014

This Act was enacted in 2014, by repealing the Pakistan Environmental Protection Act (1997). It provides the framework for establishment of the Gilgit Baltistan Environmental Protection Council, establishment of Gilgit-Baltistan Environmental Protection Agency, Establishment of the Gilgit- Baltistan Sustainable Development Fund, Protection and Conservation of Species, Conservation of Renewable Resources, Establishment of Environmental Courts and Green Courts, Initial Environmental Examination (IEE), and Environmental Impact Assessment (EIA) studies. Section 16 of the Act stresses the need to carry out environmental impact assessment study prior to construction or operation of any project enlisted under Schedule I and II of GB-Environmental Protection Act, 2014.

This EIA study has been carried out in the light of policy guidelines of the Preparation of IEE/EIA Reports under the procedures and practices formulated by the Pak EPA/GB-EPA. The major provisions/clauses of this Act are similar to that of Pakistan Environmental Protection Act, 1997. Minor amendments/changes have been made via:

- The Name of Act has been changed into “Gilgit-Baltistan Environmental Protection Act, 2014”.
- For the words “Federal Government”, wherever occur, the word “Government” shall be substituted indicating the Government of Gilgit-Baltistan;
- For the word “Council”, wherever occurs, the Gilgit-Baltistan
- Environmental Protection Council shall be referred to all the other clauses, sub-clauses, sections and sub-sections are almost same. In accordance with the regulations of Review of IEE/ EIA 2024, an EIA for the proposed project needs to be submitted to Gilgit- Baltistan Environmental Protection Agency for review and approval.

4.6.2 Gilgit-Baltistan, IEE and EIA Regulations 2024

The Gilgit-Baltistan Environmental Protection Agency (GB-EPA) has approved the regulations during 2024 for “Review of IEE and EIA”. These regulations categorize development projects for IEE and EIA into three schedules, Schedules I and II and III. Projects are classified on the basis of expected degree and magnitude of environmental impacts and are included in different schedules. The projects listed in Schedule-I include those where the range of environmental issues is comparatively narrow and the issues can be understood and managed through less extensive analysis. Schedule-I projects require an IEE to be conducted, rather than a full-fledged EIA, provided that the project is not located in an environmentally sensitive area. The projects listed in Schedule-II are generally major projects and have the potential to affect a large number of people in addition to significant adverse environmental impacts. The impacts of projects included in Schedule-II may be irreversible and could lead to significant changes in land use and the social, physical and biological environment. EIA preparation and approval process in Gilgit-Baltistan is given in **Figure 4-1**

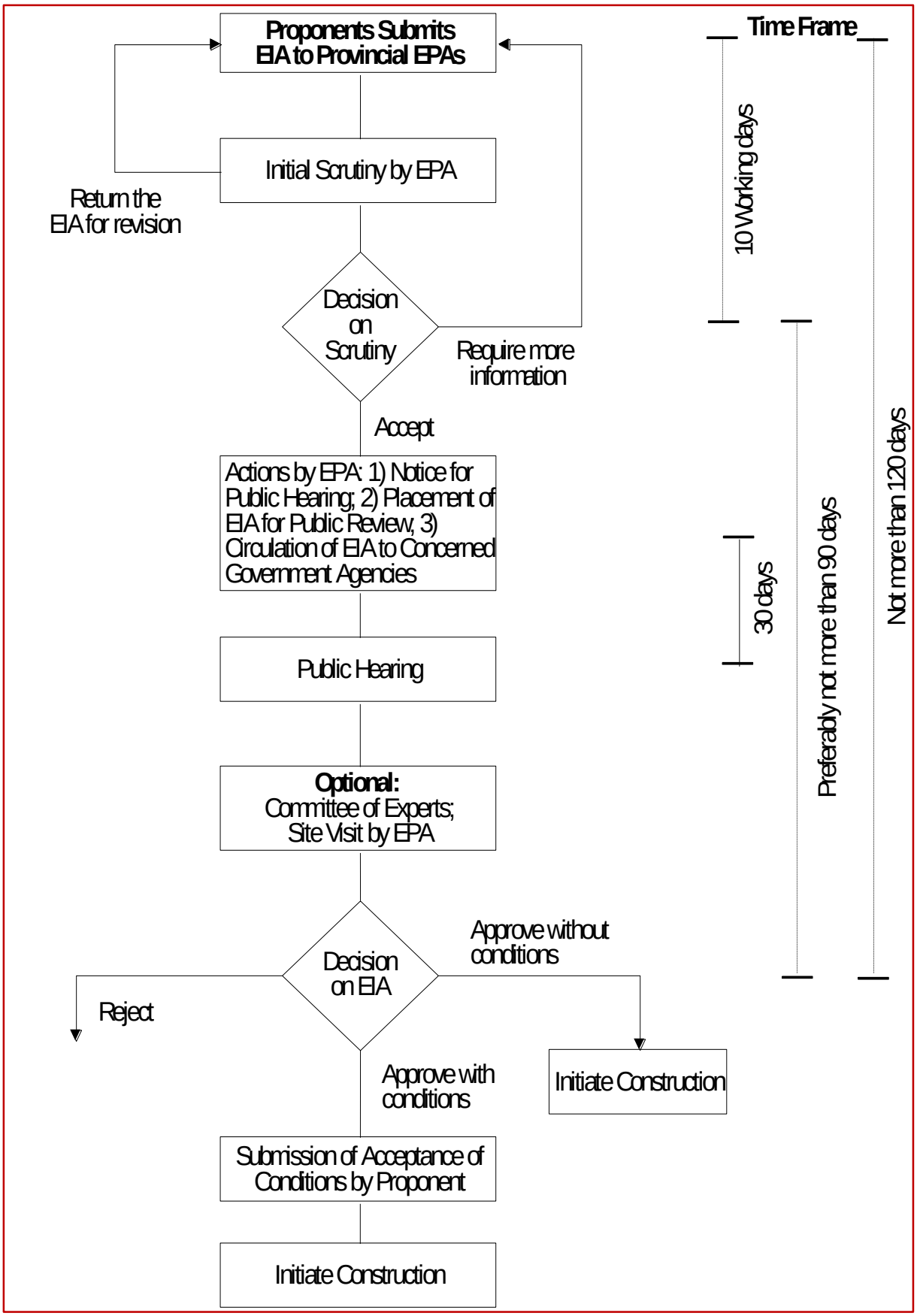


Figure 4-1: EIA Process in Gilgit-Baltistan

4.7 National Environmental Quality Standards (NEQS), 2000/ 2010

The Pakistan Environmental Protection Council first approved the National Environmental Quality Standards (NEQS) in 1993. The NEQS have been revised later for discharges of municipal and industrial effluent parameters and industrial gaseous emissions in order to control environmental pollution. The same NEQS were followed by the GB-EPA (**Annexure I**).

4.7.1 Drinking Water Quality Standards

In pursuance of the statutory requirement under clause (c) of sub-section (1) of section (6) of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency with prior approval of the Pakistan Environmental Protection Council, has published the National Standards for Drinking Water Quality in 2010. WHO Drinking water quality guidelines and USEPA standards are being used for bench marking purpose along with the National Standards for Drinking water quality since January, 2013.

4.7.2 Air Quality Standards

In pursuance of the statutory requirement under clause (e) of sub-section (1) of section (6) of the Pakistan Environmental Protection Act, 1997(XXXIV of 1997), the Pakistan Environmental Protection Agency with prior approval of the Pakistan Environmental Protection Council, has revised the NEQS for Ambient Air in 2010, which became effective in January, 2013.

4.7.3 Noise Quality Standards

In pursuance of the statutory requirement under clause (c) of sub-section (1) of section (6) of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency with prior approval of the Pakistan Environmental Protection Council, has revised the NEQS for Noise in 2010. These standards have been established for four different categories which include residential area, commercial area, industrial area and silent zone. These standards vary according to the day and night timing, day time hours are 6:00 am to 10:00 pm and night time hours are 10:00 pm to 6:00 am. USEPA standards and World Bank guidelines along with National Environmental Quality Standards for Noise are being used as bench mark purpose since January, 2012.

4.8 Other Relevant Laws

4.8.1 Pakistan Environmental Protection Ordinance, 1983

Pakistan Environmental Protection Ordinance, 1983 was the first piece of legislation designed specifically for the protection of the environment. In 1984, the promulgation of this ordinance was followed by the establishment of the Federal EPA, the primary government institution dealing with environmental issues. Provincial EPAs were also established at about the same time. According to PEPO, 1983, IEE / EIA for all development projects were essentially required, but could not be undertaken in the absence of relevant regulations under that ordinance.

4.8.2 Pakistan Penal Code, 1860

This defines the penalties for violations concerning pollution of air, water bodies and land. Protection of the environment with regards to toxic and hazardous waste is also covered by the Pakistan Penal Code (PPC), 1860. GB-EPA is mandated to monitor the transportation of hazardous materials within the prescribed limits.

4.8.3 The Explosives Act, 1884

It provides regulations for handling, transportation and use of explosives. The contractors have to abide by the regulation during quarrying and blasting for construction and for other purposes.

4.8.4 Land acquisition Act, 1894

At present, the only legislation relating to acquisition and compensation of private land for public purpose is the Land Acquisition Act (LAA) of 1894. The LAA is, however, limited to a cash compensation policy for the acquisition of land and built-up property, and damage to other assets, such as crops, trees, and infrastructure. The LAA does not consider the rehabilitation and resettlement of non-titled populations. Section 4 to 12 of Land Acquisition Act, 1894 deal with the procedure of making an award i.e. amount of compensation. The key clauses of the Act are summarized in **Table 4-1**.

Table 4-1: The Key Clauses of Land acquisition Act

LAA Section	Description
Section 4	Publication of preliminary notification and power for conducting survey.
Section 5	Formal notification of land needed for a public purpose. Section 5a covering the need for enquiry of the concerns or grievances of the affected people related to land prices.
Section 6	The Government makes a more formal declaration of intent to acquire land.
Section 7	The Land Commissioner shall direct the Land Acquisition Collector (LAC) to take order the acquisition of the land.
Section 8	The LAC has then to direct that the land acquired to be physically marked out, measured and planned.
Section 9	The LAC gives notice to all project-affected persons (PAPs) that the Government intends to take possession of the land and if they have any claims for compensation then these claims are to be made to him at an appointed time.
Section 10	Delegates power to the LAC to record statements of the PAPs in the area of land to be acquired or any part thereof as co-proprietor, sub-proprietor, mortgage, and tenant or otherwise.
Section 11	Enables the Collector to make enquiries into the measurements, value and claim and then to issue the final “award”. The award includes the land’s marked area and the valuation of compensation.
Section 11 A	Enables the Collector to acquire land through private negotiations upon request of Head of the acquiring department. Upon receipt of any such request the collector is empowered to constitute/notify a committee for assessment of market value of land and verification of title of ownership. On agreement by Head of Acquiring Department, with negotiated market value determined by the committee, the collector shall then direct parties to execute sale deed in favor of acquiring department on stamp paper.
Section 11 B	Provides time limit of six months to complete land acquisition process from the date of notification under Section-4.
Section 16	When the LAC has made an award under Section 11, he will then take possession and the land shall thereupon vest absolutely in the Government, free from all encumbrances.
Section 17	Special powers in cases of urgency.
Section 18	In case of dissatisfaction with the award, PAPs may request the LAC to refer the case onward to the court for a decision. This does not affect the Government taking possession of land.
Section 23	The award of compensation to the title holders for acquired land is determined at: i) its market value of land, ii) loss of standing crops, trees and structures, iii) any damage sustained at the time of possession, iv) injurious affect to other property (moveable or immoveable) or his earnings, v) expanses incidental to compelled relocation of the residence or business and vi diminution of the profits between the time of publication of Section 6 and the time of taking possession plus 15% premium in view of the compulsory nature of the acquisition for public purposes.
Section 28	Relates to the determination of compensation values and interest premium for land acquisition.

LAA Section	Description
Section 31	Section 31 provides that the LAC can, instead of awarding cash compensation in respect of any land, make any arrangement with a person having an interest in such land, including the grant of other lands in exchange.
Section 48A (LAA-1986)	If within a period of one year from the date of publication of declaration under section 6 in respect of any land, the Collector has not made an award under section 11 in respect to such land, the owner of the land shall, unless he has been to a material extent responsible for the delay be entitled to receive compensation for the damage suffered by him in consequence of the delay.

4.8.5 National Environment Policy, 2005

The National Environment Policy provides an overarching framework for addressing the environmental issues facing- Pakistan, particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification, natural disasters and climate change. It also gives directions for addressing the cross sectoral issues as well as the underlying causes of environmental degradation and meeting international obligations.

The National Environment Policy, while recognizing the goals and objectives of the National Conservation Strategy, National Environmental Action Plan and other existing environment related national policies, strategies and action plans, provides broad guidelines to the Federal Government, Provincial Governments, Federally Administrated Territories and Local Governments for addressing environmental concerns and ensuring effective management of their environmental resources. The Provincial, AJK, Gilgit Baltistan and Local, Governments, however, may devise their own strategies, plans and programs in pursuit of this Policy.

4.8.6 National Drinking Water Policy, 2009

The Policy aims to improve the quality of life of the people of Pakistan by reducing the incidence of death and illness caused by water-borne diseases. Toward this end, the Policy provides specific guidelines for increasing access to safe drinking water, protection and conservation of surface and groundwater resources, water treatment and safety, appropriate technologies and standardization, community participation, public awareness, capacity development, public-private partnership, research and development, emergency preparedness and response and coordinated planning and implementation.

The Policy places special emphasis on establishment of new drinking water systems, rehabilitation and up-gradation of existing water supply systems, sustainability of water supply infrastructure, water conservation, water quality improvement, water treatment and drinking water sector management information system. The Policy also suggests various legislative measures to ensure its effective implementation, including enforcement of the National Drinking Water Quality Standards. It stipulates that the respective tiers of the government will devise strategies and action plans in pursuit of the Policy.

Drinking water, as referred to in the Policy, means that the water used for domestic purposes including drinking, cooking, hygiene and other domestic uses. The term “safe water” refers to the water complying with National Drinking Water Quality Standards. Access means that at least 45 and 120 liters per capita per day of drinking water is available for rural and urban areas, respectively, within the house or at such a distance that the total time required for reaching the water source, collecting water and returning to home is not more than 30 minutes.

4.8.7 Pakistan Occupational Health and Safety Act, 2018

An act to ensure safe and healthy working conditions for the people at work; by authorizing enforcement of the rules and regulations developed under the Act; by assisting and encouraging the organizations, institutions and geographic areas governed by the federal government in their efforts to ensure healthy and safe working conditions; by providing for research, information, education, and training in the field of occupational health and safety.

The main objective of this Act is to provide for a balanced and nationally consistent framework to secure the health and safety of workers and workplaces by:

1. protecting workers and other persons against harm to their health, safety and welfare through the elimination or minimization of risks arising from work or from specified types of substances or plant; and

2. Providing for fair and effective workplace representation, consultation, Co-operation and issue resolution in relation to work health and safety; and

3. encouraging unions and employer organizations to take a constructive role in promoting improvements in health and safety practices at work and assisting persons conducting businesses or undertakings and workers to achieve a healthier and safer working environment; and

4. Promoting the provision of advice, information, education and training in relation to work health and safety; and

5. Securing compliance with this Act through effective and appropriate compliance and enforcement measures; and

6. Ensuring appropriate scrutiny and review of actions taken by persons exercising powers and performing functions under this Act; and

7. Providing a framework for continuous improvement and progressively higher standards of health and safety at work and

8. Maintaining and strengthening the national harmonization of laws relating to work health and safety and to facilitate a consistent national approach to work health and safety in this jurisdiction.

4.8.8 Hazardous Occupation Rules, 1963

With reference to the Government of West Pakistan Notification No.125 (L-II)/63, dated the 10th August, 1963, appearing in the extraordinary issue of the Gazette of West Pakistan of 12th September, 1963, the Governor of West Pakistan in exercise of the powers conferred under sub-section (4) of section 33 of the Factories Act, 1934 (XXV of 1934) and in supersession of: -

1) The Hazardous Occupations (Lead) Rules, 1937;
2) The Hazardous Occupations (Miscellaneous) Rules, 1937;
3) The Hazardous Occupations (Aerated Waters) Rules, 1937;
4) The Hazardous Occupations (Chromium) Rules, 1937;
5) The Hazardous Occupations (Cellulose Spraying). Rules, 1937; and

6) The Hazardous Occupations (Sand Blasting) Rules, 1937.
Some of the features of the rules are presented as under;

When an Inspector of Factories suspects that any substance used or intended for use in any factory contains a lead compound, he may at any time take for analysis sufficient samples of that substance: Provided that the manager of the factory may at the time when a sample is taken and on providing the necessary appliances, require the Inspector to divide the sample into two parts and to make and seal and deliver to him on such part.

No woman, adolescent or child shall be employed in any factory in any of the operations specified in the Schedule.

No person shall be employed in any factory for mere than fifteen days in the year in any of the operations specified in the Schedule unless a certificate of fitness in the form appended to these rules granted to him by a certifying surgeon is in the custody of the manager of the factory. (2) The Chief Inspector may 3require that any person granted a certificate under sub-rule (1) shall carry with him while at work, a token giving reference to such certificate. (3) Every person employed on any of the process mentioned in the Schedule shall be re-examined by a certifying surgeon once a month or at such shorter or longer intervals as may be specified in writing by the Chief Inspector of Factories according to the degree of risk of lead poisoning involved in any process. This examination shall include examination for typical fascial pallor, blood hemoglobin concentration, punctuate basophilia and where necessary laboratory facilities are available, blood and urinary coproporphyrins in addition to loading for other signs and symptoms of lead poisoning.

4.8.9 Highway Safety Ordinance, 2000

An Ordinance to provide for safe driving on the national highways. Whereas, it is expedient to provide for safe driving on the national highways and for matters connected therewith or incidental thereto; and Whereas, the National Assembly and the Senate stand suspended in pursuance of the Proclamation of Emergency of the fourteenth day of October, 1999, and the Provisional Constitution Order No. 1 of 1999; and whereas, the President is satisfied that circumstances exist which render it necessary to take immediate action; Now Therefore, in pursuance of the Proclamation of Emergency of the fourteenth day of October, 1999, and Provisional Constitution Order No. 1 of 1999, as well as order No. 9 of 1999, and in exercise of all powers enabling him in that behalf, the President of the Islamic Republic of Pakistan is pleased to make and promulgate the Ordinance :

4.8.10 Ramsar Convention

The Ramsar Convention, officially known as the Convention on Wetlands, is an international treaty for the conservation and sustainable use of wetlands. It was adopted in Ramsar, Iran, in 1971 and came into force in 1975. It's considered the only international mechanism for protecting sites of global importance related to wetlands. The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world". Wetlands are among the most diverse and productive ecosystems. They provide essential services and supply all our fresh water. However, they continue to be degraded and converted to other uses.

The Convention uses a broad definition of wetlands. It includes all lakes and rivers, underground aquifers, swamps and marshes, wet grasslands, peatlands, oases, estuaries, deltas and tidal flats,

mangroves and other coastal areas, coral reefs, and all human-made sites such as fish ponds, rice paddies, reservoirs and salt pans.

Under the “three pillars” of the Convention, the Contracting Parties commit to:

- Work towards the wise use of all their wetlands;
- designate suitable wetlands for the list of Wetlands of International Importance (the “Ramsar List”) and ensure their effective management;
- cooperate internationally on transboundary wetlands, shared wetland systems and shared species.

4.8.11 Convention on Conservation of Migratory Species of Wild Animals

The Convention on Migratory Species is a Multilateral Environmental Agreement (MEA), signed in 1979 and in force since 1983. It currently has 130 Parties. This treaty of the United Nations Environment Program (UNEP) aims to facilitate close cooperation on the conservation of migratory species between the countries through which these animals travel on their annual journeys. Among the species that do so and that are listed on the Convention’s Appendices are many marine mammals, marine turtles, fish and seabirds. CMS is actively engaged in many global and regional species-specific activities, but also a large range of broader environmental ocean matters such as unsustainable fishing, including bycatch, vessel collisions, ocean noise and marine pollution, including marine debris. 2. CMS Appendix I contains migratory species that are endangered throughout all or a significant portion of their range. Parties that are Range States for Appendix I species endeavor to conserve and restore habitats; to prevent, remove, compensate for or minimize, as appropriate, the adverse effects of activities or obstacles, which prevent or impede migration; and to prevent, reduce or control factors that endanger the species. Taking of specimens of Appendix I species is generally prohibited and Parties allowing exceptions must inform the Secretariat.

4.8.12 The Gilgit-Baltistan Forest Act, 2019

The Gilgit-Baltistan Forest Act, 2019 covers whole of the Gilgit-Baltistan and is applicable to all forests, including natural forests, private forests of District Diamer, planted forests, watershed areas, rangelands, wastelands, wetlands, river and stream beds, and glaciers and their biodiversity and allied resources found in forests and such lands or areas, whether government owned, community or privately owned. It also extends to trees grown under farm forestry and social forestry. The Act provides broad details about ownership of forests, forest lands, ecosystem products and services of protected forests, aims and objectives, principles, policy, strategy and institutional arrangements, organization, functions and administration, financial provisions, protected forests, village forests, private forests, regulated landscapes and reserved trees, wastelands, riverbeds and Khalisa lands, forest planning and management, forest management and multilateral environmental agreements (MEAS), participation of stakeholders and communities in forest planning and management, building forest ecosystem services and climate change mitigation, adaptation and forest carbon programs and projects, trade and traffic of forest and biodiversity products, control of timber and other forest produce in transit, sale and sawing of timber, collection of drift and stranded timber, duty and fees on timber and other forest and renewable natural resources produce, control over non-timber forest products (NTFPS) including medicinal and aromatic plants (maps), promotion of private sector, sustainable use of forest and other renewable natural resource products, in-situ conservation of forest genetic resources, ex-situ conservation of forests, forest protection and general restrictions, prevention, detection, suppression, investigation and

prosecution of offences, adjudication of forest offence cases, information gathering, surveys, monitoring and evaluation, research, training and education, powers, duties and obligations of forest officers, rights, duties and obligations of local communities, duties and obligations of other government functionaries, offences and penalties, enforcement and compliance, conservation orders, easements and incentives, offenders, dues recoverable and recovery, acquisition of land and other property and appointment of experts, general and miscellaneous provisions, repeal, savings, removal of difficulties and transitional provisions, rules making and overriding effect etc. Schedule-01 of the Act completed with a list of protected trees found in protected forests, private forests, and protected wastelands and for levy of royalty, duty and Schedule-02 contains list of threatened and endangered species available in Gilgit-Baltistan.

4.8.13 Protection of Trees and Brushwood Act, 1949

This Act prohibits cutting or lopping of trees along roads and canal planted by the Forest Department, without permission of the Forest Department.

4.8.14 Gilgit-Baltistan Customary Laws

In Gilgit-Baltistan customary laws are also practiced besides national laws. This system provides for at least one authority, chosen by the community either by nomination or election, with responsibility for managing natural resources and enforcing customary laws. This customary normative framework includes provisions for: community and individual ownership; resource use fees; and fines as penalties for violations of these laws. Most of the occupants, who claim to be the owner, do not have any written tenancy agreement. For such cases in the non-settled area, confirmation by the village Jirga's on land possession is accepted at community, court and local administration levels. Adoption of current 'Gilgit-Baltistan Neuter Rule' (1980) envisages that the occupant of land will be treated as its owner. All other land beyond the settlements, mostly barren, will belong to the Gilgit-Baltistan Administration.

4.8.15 Gilgit-Baltistan Forest Rules

As per these rules protected forests are either the property of the government or have property rights to the whole or part of the forest produce. However local people may have some concessions and user rights. They may be able to use these forests for grazing and collection of fuel wood and other non-timber products.

4.8.16 Gilgit-Baltistan Strategy for Sustainable Development

The strategy presents a vision and a strategic framework for economic, social, cultural, and ecological wellbeing of the people of Gilgit-Baltistan. It provides a road map to improve governess, integrated gender, environment and sustainability, prioritized development needs, and creation of an enabling environment by improving policies and legislation.

4.8.17 Project Implementation and Resettlement Ordinance, 2001

The government of Pakistan has proclaimed an ordinance entitled "Project Implementation and Resettlement of the affected Persons Ordinance 2001". This ordinance will be used to safeguard the interests of persons/groups involuntary resettled. This ordinance establishes that the resettlement of involuntary displaced persons is done as a matter of right and not by the way of charity and affected persons (APs) shall be accepted as a special group, who in the supreme interest of the country have accepted/undergone involuntary displacement. The proposed ordinance shall be supplementary to the LAA 1894 as well as others laws of land wherever applicable under resettlement policy.

4.8.18 Regulations of Mines and Oil Fields and Mineral Development Act, 1948

This legislation provides regulatory procedures for the quarrying and mining of construction material from state-owned as well as private land.

4.8.19 Motor Vehicle Rules, 1969

Motor Vehicle Rules 1969 (MVR 1969) define powers and responsibilities of the Motor Vehicle Examiner (MVE). The establishment of MVE inspection system is one of the regulatory measures that can tackle the ambient air quality problems associated with the vehicular emissions during operation phase.

4.8.20 Cutting of Trees (Prohibition) Act, 1975

This Act prohibits cutting or chopping of trees without permission of the Forest Department, Gilgit-Baltistan.

4.8.21 Highways Safety Ordinance, 2000

This ordinance includes provisions for the licensing and registration of vehicles and construction equipment; maintenance of road vehicles; traffic control, offences, penalties and procedures; the establishment of a police force for Motorways and National Highways charged with regulating and controlling traffic on National Highways and keeping the highways clear of encroachments.

4.8.22 The Gilgit-Baltistan Disaster Management Act, No. II of 2017

This Act has been enacted for the establishment of a Disaster Management System in Gilgit- Baltistan. The Act highlight roles and responsibilities of the concerned authorities and procedures for establishment of Disaster Management Commission, constitution of District Disaster Management Authority, measures to be adopted by the Government for Disaster Management, functions of the Local Authority, establishment of Gilgit-Baltistan Institute of Disaster Management, establishment of Gilgit-Baltistan Disaster Response Force and other requisite measures compulsory for Disaster Management matters.

4.8.23 The Gilgit-Baltistan Local Government Act, 2014

The Local Government System in Gilgit-Baltistan is based on Gilgit-Baltistan Local Government Act, 2014. This Act empowers Local Bodies to enforce laws for land use; conservation of natural vegetation; air, water, and land pollution; disposal of solid waste and wastewater effluents; and public health and safety, including some provisions for environmental protection. Section 48 of the Act pertains to environmental pollution, under which the local council(s) are authorized to prepare and implement schemes for the prevention of the pollution of air and for the prevention of pollution of water or land. The Local Councils of the project area have been consulted for their views on the project interventions, and mitigations are proposed based on their views.

4.8.24 Labor laws

Labor laws in Pakistan are governed by many legislative tools. Principal labor rights are provided by the constitution of Pakistan. In addition to constitutional rights, acts and ordinances have been enforced time to time for limiting working hours, minimum working age, and conditions of employment.

Of the 24 labor-related laws that existed in 2014 in Pakistan, those set out in Table relate directly to the International Labor Organization's (ILO's) core labor standards and will broadly be applicable to the proposed project.

Pakistan has ratified the ILO conventions for the core labor standards including:

- Freedom of association and collective bargaining (conventions 87 and 98)
- Elimination of forced and compulsory labor (conventions 29 and 105)
- Elimination of discrimination in respect of employment and occupation (conventions 100 and 111)
- Abolition of child labor (conventions 138 and 182).

Pakistan has also ratified the United Nations (UN) Convention on the Rights of the Child in 1990 but is not yet subscribed to the UN Convention of the Protection of the Rights of all Migrant Workers and Members of their Families. The related ILO law is shown in **Table 4-2**.

Table 4-2: Laws Related Directly to the ILO Core Labor Standards

Legislation / Guidelines	Brief Description
Employment of Children Act (1991)	Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines or any other hazardous employment. In accordance with this Article, the Employment of Child Act (ECA) 1991 disallows child labor in the country. The ECA defines a child to mean a person who has not completed his/her fourteenth years of age. The ECA states that no child shall be employed or permitted to work in any occupation set forth in the ECA (such as transport sector, railways, construction, and ports) or in any workshop wherein any of the processes defined in the Act is carried out. The processes defined in the Act include carpet weaving, *beeri* (type of cigarette) making, cement manufacturing, textile, construction and others).
Bonded Labor System (Abolition) Act (1995)	The Act seeks to eradicate bonded labor practices prevailing in the respective provinces. The Acts define the `Bonded Labor System' as a system of forced, or partly forced, labor under which a debtor enters, or is presumed to have entered into an agreement with the creditor to the effect that: In consideration of an advance obtained by him or by any of the members of his family (whether or not such advance is evidenced by any document) and in consideration of the interest, if any, due on such advance, or In pursuance of any customary or social obligation, or for any economic consideration received by him or by any member of his family.
Minimum Wages for Unskilled Workers Ordinances (1969)	The ordinances state that every employer shall be responsible for the payment of minimum wages required to be paid under the ordinances to all unskilled workers employed, either directly or through a EPC Contractor, in his commercial or industrial establishment: Provided that where an employer provides housing accommodation to a worker, he may deduct from the wages of such a worker, an amount not exceeding that in the ordinance; Where the employer provides a worker with transport to and from the place of work, he may deduct from the wages of such a worker an amount not exceeding that specified in the ordinance.
Industrial Relations Acts (2010)	These Acts seek to regulate formation of trade unions, regulation and improvement of relations between employers and workmen and the avoidance and settlement of any differences or disputes arising between them and ancillary matters.

4.8.25 Canal and Drainage Act, 1873

This Act entails provisions for the prevention of pollution of natural or man- made water bodies.

4.8.26 Project Implementation and Resettlement of Affected Persons Ordinance, 2000

This ordinance will be used to safeguard the interests of persons and groups involuntarily displaced from the existing places to new resettlement areas.

4.8.27 Wildlife Preservation Act 1975

The act emphasizes on the rules and regulations for the protection, preservation, conservation and management of wildlife.

4.8.28 Antiquities Act, 1975

The Antiquities Act of 1975 ensures the protection of the cultural and archeological resources of Pakistan.

The law prohibits new construction in the proximity of a protected antiquity and allows the Government of Pakistan to prohibit excavation in any area which is of archaeological significance. Under this Act, it is understood that all project proponents are obliged to:

- Ensure that no activity is undertaken in the proximity of a protected areas without permission of the competent authority; and
- In case any antiquities have been found or reported in any Project
- Area it will be the responsibility of the proponent to report to the department of Archaeology, Government of Pakistan.

4.8.29 Guidelines for Protected and Sensitive Areas

The Guidelines for Protected Areas, 1997, identify officially reported protected areas in Pakistan and provide checklists for environmental assessment procedures to be carried out inside or near such sites. Environmentally sensitive areas include, among others, archaeological sites, critical ecosystems, biosphere reserves and natural parks, and wildlife sanctuaries and preserves.

4.9 Environmental Administrative Framework

The Federal Ministry of Environment responsible for policy making on environmental protection in Pakistan was dissolved after the promulgation of 18th Amendment in the Constitution. Subsequently, the Ministry of Climate Change and Environmental Coordination (MoCC & EC) has been established and authorized under the amended Rules of Business to perform the same functions/assignment to safeguard & control environmental pollution in the country and the Provincial Governments have taken over the subject of Environment. Whereas W&C department as a proponent of this Project is under obligation to undertake EIA study carried out as per the stipulations of governing authorities and in complete conformity with national and GB regulations about environmental issues.

4.9.1 Pakistan Environmental Assessment Procedures

The Pak-EPA has published a set of environmental procedure and guidelines for carrying out environmental assessments and the environmental management of different types of development projects. The guidelines that are relevant to the concerned Project are listed below, followed by comments on their relevance to the proposed project.

4.9.2 Policy and Procedures for Filing, Review and Approval of Environmental Assessments

These guidelines define the policy context and the administrative procedures that will govern the environmental assessment process, from the project pre-feasibility stage to the approval of the environmental report.

4.9.3 Guidelines for the Preparation and Review of Environmental Reports

These Guidelines on preparation of environmental reports address project proponents, and specify:

- The nature of the information to be included in environmental reports
- The minimum qualifications of the EIA consultant
- The need to incorporate suitable mitigation measures into every stage of project implementation
- The need to specify monitoring procedures.
- The terms of reference for the reports are to be prepared by the project proponents themselves. The reports must contain baseline data on the project area, a detailed assessment thereof, and mitigation measures.

4.9.3.1 Guidelines for Public Consultation

The guidelines deal with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures the incorporation of their concerns in impact assessment

4.9.3.2 Guidelines for Sensitive and Critical Areas

The guidelines identify officially notified protected areas in Pakistan, including critical ecosystems, archaeological sites, etc., and present checklists for environmental assessment procedures to be carried out inside or near such sites. Environmentally sensitive areas include, among others, archaeological sites, biosphere reserves and natural parks, and wildlife sanctuaries and preserves.

GB-EPA has notified rules named as “Establishment of Tourist Facilities at Ecologically Sensitive and Critical Areas Rules, 2023 (ESCA, 2023)

4.9.3.3 The Solid Waste Management Policy

This policy was promulgated by PEPA in collaboration with JICA in 2000, which aims to facilitate control on waste by providing principles of good waste management and reducing waste at source. The Guidelines should be consulted during planning and designing the disposal of solid waste from contractors’ camps, offices and colonies.

4.9.4 Gilgit-Baltistan Sustainable Development Fund

Gilgit-Baltistan Sustainable Development Fund has been established following the guidelines of the GB-EPA, 2015. The fund is to be used to financially aid and support projects aimed at environmental protection, conservation, rehabilitation and improvement. It is administratively headed by the Chief Secretary as the Chairperson along with members from other relevant departments.

4.9.5 Environmental Courts

Government of GB exercises the power to formulate as many Environmental Courts as it deems fit under the GB EPA, 2015. In case of more than one Environmental Courts, it is mandatory to specify the territorial limits within which their jurisdiction falls. An Environmental Court shall consist of a Chairperson who is, or has been, or is qualified for appointment as a Judge of the Session Court to be appointed after consultation with the Chief Justice of the Chief Court and two members to be appointed by the Government, of which at least one shall be a technical member with suitable professional qualifications and experience in the environmental field as may be prescribed.

4.10 Other Provincial Departments

The key relevant departments and their roles are summarized below.

4.10.1 Department of Forest

- Preparation and implementation of policies and programs in forestry sector.
- Implementation of Forestry Laws and rules.
- Protection, conservation, development and management of renewable natural resources, particularly forests and range lands in the province.
- Sustainable management of forest for production of timber, firewood and other non-timber produce and services.
- Demarcation and protection of Forest lands against encroachment.
- Raising of nurseries and plantations.
- Provide extension services for mass awareness and conduct research and training for capacity building.

The Forest Department will be involved in case of the need to fell any trees in the government forests.

4.10.2 Department of Wildlife

- Protection, conservation, preservation and management of wildlife.
- Management of protected areas, wildlife parks, safaris and zoos.
- Public and private participation through trophy hunting, private breeding farms and hunting associations.

As such, no protected areas fall within or adjacent to the study area of the EIA, however, EPC Contractor and its staff will have to comply with the relevant wildlife protection legislation.

4.10.3 Department of Fisheries

- Extension services/fish farming/aquaculture development.
- Conservation, management and development of natural resources.
- Production of fish seed under controlled conditions.
- Research and training activities.
- Introduction of new technologies for enhancing fish production.

The Fisheries Department will be involved in case of any damage to any fish resources and fish ponds caused by the project activities. In the proposed motorway project, there will no impact on fish, motorway passes above water bodies.

4.10.4 Revenue Department

Revenue department is responsible for the acquisition of land (permanent or temporary) including assessment, valuation, disbursement of compensation, and mutation in favor of Project Proponent.

4.10.5 Agriculture Department

In case of impact on crops and fruit trees, the Agriculture Department is fully responsible for the assessment and valuation of losses.

4.10.6 Communication & Works (C&W) Department

The C&W will be involved for the assessment and valuation of losses in case of project impact on structures/ buildings and roads.

4.11 International Conventions

The key relevant international Convention are summarized below;

4.11.1 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington, 1975

The convention aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. It protects certain endangered species from over-exploitation by means of a system of import/export permits. Through its three appendices, the Convention accords varying degrees of protection to more than 30,000 plant and animal species.

4.11.2 Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972

The primary mission of the World Heritage Convention (WHC) is to identify and conserve the world's cultural and natural heritage, by drawing up a list of sites whose outstanding values should be preserved for all humanity and to ensure their protection through a closer co-operation among nations.

5 Environmental and Social Baseline Conditions

5.1 Overview

This section examines the existing environmental conditions of the project surrounding area against which the project impacts can be measured. This chapter also identifies sensitive flora and fauna receptors in the project area. The information provided in this section is both quantitative and qualitative and is based on secondary and primary sources collected through field surveys specifically for this study and desk studies related to the project area. The baseline information is required for scoping potential social and environmental issues associated with the implementation of the project. On the basis of baseline information, the project interventions are addressed and mitigation measures are proposed. The baseline information also helps to indicate the specific issues to be monitored during project execution as well as during the operational phase.

5.2 Methodology of data Collection

The necessary data were collected from the project area through physical observations, from Government surveys, Local government statistics, site visits and District Census Report.

5.3 Physical Environment

Gilgit-Baltistan, is a region administered by Pakistan as an administrative territory and consists of the northern portion of the larger Kashmir region. Gilgit-Baltistan covers an area of over 72,971 km^2 (28,174 sq mi)[1]. The region is located between 35-37 N and 72-75 E, divided into 3 divisions (Baltistan, Diamer and Gilgit) and 10 districts. Most of the area consists of rugged mountains, the higher elevations remaining snow covered throughout the year. The area constitutes an important segment of South Asia, covering the intersection zone of three majestic mountain ranges - Himalaya, Karakoram and Hindukush. Among these mountain ranges Gilgit-Baltistan has some of the world's most massive glaciers, magnificent rivers, splendid valleys and unique ecological zones. This ecological backdrop is home to some unique the floral and faunal species, adapted to rugged environments and high mountains. Overall Gilgit-Baltistan has about 4% land under forest or tree cover (including farm forests and plantations), with 14.5% of the land comprising of alpine and winter pastures. Only 0.64% of the land is used for agricultural and settlement purposes in the province, whereas more than 80% of the remaining land area is either barren or permanently snow covered.

The project area falls in the Diamer district of the GB. Diamer District lies in the southwest of the GB. The Karakoram Highway enters the GB in this district The Indus River runs in the east to west direction through the middle of the district. The elevation near the Indus is less than 1,500 m. At north and south of the Indus valley the elevation increases to more than 4,000 m. Nanga Parbat, the 9th highest peak in the world at 8,126 m, lies in Diamer district at its border with Astore district. The climate of the Diamer District has considerable variation with elevation. The areas below 3,000 m are warm and have very little precipitation. The summer season in low lying valleys is hot but at high altitude is very pleasant. Similarly, winter season at high altitude is extremely cold as compared to the valleys. During winter the northern winds blow constantly bringing the temperature down considerably. The areas covered under physical resources are; climate, water resources, topography, seismology, geology and soil conditions.

[1] https://gilgitbaltistan.gov.pk/

5.3.1 Topography

The Gilgit-Baltistan is composed by the Himalayan, Karakoram and Hindu Kush ranges, presenting one of the most enthralling and beautiful mountains in the world. Pakistan has five above 8000m peaks, K-2 (8611m), Nanga Parbat known as Killer Mountain (80125m), Hidden Peak (8068m), Broad Peak (8048m) and Gasha brumII (8035m). Darel Expressways starts from KKH at a distance of 67 km from Chillas city. Topography revealed that site terrain is hilly, rolling and prone to natural landslides and erosion. Both expressways tend to be low at the starting point and on higher ground at the end point. As such the roads run from the lower reaches to the upper reaches along the Tangir and Darel Rivers. Slides/slips are also frequent on both sides of rivers. Rolling down of big boulders is caused by gravity, wedge failure and weathering process i.e. thawing and frost action is quite common. The rock exposures on both sides are steep and dissected at many places, by Nullah flows and avalanches -

There is flat, small-areas and stable constructional terraces at part of the villages and towns along the roads. The mountain vegetation is extremely sparse and trees are found mostly in villages. The mountains are partially eroded due to severe weather conditions and landslides developed along the roads, albeit are in a state of equilibrium and can be disturbed/ imbalanced due to rain and snow. The landside masses can be seen along the road as shown in the **Figure 5-1**.

Figure 5-1: Topography/Landslides of the Project Area

5.3.2 Regional Geology

The geology of Gilgit Baltistan is very diverse (**Figure 5-2**) in nature. The region has been effected by the collision of two major plates: Indian Mass present in the South, separated from Island Arc by a major Thrust Zone Main Mantle Thrust Zone (MMTZ), an East West trending fault which form a structural loop at Nanga Parbat Haramosh Massif (NPHM), due to two strike slip faults i.e. Raikot left lateral fault in the West and stack, a right lateral fault in the East of Nanga Parbat Haramosh Massif "The Asiatic Mass" marked by Main Karakorum Thrust (MKT) in the North along the line Hini-chalt-Yasin-Drosh area with a sedimentary basin sandwich between these two plates. The land forms of the region have been further modified by the more recent effect of emotional and depositional glaciations.

Bed rock consists of a wide variety of igneous and metamorphic rocks, which had undergone extensive deformation. Superficial materials occur mainly as glacial deposit terraces along the river valleys, as alluvial fans at the confluence of Indus and its tributaries and as recently deposited alluvial material in

and along the Nullahs and the river-beds. The region has been affected by the collusion of Indian and Asiatic mass with a sedimentary basin in between. Rugged mountains, deep U-shaped valleys, flat terraces and narrow flood plains, characterize the area. The rocks exposed are mostly Norites. These rocks range from Precambrian to Miocene in age. The recent deposits are the most widespread soil units in the project area, covering the bed rock. The slopes are covered with overburden having variable thicknesses varying from 5 to 20m. Terrace deposits include mixtures of clay, sandy silt, boulders and gravel in various proportion, mostly formed on morainic material, present at places on the both banks of the river. The rocks of the Indian Mass, located in the West and South, of the project area include Meta sediments, granites, quartzite's, slates and sedimentary rock units. The Asiatic Mass includes, granites, granodiorites, gneisses, slates, marbles sedimentary rocks i.e. shale, sandstone and limestone **Figure 5-2**.

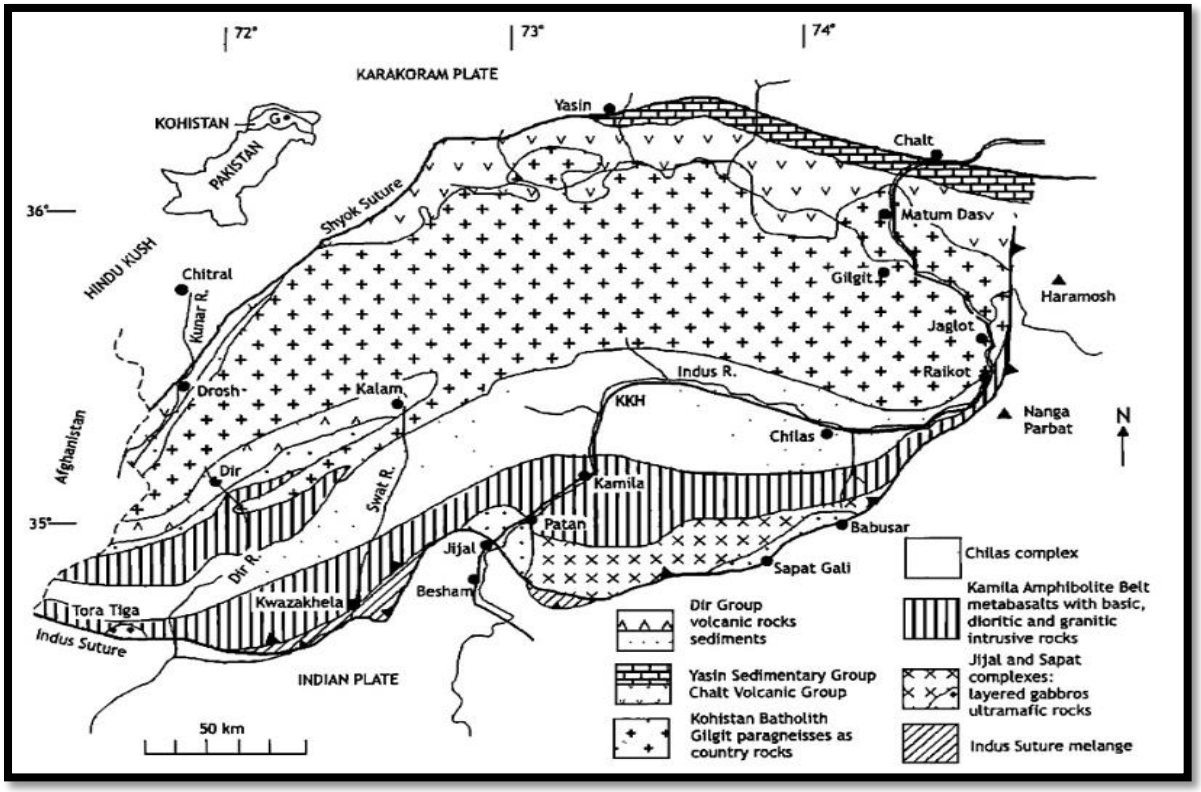
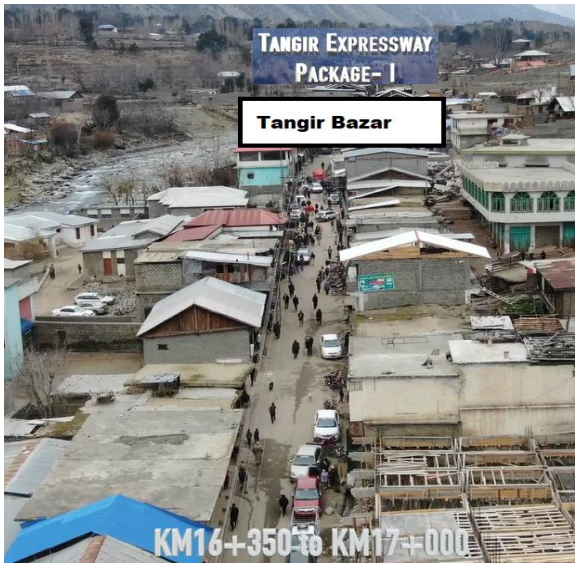


Figure 5-2: Geological Map of Kohistan.

5.3.3 Land use along the Project Route

The project area along the roads is observed to have three main types of surroundings: residential and commercial areas (including shops and small markets), cultivated lands (including areas privately owned by inhabitants on which different fruit trees and other crops are grown), and a high mountain slope as well. Scattered houses, rooms, shops, small hotels, mosques and dispensaries have been found. Sparsely populated human settlements are located in the vicinity of the project area. The land terrain of the project area is observed to be mountainous and rolling. Land acquisition is required for the project because the proposed project aims to reconstruct and widen the existing Tangir and Darel roads with the addition of bridges to ensure smooth traffic flow and alleviate the occurrences of deadly road accidents. It is revealed from the survey of the area that structures including residences, shops, mosques, and cultivated areas are likely to be affected as a consequence of the proposed project. Moreover, some small culverts or water channels constructed by the locals to derive water from the natural springs for domestic purpose would also be demolished as a result of the proposed project.

Structures and settlements such as shops, houses, mosques within the ROW project area are shown in the **Figure 5-3:** .



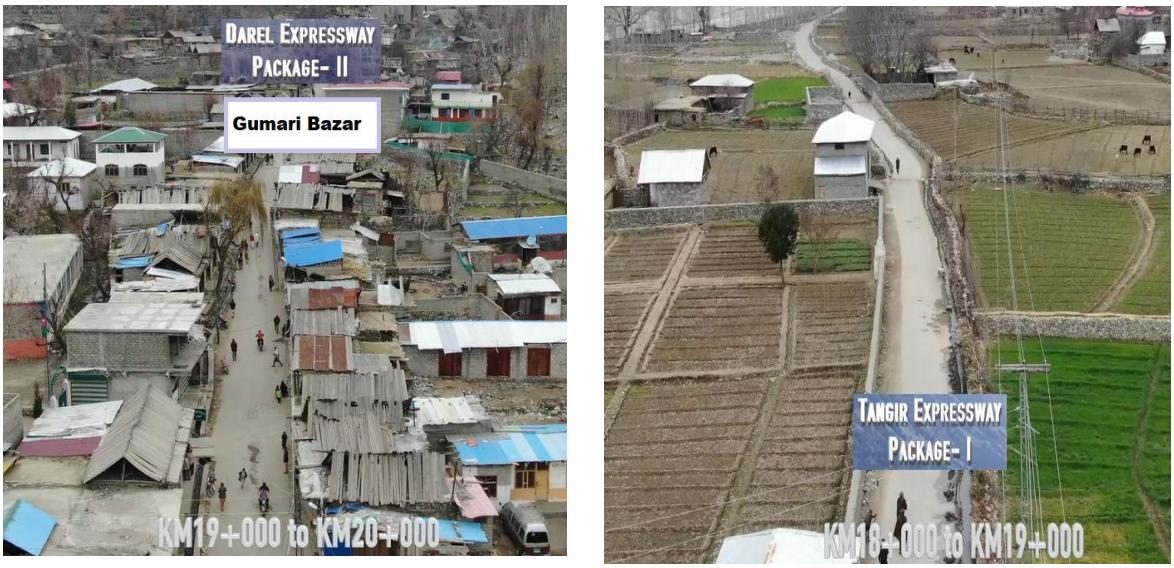


Figure 5-3: Views of Land use along the Project Route

5.3.4 Seismicity

The Project Area is located in District Diamer and lies in seismic province and mostly shows E-W trending folds and faults **(Figure 5-4)**.

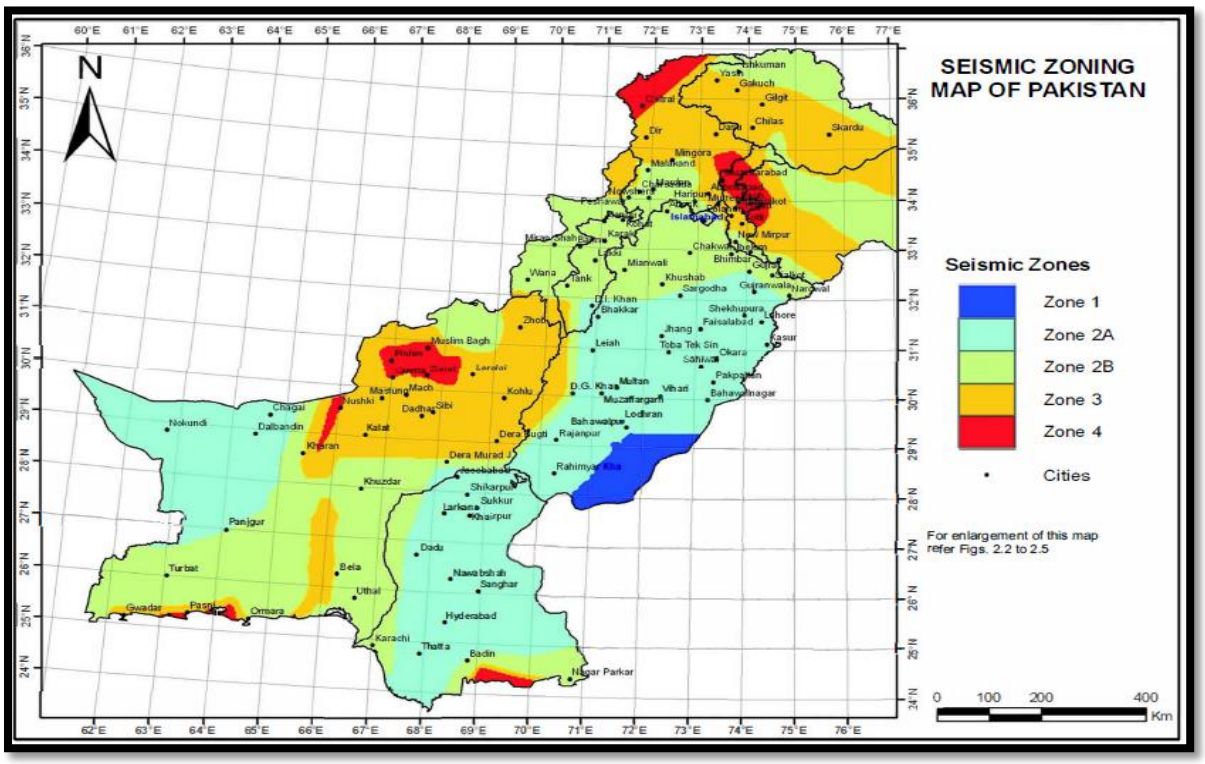


Figure 5-4: Seismic Zoning Map of Pakistan

The deformation within this zone is primarily the result of thrusting and of deep crustal devolvement processes associated within the collision of the plates. Tele seismic data for northern Pakistan shows

a concentration of seismic activities in three main zones around the Project Area. The project area lies in the north of Pakistan with major fault lines passing through the area. The seismic activity is the result of movement along various active faults in the region. Thus, it may be seen that the collision mountain ranges, where active faults are common, is characterized by extensive zones of high seismicity and contains several seism tectonic features generated by an integrated network of active faults.

Zone	PGA (g)
1	0.05 to 0.08
2A	0.08 to 0.16
2B	0.16 to 0.24
3	0.24 to 0.32
4	> 0.32 g

5.3.4.1 Regional Faults

The major faults of project region include, from North to South, the Main Karakoram Thrust (MKT), Main Mantle Thrust (MMT), Main Central Thrust (MCT), Panjal Thrust (PT), Nathia Gali Thrust (NGT), Main Boundary Thrust (MBT), Kashmir Boundary Thrust (KBT) / Himalayan Frontal Thrust (HFT) and Salt Range Thrust (SRT). The general trend of these faults is predominantly East-West with change in trend due to syntaxial bends. The general description of these major faults is as follows:

5.3.4.2 Main Karakoram Thrust

The MKT is a low angle mega-shear with strike slip component, which passes through Hasupa in Shigar valley, Machelu in Shyok valley and Chalt (upstream of Gilgit) on Eastern side and extended on Western side through Ishkuman and Yasin valleys in Baltistan and Shishi valley in Chitral, encircles the Island Arc zone on the Northern side. Its general trend swings between E and E-NE and dips towards the North at low to medium angle. It is believed that this fault is seismically active.

5.3.4.3 Main Mantle Thrust

The MMT, which is aligned with the Nanga Parbat-Haramosh Massif tectonically, spans over an area of about 400 km through Diamer, Kohistan, and Bajour, before entering Afghanistan. The general trend of MMT is NE-SW. It is located along the contact of the mafic/calc-alkaline Meta igneous rocks and the meta-sediments belonging to the Indo-Pakistan continental mass. Along this megashear near Jijal village on Indus River (right bank), the igneous rocks have over thrusted the meta-sediments to the south over a 10-15 km wide zone. The thrust also manifests as the broad high topography of Kohistan relative to the Hazara adjacent to the south. In addition, numerous auxiliary fractures are developed and across the thrust frequent brecciation and melaninization are also present along the contact. It is seismically active fault.

5.3.4.4 Main Central Thrust

It is E-W trending fault separating Higher Himalayas in North and Lesser Himalayas in South, exposed in Upper Kaghan valley, Neelum valley, Northern Hazara, Swat and Dir (Chaudhary *et al*., 1994). Generally, it is a ductile shear zone along which a distinct break in metamorphism is observed along this thrust, toward North, metamorphism of upper amphibolite to eclogite facies took place while to the South, green schist facies are present. It is seismically active fault.

5.3.4.5 Panjal Thrust

Panjal Thrust is nearly NW–SE trending fault on Eastern side, bending at 180° around Hazara Kashmir Syntaxes (HKS) and have NE-SW trend on western side, separating Lesser Himalayan Igneous and Metamorphic zone in the North from Sedimentary zone in the South. It traces Eastward in Kashmir basin, at the foot hill of Pir-Panjal ranges through India and extends Westward through Mansehra, Attock, Nowshera, Peshawar and Afghanistan. It is seismically active fault.

5.3.4.6 Nathia Gali Thrust

It is nearly NE-SW trending thrust originates from Western side of Hazara Kashmir Syntaxis (HKS) extends Westward through Hazara area (well exposed in Jabri and Khanpur area) and Kala Chitta ranges to Afghanistan. It is low angle fault along which Tertiary rocks are in contact with Precambrian rocks (slates). It is seismically active fault.

5.3.4.7 Main Boundary Thrust

The MBT is the most significant and active tectonic feature of regional extent separating Lesser Himalayas in the North from Sub Himalayas in the South. It runs along the Himalayan arc for about 2800 km from the Asam in the East to Kashmir and Parachinar in the West. MBT along with other associated thrusts forms a sharp conspicuous Hazara-Kashmir syntaxis. This syntaxial bend is the most dominal tectonic feature of the area as all local major fault systems and geologic structures follow its trend. Near its surface trace the MBT dips north ward at a steep angle, which becomes sub horizontal with depth? The project is located to the North of this fault. It is also seismically active fault.

5.3.4.8 Kashmir Boundary Thrust / Himalayan Frontal Thrust

It is nearly NW-SE trending fault coming from India which become nearly NW and SE trending thrust near Kotli, joins HKS, northward with other faults in the Western epical portion. Toward South passing through Garhi Habibullah, Muzaffarabad, Domel and Kotli, runs eastward to India. A devastating earthquake of October 08, 2005 having magnitude 7.6 on scale is associated with rupture along this fault having epicenter, about 10 km upstream of Muzaffarabad in Gohri-da-Katha (right tributary of Neelum River).

5.3.5 Land Sliding, Erosion and Sedimentation

Land sliding is very common feature in the project area because of high steep terrain. Erosion and Sediment input in the river is a function of landslides and riparian erosion processes. There are frequent talus accumulations along the side slopes of the river. These are typically in a state of stable equilibrium at their current slope angle and environment, but become unstable when the equilibrium is disturbed. Excess water and earthquake shaking often trigger landslides.

5.3.6 Climate

The climate is one of the important elements of the project physical environment, not only controlling the evolutionary process of human beings, but also influences their characters, mode of existence, cultural and social characteristics. On the other hand, the climate is affected by human activities like agriculture, population growth, industrialization and transportation etc. There is no weather station within the project area therefore climatic data of Chillas (Nearest weather station) covering the time period of last fifteen years (2009-2024) (*https://www.worldweatheronline.com/Chillas-weather-averages/northern-areas/pk.aspx*) were utilized to evaluate climatic condition of project area.

5.3.6.1 Temperature

Temperature significantly impacts the climate of the area by influencing evaporation, precipitation, and overall weather patterns. Rising temperatures can alter precipitation patterns, leading to more intense rainfall in some areas and less in others. This can result in more frequent and severe flooding or droughts. Changes in temperature can also alter the distribution of plant and animal species, as they may need to adapt to prevailing climatic conditions.

To describe the weather conditions, the monthly maximum, minimum and average temperatures, recorded during the last 15 years (from 2009 to 2024) in Chillas are shown in **Table 5-1**, **Table 5-2** and **Table 5-3** respectively. Based on historic data, annual average maximum, minimum and average temperature hover around 23ºC, 11ºC and 16ºC respectively. The average maximum temperature of 31ºC was recorded in June. However, monthly maximum temperature fluctuated between 25ºC to 36ºC in summer months of May to September. The average minimum temperature of 1ºC was recorded in the month of January. Overall, December, January and February are the coolest months when average minimum temperatures remained between 1ºC to 3ºC.

Table 5-1 indicate that the average monthly maximum temperature in Chillas recorded at 12°C in January and gradually increased at 31°C in June and again gradually declined at 15°C in December. Annual maximum temperature remained between 22°C to 24°C. **Table 5-2** indicate that the monthly minimum temperature in Chillas remained at 1°C in January and gradually increased at 21°C in July and again gradually declined at 3°C in December. Annual minimum temperature remained between 10°C to 13°C.

Table 5-3 indicate that the monthly average temperature in Chillas remained at 6°C in January and gradually increased at 25°C in June and July and again gradually declined at 8°C in December. Annual average temperature remained between 15°C to 18°C. Monthly average high and low temperature ºC of Chillas (2009 – 2022) is also shown in ***Figure 5-5***.

Table 5-1: Monthly Maximum Temperatures (°C) in Chillas

Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	13	14	19	22	29	31	32	30	29	24	19	14	**23**
2010	15	12	22	26	28	31	30	27	27	24	21	15	**23**
2011	12	12	19	22	31	31	28	28	27	23	20	15	**22**
2012	9	11	17	22	27	32	31	28	27	23	18	13	**22**
2013	12	13	20	23	29	31	30	27	27	24	18	14	**22**
2014	12	12	16	21	26	32	30	28	26	23	19	15	**22**
2015	13	14	17	23	28	30	28	28	27	23	18	14	**22**
2016	13	16	18	23	29	32	29	29	28	26	21	18	**24**
2017	10	15	17	25	29	30	29	28	28	25	19	15	**23**
2018	14	15	20	24	27	31	29	28	27	22	18	14	**22**
2019	10	11	16	24	27	30	29	28	28	23	17	14	**21**
2020	9	15	16	22	26	30	31	28	28	26	17	13	**22**
2021	13	17	19	22	27	31	30	28	28	24	20	14	**23**
2022	10	13	23	30	32	33	28	27	27	24	19	16	**24**
2023	11	16	21	23	25	31	29	29	28	25	21	17	**23**
2024	16	14	19	23	32	36	33	26	28	26	21	15	**24**
Average	**12**	**14**	**19**	**23**	**28**	**31**	**30**	**28**	**28**	**24**	**19**	**15**	**23**

https://www.worldweatheronline.com/Chillas-weather-averages/northern-areas/pk.aspx

Table 5-2: Monthly Minimum Temperatures (°C) in Chillas

Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	2	3	7	11	16	15	21	20	17	12	6	3	**11**
2010	3	3	9	13	16	18	20	19	15	11	7	2	**11**
2011	-1	1	6	9	16	19	20	19	16	12	8	2	**11**
2012	-1	1	5	11	14	18	21	19	16	10	6	2	**10**
2013	-1	3	7	10	15	20	21	19	16	13	5	2	**11**

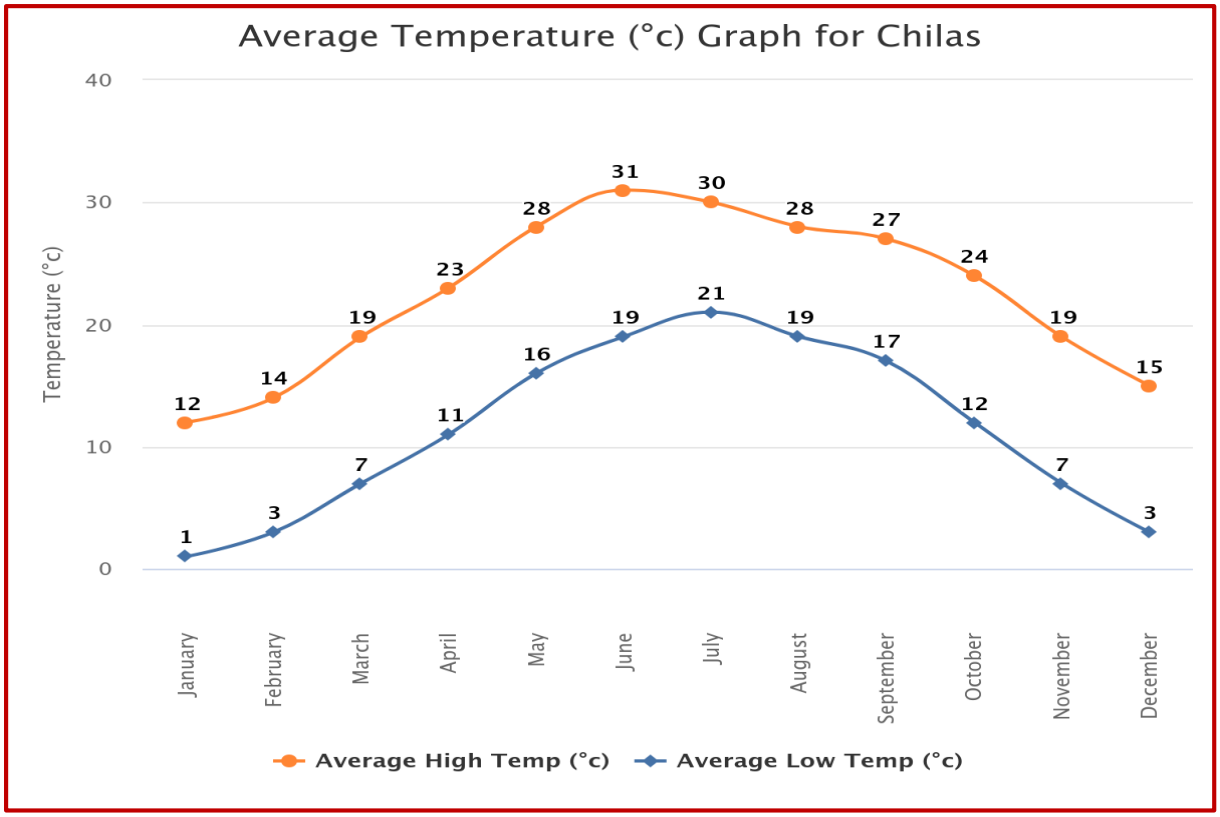
Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2014	1	1	5	9	14	19	20	18	16	12	6	3	**10**
2015	1	4	7	11	15	18	21	19	16	12	7	3	**11**
2016	2	3	8	11	17	11	20	19	18	13	9	5	**11**
2017	2	4	6	11	17	19	21	20	17	13	8	4	**12**
2018	2	4	9	12	15	21	21	20	17	11	7	2	**12**
2019	1	2	5	13	15	18	22	20	19	13	8	2	**12**
2020	0	4	7	12	16	19	22	21	18	14	7	3	**12**
2021	1	5	8	10	16	20	22	19	18	22	7	3	**13**
2022	2	2	9	14	18	19	21	20	17	13	6	3	**12**
2023	1	5	10	11	14	19	20	20	18	13	10	7	**12**
2024	5	3	8	11	18	20	22	20	18	15	10	4	**13**
Average	**1**	**3**	**7**	**11**	**16**	**18**	**21**	**20**	**17**	**13**	**7**	**3**	**11**

https://www.worldweatheronline.com/Chillas-weather-averages/northern-areas/pk.aspx

Table 5-3: Monthly Average Temperatures (°C) in Chillas

Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	7	8	13	16	22	25	27	25	23	17	12	8	**17**
2010	8	7	15	19	22	25	25	23	21	17	13	7	**17**
2011	5	6	12	15	23	25	24	13	21	17	13	7	**15**
2012	3	5	11	16	20	25	26	24	21	16	11	7	**15**
2013	5	7	13	16	22	26	25	23	21	18	11	7	**16**
2014	6	6	10	15	20	26	25	23	21	16	11	7	**16**
2015	6	8	11	17	20	24	24	23	21	17	12	7	**16**
2016	7	9	13	17	23	26	25	24	23	19	13	11	**18**
2017	5	9	11	18	23	25	25	24	22	19	13	8	**17**
2018	8	9	14	18	21	26	25	24	22	16	12	7	**17**
2019	5	6	10	18	21	24	25	24	23	17	12	7	**16**
2020	4	9	11	17	21	25	27	24	23	19	11	7	**17**
2021	7	11	14	16	22	26	26	24	23	18	12	8	**17**
2022	5	7	16	22	25	26	24	23	22	18	12	9	**17**
2023	5	10	15	17	19	25	24	24	22	18	14	10	**17**
2024	9	8	12	16	25	28	27	23	22	19	14	8	**16**
Average	**6**	**8**	**13**	**17**	**22**	**25**	**25**	**23**	**22**	**18**	**12**	**8**	**16**

https://www.worldweatheronline.com/Chillas-weather-averages/northern-areas/pk.aspx



https://www.worldweatheronline.com/Chillas-weather-averages/northern-areas/pk.aspx

Figure 5-5: Monthly Average High and Low Temperature (ºC) of Chillas (2009 – 2024).

5.3.6.2 Rainfall

Rainfall significantly impacts an area's climate, primarily by influencing temperature and precipitation patterns. Higher rainfall leads to cooler temperatures, while reduced rainfall can cause drier conditions and increased drought risk. Climate change can further exacerbate these effects by altering precipitation patterns, leading to more intense rainfall events and increased flooding, as well as prolonged droughts in some areas.

Table 5-4 indicates the distribution of monthly rainfall amount in Chillas (2009-2024). Monthly average rain fall remained minimum (41mm to 87mm) during the months of May, June, October, November and December. While maximum average rainfall of 265mm and 234mm was received in July and August respectively with an annual average amount of 1494mm. Table also reveals that maximum rainfall of 1739mm was received during 2010, while minimum rainfall of 1247mm during 2022.

Table 5-5 shows the monthly and annual Rainy Days of Chillas (2009-2024). Monthly average rainy days remained minimum (4 to 7 days) during the months of Oct., Nov., Dec., and Jan. While maximum number of rainy days (20 days) were recorded in July and August.

Table 5-5 also reveals that the most minimum annual rainy days of 49 days were recorded for 2024, while the maximum figure of 181 annual rainy days were recorded during 2019.

Month wise average rainfall and rainy days of Chillas are plotted in **Figure 5-6**. Figure reveals that maximum amount of rainfall is received during the months of July and August. While October,

November and December are the months of lowest rainfall. Generally rainy days are proportionate to rainfall amount. Based on precipitation, the project area may be categorized in arid climate.

Table 5-4: Monthly Rainfall Data of Chillas in mm (2009-2024)

Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	134	221	144	163	71	53	91	127	58	15	47	25	**1150**
2010	51	405	146	100	131	56	528	213	65	21	1	21	**1739**
2011	51	314	187	164	60	73	145	232	112	91	33	32	**1495**
2012	97	184	189	136	55	26	104	169	138	29	27	104	**1259**
2013	54	257	80	119	60	93	177	428	79	39	26	27	**1439**
2014	33	159	306	101	144	52	202	209	247	47	53	1	**1554**
2015	83	225	260	189	71	49	298	152	110	109	80	75	**1701**
2016	84	106	337	163	71	70	244	158	63	5	6	19	**1326**
2017	297	130	129	247	64	98	253	159	43	7	17	91	**1535**
2018	18	75	152	236	142	62	356	140	44	81	74	44	**1424**
2019	218	216	163	126	83	108	237	244	80	44	117	43	**1678**
2020	206	78	253	172	87	80	169	381	107	3	111	88	**1734**
2021	105	69	218	128	79	49	497	132	77	123	4	50	**1529**
2022	196	135	71	40	37	90	227	220	89	42	67	35	**1247**
2023	56	30	20	205	237	166	420	246	147	71	28	1	**1627**
2024	28	78	161	171	7	24	289	542	151	4	13	2	**1469**
Average	**107**	**168**	**176**	**154**	**87**	**72**	**265**	**234**	**101**	**46**	**44**	**41**	1494

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Table 5-5: Monthly and Annual Number of Rainy Days of Chillas (2009-2024)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	9	15	15	16	16	14	19	17	10	3	5	3	142
2010	3	14	11	21	16	17	20	23	13	4	1	1	144
2011	3	14	12	18	9	13	19	25	16	9	5	3	146
2012	8	12	13	19	12	12	14	23	20	5	3	7	148
2013	3	11	8	23	13	13	16	22	14	8	3	5	139
2014	5	13	22	12	25	13	20	18	17	10	4	0	159
2015	7	11	14	14	18	14	25	25	13	6	7	4	158
2016	7	3	16	15	9	14	22	23	14	3	2	2	130
2017	12	8	13	16	16	17	25	23	13	5	5	4	157
2018	3	5	11	11	16	10	24	15	12	13	6	4	130
2019	15	17	16	15	13	18	25	19	14	15	9	5	181
2020	13	5	19	17	21	17	19	20	14	1	7	9	162
2021	4	7	14	11	18	11	20	16	17	9	1	5	133
2022	11	11	8	12	13	12	22	22	13	8	5	4	141
2023	10	4	5	14	21	17	22	18	8	3	0	0	122
2024	1	6	7	9	0	2	6	12	2	0	3	1	49
Average	**7**	**10**	**13**	**15**	**15**	**13**	**20**	**20**	**13**	**6**	**4**	**4**	**140**

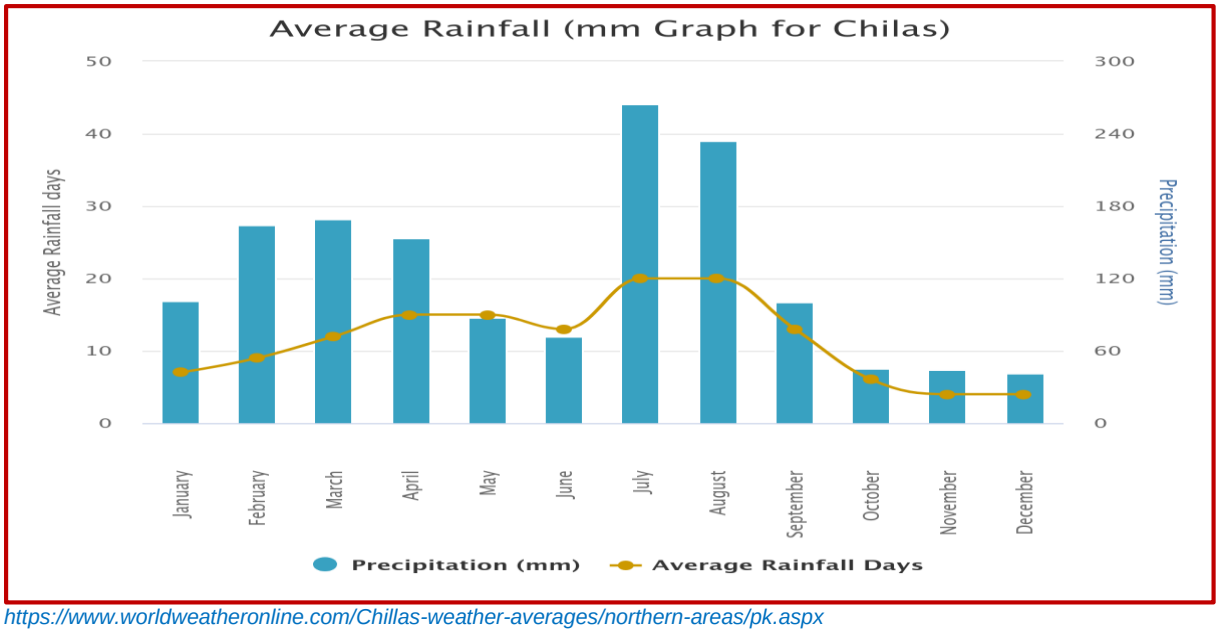

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Figure 5-6: Graph Showing Monthly Average Rainfall and Rainy Days of Chillas (2009 to 2024).

5.3.6.3 Annual Sun Hours and Sun Days Averages

Annual sunshine hours refer to the total amount of time, measured in hours, that a location experiences bright sunshine within a year. Sun days, on the other hand, typically refers to the number of days within a year when the sun is shining brightly for a significant portion of the day, often compared to the total number of days in a year.

Table 5-6 indicate distribution annual sun hours in Chillas. Feb., July and August moths were found with minimum sun hours. While Oct., Nov. and December having maximum sun hours. Overall, annual sun hours remained between 2226 and 3187 with annual average of 2847. **Table 5-7** indicate distribution annual sun days in Chillas. July and August moths were found with minimum sun days. While Oct., Nov. and December having maximum sun days. Overall, annual sun days remained between 185 and 315 with annual average of 224. Average annual sun hours and sun days are also depicted in **Figure 5-7**.

Table 5-6: Annual Sun Hours in Chillas

Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	228	182	235	225	301	286	255	200	323	345	290	277	**3147**
2010	304	162	260	241	276	293	209	157	286	344	339	316	**3187**
2011	278	104	242	244	324	275	216	183	269	306	287	326	**3054**
2012	254	146	214	225	295	316	270	188	240	306	300	254	**3008**
2013	278	163	274	229	280	274	206	165	250	289	305	282	**2995**
2014	248	173	147	239	245	229	209	228	269	285	285	295	**2852**
2015	245	174	126	226	299	286	160	191	258	314	237	256	**2772**
2016	284	288	176	180	286	290	150	243	283	357	275	342	**3154**
2017	147	184	209	241	300	266	177	221	295	357	299	302	**2998**
2018	300	208	259	253	266	302	170	224	302	315	262	319	**3180**
2019	192	145	209	244	290	276	175	210	231	315	212	282	**2781**

Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2020	134	233	114	160	180	183	138	45	238	349	227	225	**2226**
2021	245	230	222	189	196	233	125	75	173	271	326	285	**2570**
2022	156	178	268	267	245	222	21	75	197	305	248	279	**2461**
2023	59	76	226	190	148	192	75	107	244	329	275	317	**2238**
2024	270	228	206	236	346	318	253	49	287	113	318	308	**2932**
Average	**226**	**180**	**212**	**224**	**267**	**265**	**176**	**160**	**259**	**306**	**280**	**292**	**2847**

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Table 5-7: Monthly and Annual Sunny Days in Chillas

Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	22	17	16	14	15	16	12	14	20	28	25	28	**227**
2010	28	14	20	9	15	13	11	8	17	27	29	30	**221**
2011	26	12	19	12	22	17	12	6	14	22	25	26	**213**
2012	21	14	18	11	19	18	17	8	10	26	27	24	**213**
2013	26	17	23	7	18	17	15	9	16	23	27	23	**221**
2014	25	14	9	18	6	17	11	13	13	21	26	31	**204**
2015	22	17	17	17	13	16	6	6	17	25	23	26	**205**
2016	24	26	15	15	22	16	9	8	17	28	28	29	**237**
2017	17	20	18	14	15	13	6	8	17	26	25	27	**206**
2018	28	23	20	19	15	20	7	16	18	18	24	27	**235**
2019	15	11	15	15	18	12	6	12	16	18	21	26	**185**
2020	12	24	12	13	10	13	12	11	16	30	23	22	**198**
2021	27	21	17	19	13	19	11	15	13	22	29	26	**232**
2022	20	17	23	18	18	18	9	9	17	23	25	27	**224**
2023	20	24	26	16	10	13	9	13	22	28	30	31	**242**
2024	30	22	23	21	31	28	25	19	28	31	27	30	**315**
Average	**23**	**18**	**18**	**15**	**16**	**17**	**11**	**11**	**17**	**25**	**26**	**27**	**224**

https://www.worldweatheronline.com/Chillas-weather-averages/northern-areas/pk.aspx

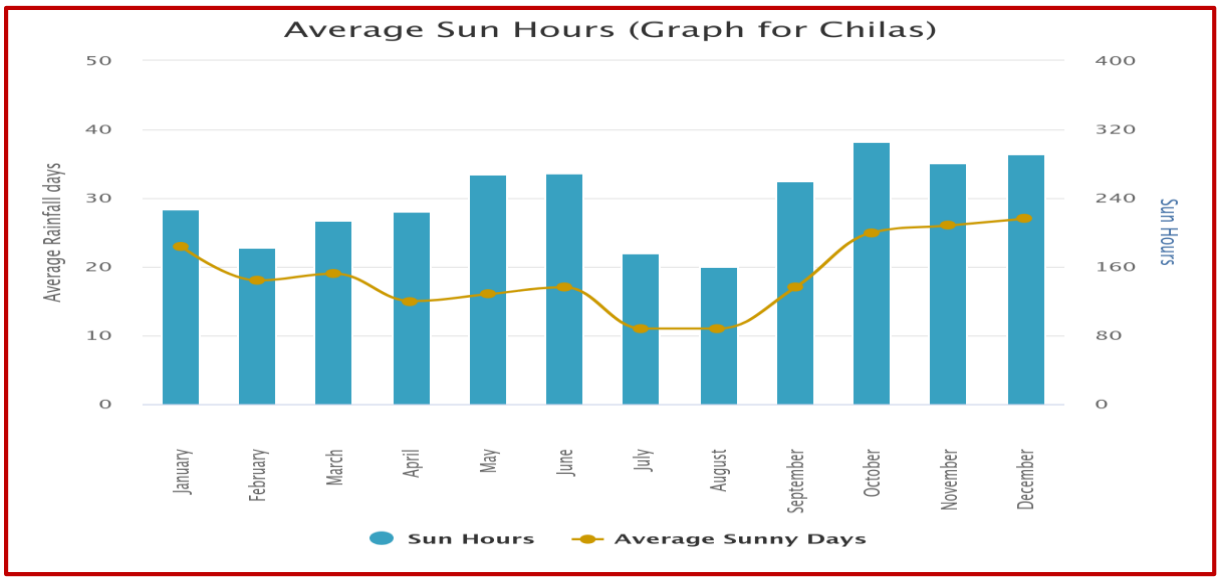

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Figure 5-7: Graph Showing Month wise Average Sun Hours and Sunny Days of Chillas (2009 to 2024).

5.3.6.4 Annual Humidity and Cloud Averages

Humidity is the concentration of water vapor present in the air. Too much or too little humidity can be dangerous. For example, high humidity combined with hot temperatures is a combination that can be a health risk, especially for the very young and the very old. Likewise, very low humidity can make us feel cooler than the actual temperature.

Cloud cover can be defined as the approximate fraction of the sky that is covered in clouds. Cloud cover is an important component of understanding and predicting the weather. Not only does cloud cover impact sky conditions and inform precipitation predictions, it also helps regulate the temperature that occurs in a region.

Annual humidity averages in Chillas are given in

Table 5-8. Table indicate that maximum humidity of 56 to 67% remained in the months of July, August and September. While minimum humidity of 31 to 37% remained in May, June, Nov. and Dec. Overall, annual humidity remained between 39 and 52% with annual average of 45%.

Annual cloud cover averages in Chillas are given in **Table 5-9**. Table indicate that maximum cloud cover of 42% remained in the months of July and August. While minimum cloud cover of 12 to 22% remained in May, June, Oct. Nov. and Dec. Overall, annual cloud cover remained between 22 and 37% with annual average of 27%. Month wise Humidity and Cloud Cover (%) averages in Chillas are also depicted in **Figure 5-8**.

Table 5-8: Annual Humidity Averages in Chillas (%)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Annual**
2009	53	61	49	47	28	25	33	40	37	26	30	39	**39**
2010	33	69	47	39	38	31	48	76	53	37	27	22	**43**
2011	39	66	55	51	36	41	60	72	61	41	33	23	**48**
2012	42	53	44	50	36	27	44	66	53	36	27	37	**43**
2013	37	53	41	39	28	36	55	71	59	45	29	26	**43**
2014	34	43	50	44	40	31	54	59	59	44	30	21	**42**
2015	30	51	55	47	32	37	63	63	46	40	39	36	**45**
2016	37	34	53	45	34	36	59	56	47	28	21	20	**39**
2017	53	47	47	40	36	43	60	58	47	28	28	28	**43**
2018	24	38	41	43	35	35	57	64	53	37	33	25	**40**
2019	48	59	52	46	36	36	62	72	62	49	55	42	**52**
2020	62	49	66	60	48	41	46	74	53	29	41	48	**51**
2021	41	38	49	51	46	37	58	69	69	53	33	37	**48**
2022	62	56	42	30	30	33	74	78	68	47	45	33	**50**
2023	57	49	53	52	54	50	69	69	60	46	39	31	**52**
2024	31	50	54	57	36	32	57	80	63	39	38	27	**47**
Average	**43**	**51**	**50**	**46**	**37**	**36**	**56**	**67**	**56**	**39**	**34**	**31**	**45**

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Table 5-9: Annual Cloud Cover Averages in Chillas (%)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	32	35	30	29	15	15	23	31	9	7	18	22	**22**
2010	17	43	23	27	20	15	33	43	18	7	6	14	**22**
2011	23	51	32	26	11	19	33	39	22	14	18	13	**25**
2012	27	40	33	29	17	9	24	38	26	12	15	27	**25**
2013	21	38	24	26	17	19	40	44	21	17	15	19	**25**
2014	27	35	43	26	25	12	37	29	22	19	18	17	**26**
2015	29	40	48	28	15	14	47	35	22	14	27	23	**29**
2016	23	17	40	37	19	16	45	27	16	5	18	12	**23**
2017	44	32	32	25	15	19	43	32	14	3	13	20	**24**
2018	17	29	27	25	21	14	42	34	14	16	23	13	**23**
2019	42	46	34	27	18	16	43	36	27	17	34	21	**30**
2020	55	28	54	44	38	33	43	60	23	4	33	32	**37**
2021	26	26	34	36	39	29	49	56	35	25	10	23	**32**
2022	44	38	23	19	23	29	69	58	32	14	25	26	**33**
2023	46	34	36	37	42	38	62	56	30	15	24	19	**37**
2024	27	31	39	32	9	16	35	61	17	10	15	21	**26**
Average	**31**	**35**	**35**	**30**	**22**	**20**	**42**	**42**	**22**	**12**	**20**	**20**	**27**

https://www.worldweatheronline.com/Chillas-weather-averages/northern-areas/pk.aspx

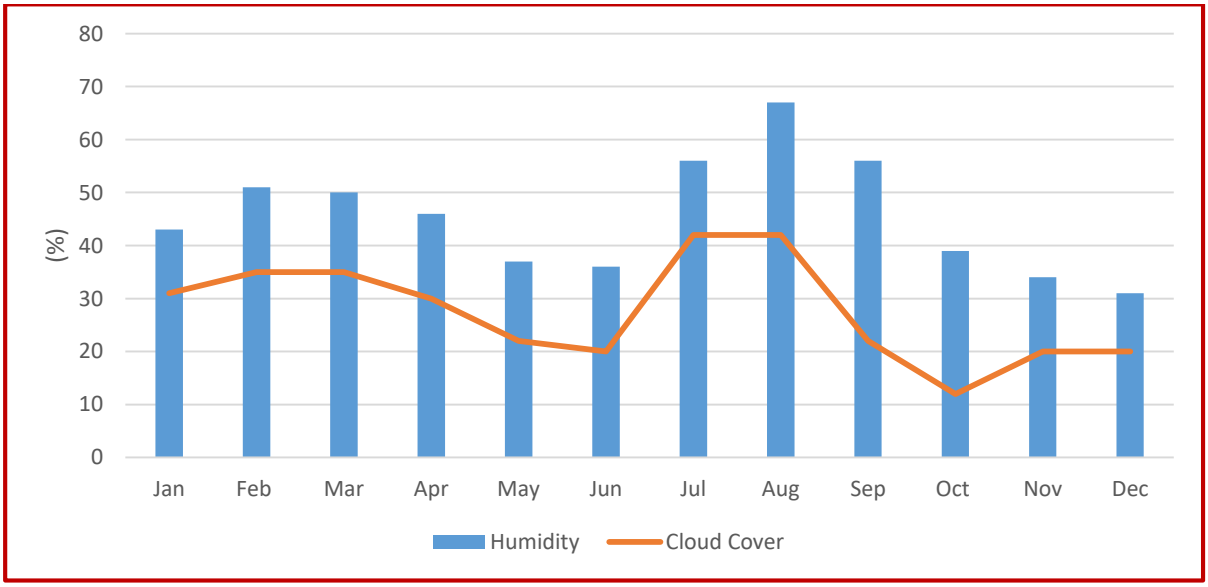

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Figure 5-8: Month Wise Humidity and Cloud Cover Averages in Chillas (%)

5.3.6.5 Atmospheric Pressure

Atmospheric pressure significantly influences weather patterns. Low-pressure systems generally bring cloudy, windy, and potentially precipitation-filled weather, while high-pressure systems are associated with clear skies, calm winds, and dry conditions.

The high pressure of the study area is 1020mb in December and a lowest of 1001mb in July. The annual mean pressure of the area remained between 1010mb to 1013mb with annual average of 1012mb. The annual trend of the mean monthly pressure reveals that it is decreasing from January to July (winter season) and increase onward till December. Generally, the pressure of the area remains low during the summer months and high during winter **(Table 5-10 & Figure 5-9)**.

Table 5-10: Monthly and Annual Average Pressure (mb) - Chillas (2009–2024)

Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	1021	1017	1015	1013	1008	1004	1000	1003	1008	1014	1018	1020	**1012**
2010	1021	1018	1015	1012	1007	1005	1003	1004	1009	1013	1018	1017	**1012**
2011	1020	1018	1015	1014	1007	1001	1001	1002	1006	1015	1018	1012	**1011**
2012	1020	1018	1015	1012	1009	1002	999	1002	1008	1016	1017	1019	**1011**
2013	1020	1019	1016	1012	1007	1001	1000	1003	1008	1014	1019	1020	**1012**
2014	1022	1018	1018	1014	1010	1002	1001	1004	1008	1016	1019	1021	**1013**
2015	1022	1019	1018	1013	1009	1004	1001	1004	1010	1017	1019	1021	**1013**
2016	1020	1020	1017	1013	1007	1004	1001	1004	1008	1014	1019	1020	**1012**
2017	1022	1020	1016	1011	1009	1004	1002	1004	1009	1014	1019	1022	**1013**
2018	1019	1020	1016	1013	1010	1003	1000	1002	1010	1017	1019	1021	**1012**
2019	1023	1020	1018	1014	1011	1005	1000	1003	1008	1016	1019	1021	**1013**
2020	1020	1020	1015	1013	1008	1003	1001	1001	1007	1012	1019	1019	**1012**
2021	1019	1017	1014	1012	1007	1003	1001	1005	1008	1013	1016	1020	**1011**
2022	1018	1016	1013	1009	1003	1002	1003	1005	1008	1014	1017	1017	**1010**
2023	1020	1017	1015	1012	1010	1004	1004	1004	1008	1014	1018	1019	**1012**
2024	1018	1019	1016	1012	1006	1003	1000	1006	1008	1013	1016	1018	**1011**
Average	**1020**	**1018**	**1016**	**1012**	**1008**	**1003**	**1001**	**1004**	**1008**	**1014**	**1018**	**1019**	1012

https://www.worldweatheronline.com/Chillas-weather-averages/northern-areas/pk.aspx

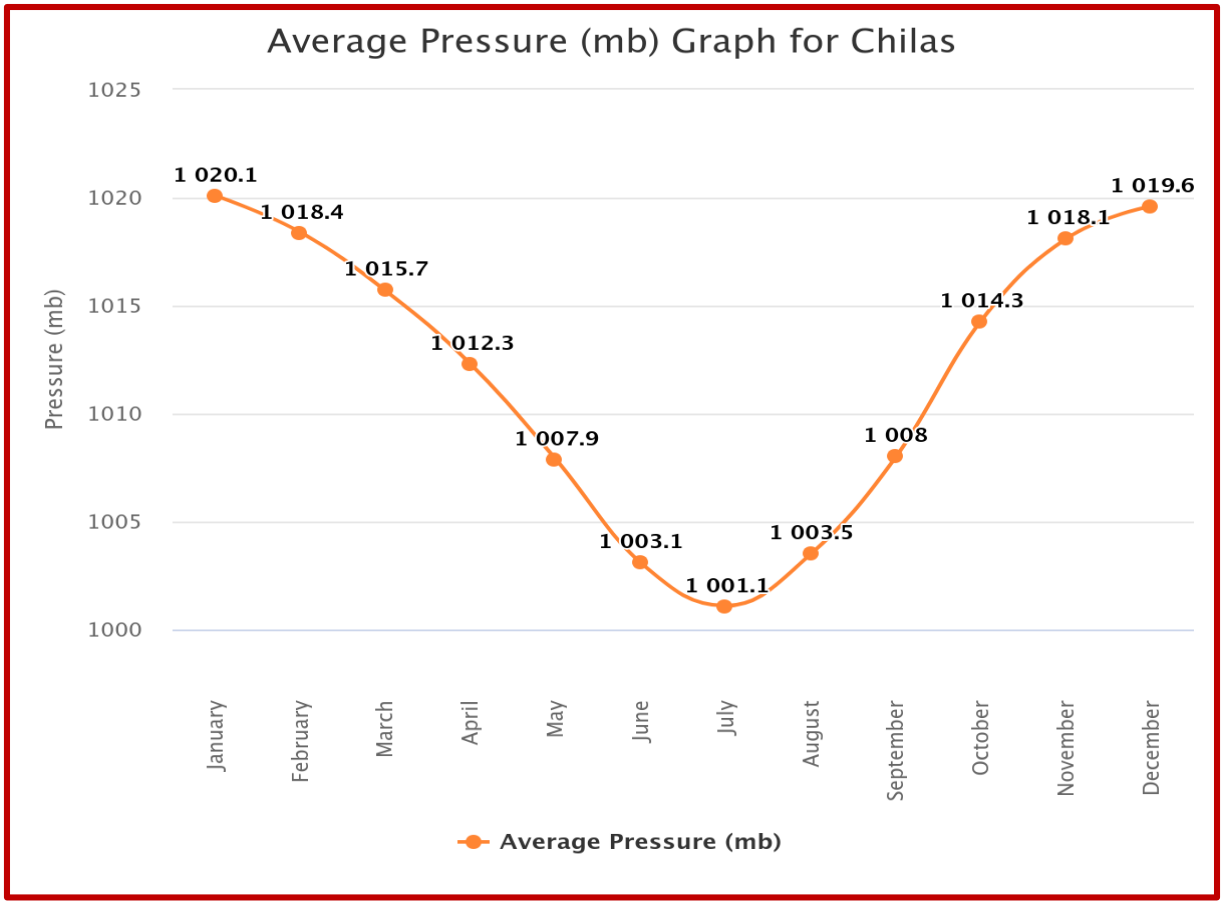

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Figure 5-9: Graph showing Atmospheric Pressure in Chillas throughout the year.

5.3.6.6 Wind Speed

Monthly and annual Maximum and Average wind speed and wind gust (kmph) in Chillas (2009–2024) is depicted in **Table *5-11***, **Table *5-12*** and **Table *5-13*** respectively. **Figure 5-10** also showing Maximum, Average Wind Speed and Wind Gust kmph (Average of 2009 to 2024). Data indicate all the values of Maximum, Average and Wind Gust gradually increased from the month of January to May and decreased to August again increased to October. **Table *5-11*** indicate highest wind speed of 13.6 kmph in May and the lowest of 11.1 kmph in December with annual wind speed of 11.8 kmph. **Table *5-12*** indicate highest wind speed of 9.0 kmph in May and the lowest of 7.3 kmph in January with annual wind speed of 7.8 kmph. **Table *5-13*** indicate highest wind gust of 18.2 kmph in April and the lowest of 12.5 kmph in August with annual wind gust of 15.9 kmph.

Table 5-11: Monthly and Annual Average Maximum Wind Speed - Chillas (2009–2024) kmph

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	12.4	12.9	13.0	14.0	14.3	14.0	12.9	12.4	12.5	12.8	12.3	12.1	**13.0**
2010	12.1	12.7	13.2	15.0	14.5	13.1	11.8	10.2	11.3	11.9	10.6	10.9	**12.3**
2011	12.3	12.0	13.1	12.6	13.1	12.0	11.6	11.2	11.3	12.5	12.5	12.1	**12.2**
2012	11.4	11.7	13.4	12.8	14.2	14.1	12.2	11.6	11.5	12.4	11.5	12.4	**12.4**
2013	11.7	12.0	12.9	13.5	14.6	12.4	11.7	10.7	11.0	11.8	11.8	11.9	**12.2**
2014	12.1	11.9	12.9	13.2	12.8	12.8	11.6	11.2	11.0	12.0	12.5	11.8	**12.2**
2015	11.0	11.8	11.9	12.2	13.6	12.4	9.7	10.1	11.5	12.2	11.7	10.9	**11.6**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2016	11.0	11.8	12.5	13.8	13.0	11.6	10.7	10.4	11.0	12.0	11.8	11.7	**11.8**
2017	11.3	12.0	11.9	13.8	12.8	11.6	10.9	11.1	11.8	12.5	11.9	12.4	**12.0**
2018	11.2	12.0	13.1	12.7	14.0	12.8	11.3	11.0	12.0	12.7	12.6	11.8	**12.3**
2019	10.3	10.7	10.6	11.8	12.4	12.8	10.7	8.2	9.4	9.2	10.9	9.3	**10.5**
2020	9.5	10.0	10.3	10.5	12.4	11.5	11.2	8.9	9.7	10.5	10.1	10.1	**10.4**
2021	11.1	10.7	12.2	13.0	12.3	12.1	10.2	10.1	9.1	10.3	10.3	10.1	**11.0**
2022	9.7	10.0	12.2	14.0	14.5	13.7	10.1	9.4	9.4	10.9	11.2	9.7	**11.2**
2023	10.6	11.6	13.3	12.6	12.8	11.7	10.6	10.2	11.1	13.5	10.8	10.2	**11.6**
2024	10.9	11.8	12.8	15.4	15.8	18.2	12.5	10.5	10.7	11.3	10.7	10.8	**12.6**
Average	**11.2**	**11.6**	**12.5**	**13.2**	**13.6**	**12.9**	**11.2**	**10.5**	**10.9**	**11.8**	**11.5**	**11.1**	**11.8**

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Table 5-12: Monthly and Annual Average Wind Speed - Chillas (2009–2024) kmph

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	8.4	8.3	8.4	9.3	9.7	9.4	8.4	7.7	8.8	9.0	8.7	8.1	**8.7**
2010	8.4	8.4	9.2	10.5	10.2	9.2	7.7	5.8	7.3	8.1	7.2	7.3	**8.3**
2011	7.9	8.3	8.5	8.2	8.5	7.5	6.1	5.9	6.9	7.8	8.1	8.2	**7.7**
2012	7.6	7.5	8.7	8.3	9.3	9.3	7.3	6.2	7.3	8.2	7.4	8.1	**7.9**
2013	7.6	8.0	8.2	8.7	9.8	7.9	6.3	5.5	6.8	7.5	7.4	7.7	**7.6**
2014	7.3	7.7	8.2	8.4	8.3	8.4	6.5	7.0	7.2	7.7	7.9	7.8	**7.7**
2015	6.7	7.5	7.6	8.0	8.6	7.7	5.5	6.0	7.6	7.6	7.2	6.8	**7.2**
2016	6.7	7.3	7.9	8.8	8.8	7.7	6.6	6.6	7.5	7.7	7.4	7.2	**7.5**
2017	7.4	7.5	7.9	8.9	8.2	7.3	6.4	7.3	8.0	8.4	7.6	8.0	**7.7**
2018	7.5	7.9	8.8	8.8	9.4	8.6	7.0	7.3	8.2	8.7	8.1	7.3	**8.1**
2019	7.4	7.6	7.6	8.2	9.0	9.3	6.9	5.9	6.7	6.9	7.3	6.5	**7.4**
2020	6.3	7.1	7.2	7.5	8.7	8.1	7.6	5.9	7.2	7.8	7.3	7.0	**7.3**
2021	7.6	7.7	8.9	9.0	8.5	8.8	6.8	7.0	6.1	7.5	7.6	7.0	**7.7**
2022	6.4	6.9	8.4	9.9	9.8	9.4	5.9	5.7	6.3	7.3	7.8	6.9	**7.6**
2023	7.0	7.9	8.2	8.4	8.2	7.6	6.2	6.6	7.4	8.3	6.9	7.0	**7.5**
2024	7.0	7.6	8.0	9.9	9.4	11.0	7.8	6.2	6.8	7.9	7.4	7.5	**8.0**
Average	**7.3**	**7.7**	**8.2**	**8.8**	**9.0**	**8.6**	**6.8**	**6.4**	**7.3**	**7.9**	**7.6**	**7.4**	**7.8**

https://www.worldweatheronline.com/Chillas-weather-averages/northern-areas/pk.aspx

Table 5-13: Monthly and Annual Average Wind Gust - Chillas (2009–2024) kmph

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	19.5	19.1	18.3	20.3	19.5	19.2	16.2	15.0	16.7	17.7	18.4	17.5	**18.1**
2010	18.5	20.1	19.6	22.1	20.8	18.1	16.0	11.7	14.1	15.4	15.5	16.2	**17.3**
2011	17.8	19.7	19.1	17.9	17.0	14.8	11.9	11.4	12.8	16.0	17.8	18.9	**16.3**
2012	17.2	17.4	20.0	16.8	19.2	19.0	14.3	11.9	14.1	16.9	16.0	19.1	**16.8**
2013	18.0	19.2	18.4	18.4	20.8	15.4	12.5	11.1	12.8	14.4	16.5	17.6	**16.3**
2014	16.9	17.3	18.8	17.7	17.3	17.1	12.6	13.3	13.5	15.5	18.2	17.5	**16.3**
2015	15.7	17.9	17.8	17.4	18.3	15.7	11.2	11.9	14.8	15.9	16.0	15.5	**15.7**
2016	15.0	17.0	18.6	18.8	17.9	15.5	13.0	12.9	14.2	15.9	15.9	15.4	**15.8**
2017	17.4	17.4	17.0	19.4	16.8	15.2	12.5	13.1	15.4	16.5	16.3	18.4	**16.3**

2018	16.6	17.2	18.8	18.1	19.1	16.1	13.1	13.3	15.2	17.4	17.1	16.0	**16.5**
2019	16.5	16.8	15.8	16.9	17.7	18.4	13.2	12.1	13.0	13.4	15.9	13.3	**15.3**
2020	14.4	14.5	15.1	15.8	17.0	15.8	14.7	12.6	13.9	14.7	14.4	15.4	**14.9**
2021	16.2	15.5	19.2	18.4	16.6	16.7	13.8	14.0	12.9	15.5	14.2	14.2	**15.6**
2022	13.3	14.2	16.4	19.1	19.2	18.4	11.3	11.3	12.7	13.9	16.1	13.4	**14.9**
2023	15.5	16.9	14.4	17.0	16.4	14.4	12.2	12.7	12.9	14.5	12.6	13.2	**14.4**
2024	12.4	13.6	14.1	17.6	16.1	18.4	14.3	10.9	11.8	14.2	13.5	13.9	**14.2**
Average	**16.3**	**17.1**	**17.6**	**18.2**	**18.1**	**16.8**	**13.3**	**12.5**	**13.8**	**15.5**	**15.9**	**16.0**	**15.9**

https://www.worldweatheronline.com/Chillas-weather-averages/northern-areas/pk.aspx

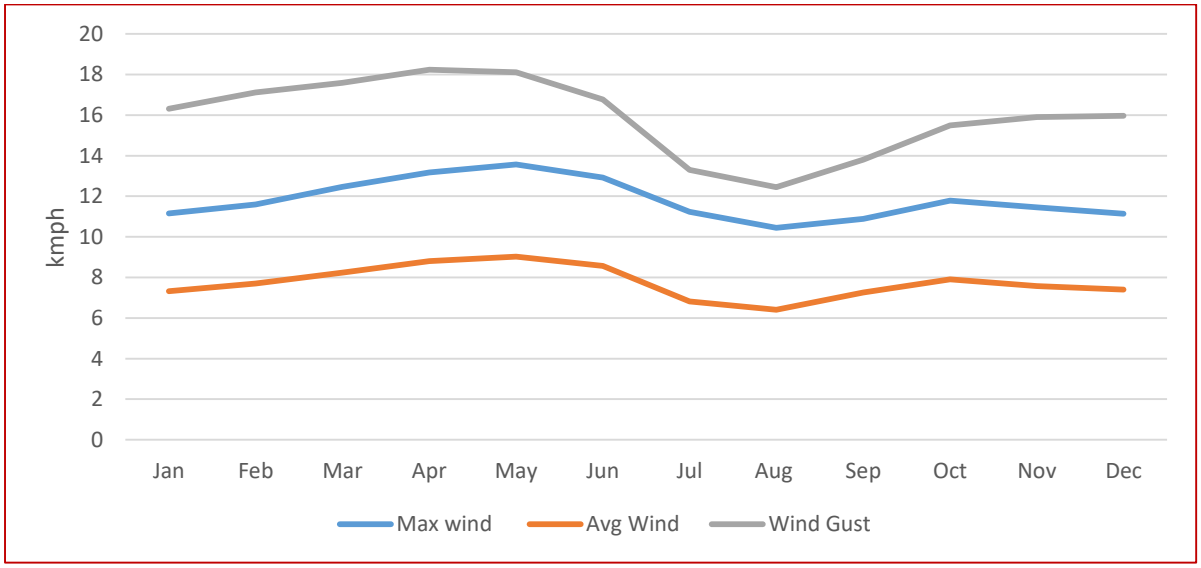


Figure 5-10: Graph showing Maximum, Average Wind Speed and Wind Gust kmph in Chillas (Average of 2009 to 2024).

5.3.6.7 Ambient Air & Noise Quality

Several factors impact both air and noise quality, with many overlapping causes. Air quality is primarily affected by emissions from vehicles, industries, and other sources, as well as natural events like wildfires and dust storms. Noise pollution, on the other hand, is largely driven by traffic, industrial machinery, construction, and recreational activities. Weather patterns and the geographical location of project area also play a significant role to impact both air and noise quality.

Although no historic background air quality data for the project area is available, but considering existing land use of the area, industrial presence and population pressure we can consider good (Within NEQS) ambient air quality of the project area. There may be background concentrations of Sulphur dioxide, nitrogen dioxide and dust in the area mainly due to diesel driven heavy traffic on KKH. The burning of wood as a fuel for cooking contributes to particulate and nitrogen dioxide concentrations. Increasing traffic in the project area will also be a contribution in the background pollutant concentration. The un-metaled road in the valley is also contributing dust to air due to vehicular movement. Domestic sources of air pollution, such as emissions from wood and kerosene burning stoves as well as small diesel standby generators in some households, are well dissipated. No other industrial pollution sources are present in the vicinity. The air quality of the Project area is generally fresh and free of any pollutants because there is no major source of air pollution like industrial activity, or vehicular traffic. There may be rise in suspended particulate matter (SPM) during high winds or major traffic movement which is of

temporary nature. During construction phase transportation of construction material and heavy equipment, dust levels are expected to rise in the project area. The large particles of the dust will deposit in the adjoining areas and smaller particles will remain suspended in the air causing air pollution in the surrounding areas. Although the problem will be temporary and localized still special measures should be taken to reduce this impact.

No data regarding noise in the valley is available; however, the noise of running water in the Tangir and Darel Nullahs may be higher in the valley due to high turbulence and falling of water on the boulders. During night time the noise of the stream is more prominent. Another source of noise in the vallies may be movement of vehicles, which move for transportation from valley to other parts of the region. The NEQS has defined four categories of areas for noise level (i.e., residential areas (a), commercial areas (b), industrial areas, (c) and silence zone (d), with limiting values of 55 dB, 65 dB, 75 dB and 50 dB, respectively.

5.3.6.8 Environmental Monitoring of Air and Noise quality

Historic background air quality and noise level secondary data for the project area is not available but recently (August, 2024) such data is reported for another project "*Construction/ Metaling of Road from Gorikote Astore to Shagharthang Skardu,"* The project feasibility consultant (M/S CAMEOS) engaged the services of AES (Asian Environmental Services Pakistan), an approved laboratory by Punjab EPA, to undertake Environmental Monitoring of Air & Noise Quality in compliance with the National Environmental Quality Standards (NEQS). As physical, biological and social environmental conditions of the said project area are similar to Darel and Tangir Expressway Project, so the Ambient Air Quality monitoring results (**Table 5-14)** and noise level (Table 5-15) are being considered as of project area.

Table 5-14: Results of Environmental Testing of Ambient Air Quality Monitoring

Sr.#	Parameters	Avg. Sampling Time	Unit	NEQS for Ambient Air	Average Concentration			Average of three locations
					Location 1	Location 2	Location 3	
1	Sulfur Dioxide (SO2)	24 hr.	µg/m^3	120	0.91	0.80	0.96	0.89
2	Nitrogen Dioxide (NO2)	24 hr.	µg/m^3	80	5.52	6.03	5.85	5.80
3	Nitric Oxide (NO)	24 hr.	µg/m^3	40	1.44	1.47	1.44	1.45
4	PM 2.5	24 hr.	µg/m^3	35	27.44	27.30	27.23	27.32
5	PM 10	24 hr.	µg/m^3	150	90.37	81.14	91.53	87.68
6	Carbon Monoxide (CO)	24 hr.	mg/m^3	5	0.32	0.23	0.32	0.29
7	Ozone (O3)	24 hr.	µg/m^3	80	3.24	3.96	3.32	3.51

Source: EIA Report of "Construction/ Metaling of Road from Gorikote Astore to Shagharthang Skardu,"

Table 5-15: Noise Level Result

Sr.#	Monitoring time	Location 1 dB(A)	Location 2 dB(A)	Location 3 dB(A)	Average of three locations
1	6:00 AM (Day)	34.8	33.2	37.4	35.10

2	9:00 AM (Day)	65.2	35.1	62	54.10
3	1:00 PM (Day)	41.4	38.3	54.7	44.80
4	5:00 PM (Day)	53.2	42.4	64.7	53.40
5	9:00 PM (Night)	39.6	30.1	50.2	40.0
6	12:00 AM(Night)	31.2	35.2	38.4	34.9
NEQS (day time)		Not More than 65 dB(A) Leq			
NEQS (night time)		Not More than 55 dB(A) Leq			

Source: EIA Report of "Construction/ Metaling of Road from Gorikote Astore to Shagharthang Skardu,"

5.3.6.9 Greenhouse Gases

Greenhouse gases are those gases (CO_2, CH_4, O_3, CFCs and NO) which contribute in global warming. The main sources of these gases are industries and vehicles using fossil fuel as fuel. At present there is no industry in the project area that is emitting greenhouse gasses and vehicles intensity is also very low. The main sources of carbon and nitrogen oxide emissions are the automobiles being operated in the project area. Similarly, there is no voluminous stagnant water body in the project area which could trap significant amount of organic matter that could cause emission of methane and other greenhouse gases.

5.3.7 Natural Disaster

Diamer in Gilgit-Baltistan, Pakistan, is prone to various natural disasters, including flash floods, landslides, and glacier lake outburst floods (GLOFs). The project area is particularly vulnerable due to its mountainous terrain and the presence of numerous glaciers. Recent events have highlighted the impact of these disasters on communities and infrastructure.

Here's a more detailed look at the types of natural disasters affecting Diamer:

5.3.7.1 Flash Floods:

Heavy rainfall and melting snow can cause flash floods, particularly in areas with steep slopes and narrow valleys. In 2018, flash floods from the Gonarforam stream in the Goharabad valley killed two people. In 2021, flash floods caused by heavy rainfall in Diamer district resulted in three deaths and damage to property.

5.3.7.2 Landslides:

The mountainous terrain and unstable slopes make Diamer susceptible to landslides, which can block roads, damage infrastructure, and cause casualties.

5.3.7.3 Glacier Lake Outburst Floods (GLOFs):

Diamer is home to numerous glaciers and their associated lakes. The sudden release of water from these lakes can cause devastating floods downstream, as seen in the 2018 floods.

5.3.7.4 Earthquakes:

Diamer lies in a seismically active region, and earthquakes can cause damage and displacement.

5.3.8 Surface Water Resources

Tangir and Darel Rivers are tributaries of the Indus River and are the major surface water sources in the project area, which supplies water mainly for drinking and irrigation purpose. The Project area is rich in water for irrigation purposes. There are Nullahs/hill torrents fed by snow melt from mountains.

Tangir and Darel Rivers originate from maximum elevation of 5991 and 4105 masl and their elevation at the confluence with Indus River are 932 and 950 masl respectively. These rivers flow through rugged mountains with steep slopes of morainic material. They have large catchment areas and are also fed by small glaciers (**Figure 5-11**). The total catchment area of Tangir River at its confluence with Indus River is 913 km^2. The Tangir and Darel valleys are in the maturity phase and highly developed for agriculture and irrigation on both sides of the rivers (**Figure 5-12** and **Figure 5-13**). Most of the watershed remains covered with snow and glaciers in winter season. The average gradient of Tangir River in lower 16 km stretch is about 5.3%. The catchment area of the river at its confluence with Indus River is about 914 km^2. The flow in the river is mainly due to glacier and snow melting**.**

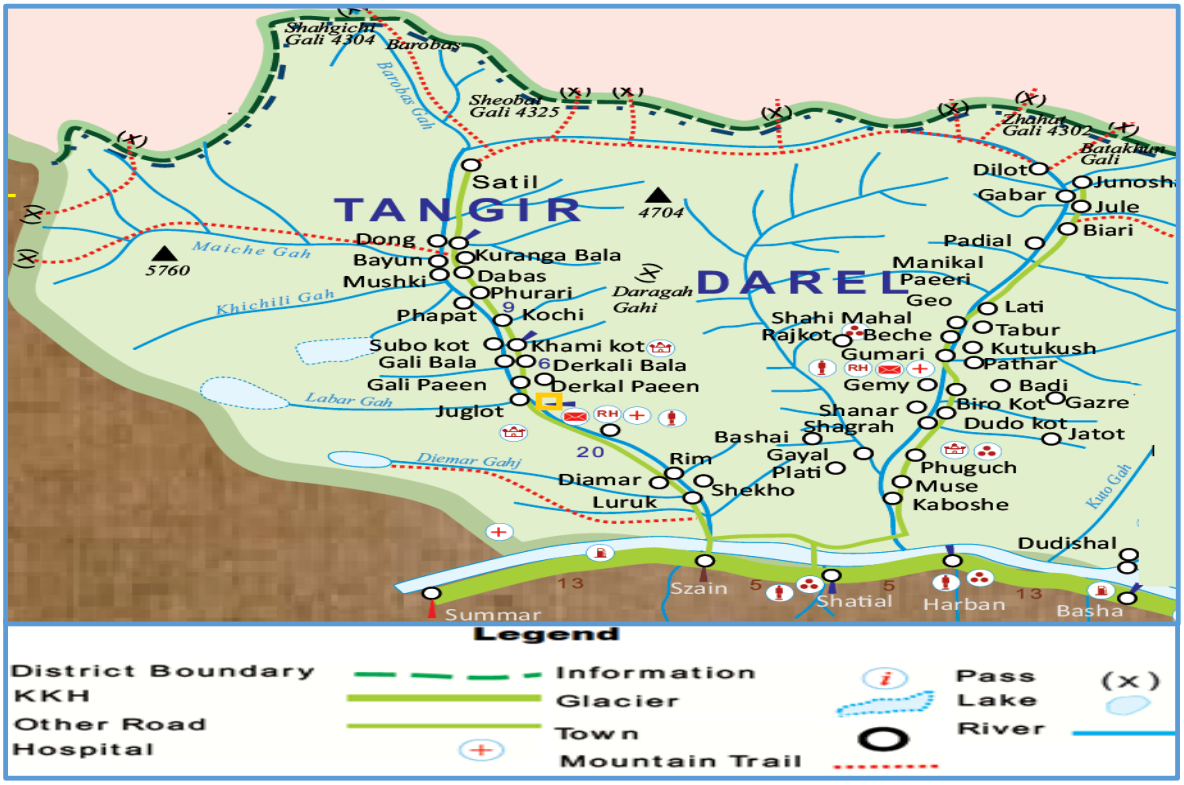


Figure 5-11: Catchment area of Tangir and Darel Rivers

Figure 5-12: A view of Tangir Valley and River.

Figure 5-13: A view of Darel Valley and River.

5.3.9 Spring Water

In Project Area local people mostly use spring water for drinking which is being provided through piped network. Principal source of domestic and household water in the GB is glacial and snowmelt runoff in the form of streams, rivers, lakes and springs. Supply of fresh and flowing water is abundant during summer especially from April to August and then gradually decreases from September to November. Later on, there is snowfall during December to February which results in the shortage of drinking water in the rural areas. Villages at higher altitude use snowmelt, if no other water source is available.

5.3.10 Project Water Quality

Safe and readily available water is important for life, whether it is used for drinking, domestic use, food production or recreational purposes. Improved water supply and sanitation, and better management of water resources, can boost regional economic growth and can contribute greatly to poverty reduction. Sustainable Development Goal target 6.1 calls for universal and equitable access to safe and affordable drinking water. The target is tracked with the indicator of “safely managed drinking water services” – drinking water from an improved water source that is located on premises, available when needed, and free from fecal and chemical contamination.

In the project area, at most of the places both rivers flow in a deep gorge making it difficult to use the water directly for drinking, agricultural and other purposes. All settlements are on the banks of these perennial rivers and generally there is shortage of potable water in the project area as it is very difficult to fetch the river water due to the very steep slopes. At some places rivers water is diverted to settlements through gravity flow and thus its use becomes easy. Springs are another source of water at some places. Main sources of rivers water are rainfall and snowmelt. Initially rainwater as well as snowmelt water do not contain significant impurities. As these waters flow over land, they pick up sediments, salts, toxic elements and bacteria from the surface.

The water samplings were taken from 04 selected locations each at Tangir and Darel Rivers and got analyzed from Gilgit-Baltistan Environmental Protection Agency Water Testing Laboratory. The observed results for water quality parameters are given in **Table *5-16***, which were compared with the National Standards of Drinking Water Quality (NSDWQ). The results show that in general the Microbiological, Chemical and Physical parameters of the tested samples are within (NSDWQ). The TDS of all collected samples is also shown graphically in

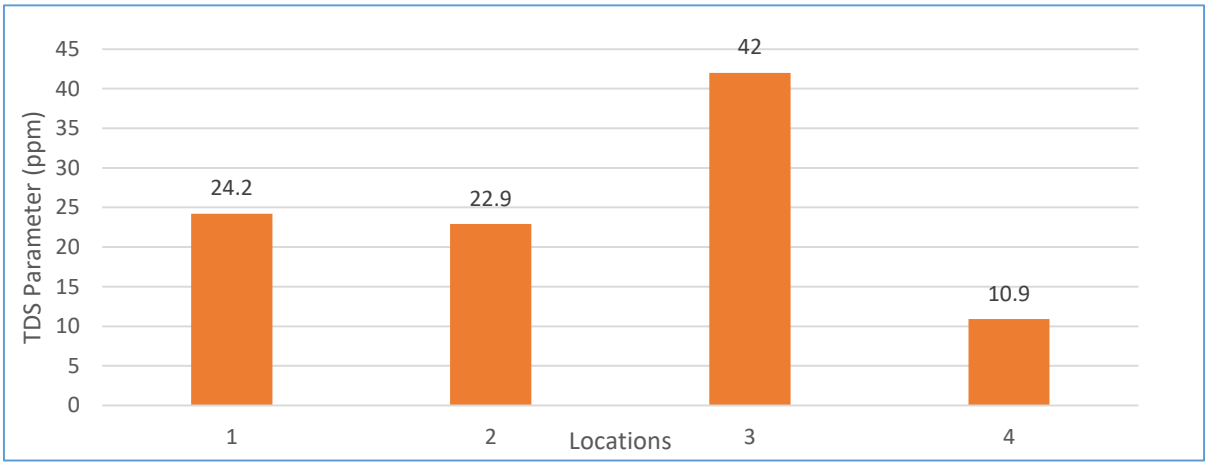


Figure 5-14 and **Figure 5-15**. Detail reports of water testing Lab are attached as **Annexure II*.***

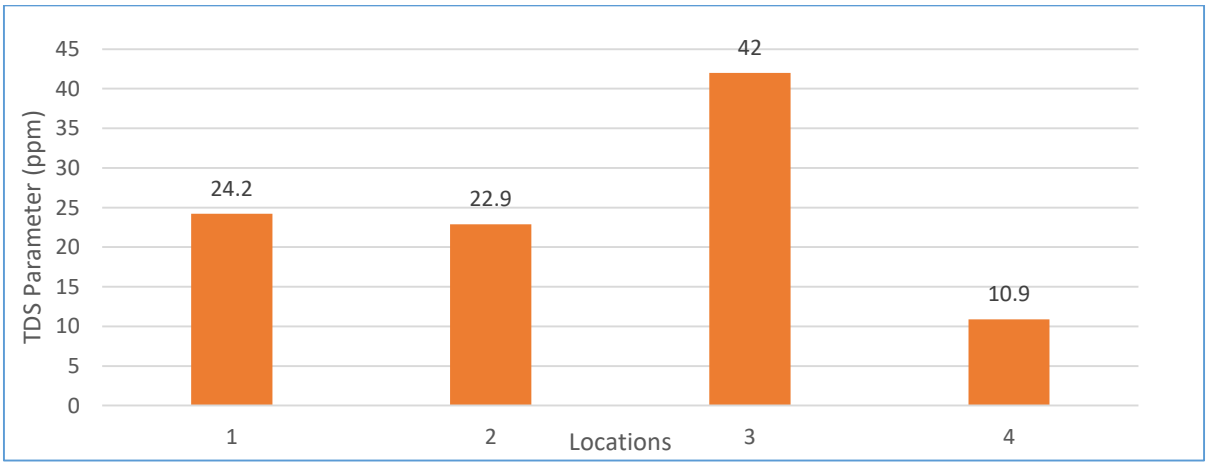


Figure 5-14: Tangir River Water Quality Analysis

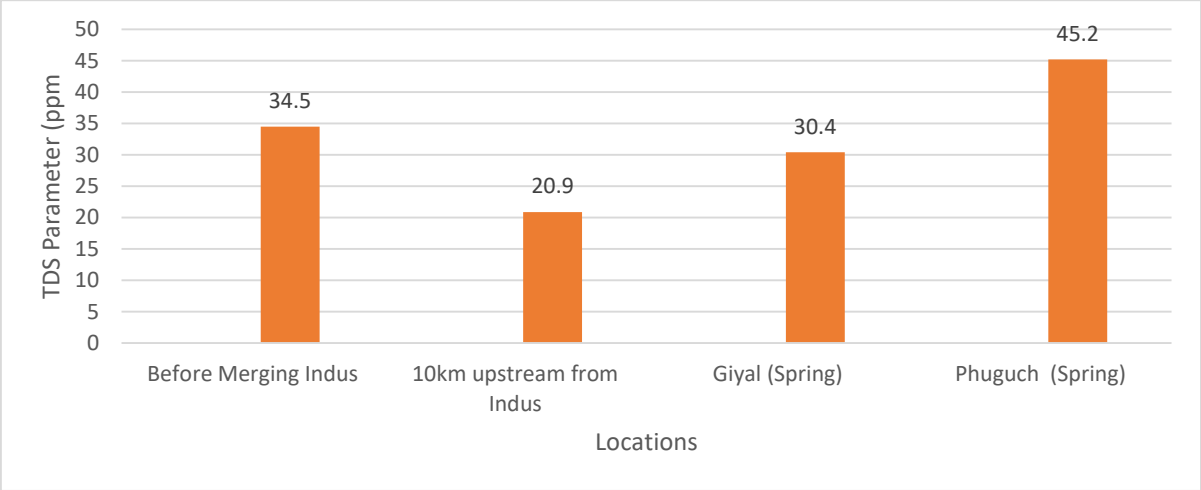


Figure 5-15: Darel River Water Quality Analysis

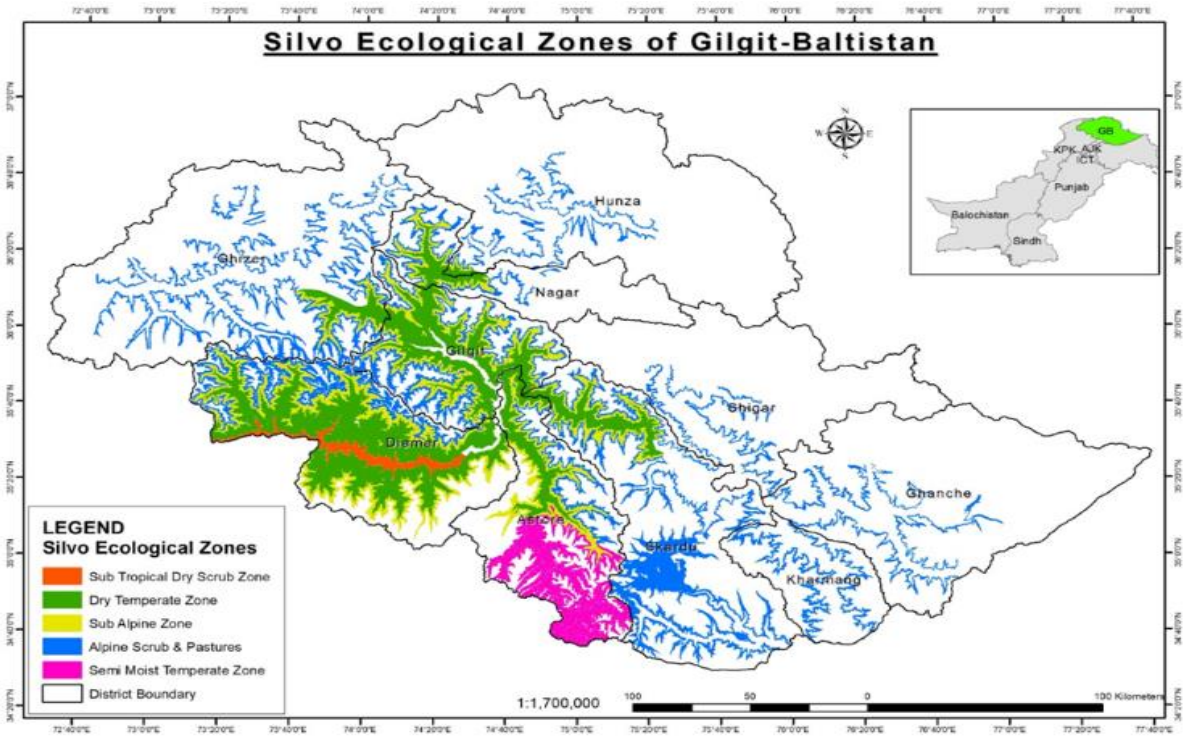
Table 5-16: Results of Water Quality Analysis

Parameters	Unit	NSDWQ	Tangir River				Darel River			
			Before Merging Indus	10km upstream from Indus	Luruk (Spring)	Juglot (Spring)	Before Merging Indus	10km upstream from Indus	Giyal (Spring)	Phuguch (Spring)
Physical										
Color	Un-Object		Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless
Odor	Un-Object		Odorless	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless
Taste	Un-Object		Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
pH	6.5 - 8.5		8.0	7.9	8.1	7.7	8.0	8.0	7.6	7.8
Temperature	°C	-	4	4	4	4	4	4	4	4
TDS	ppm	< 1000	24.2	22.9	42.0	10.9	34.5	20.9	30.4	45.2
Turbidity	NTU	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
EC	µs	2000	48.4	43.8	84.0	21.8	69.0	41.2	60.8	90.4
Chemical										
Nitrate	mg/l	≤50	33.5	21.3	23.5	18.0	0	0	16.3	27.9
Nitrite	mg/l	≤3	1	1	2	2	**0**	**0**	**2**	**3**
Copper (Cu)	mg/l	2	0.08	0.06	0.08	0.08	0	0	0.5	0.3
Aluminum (Al)	mg/l	≤0.2	0	0	0	0	0	0	0	0
Manganese (Mn)	mg/l	≤0.5	0	0	0	0	0	0	0	0
Chromium (Cr)	mg/l	≤0.05	0	0	0	0	0	0	0.02	0.03
Iron (Fe)	mg/l	-	0	0	0	0	0	0	0	0
Zinc (Zn)	mg/l	5.0	0	0	0	0	0	0	0	0
Nickel (Ni)	mg/l	≤0.02	0	0	**0.1**	**0.1**	0.02	0.02	0.1	0.1
Boron (B)	mg/l	0.3	0	0	0	0	0	0	0	0
Microbiological										
E-coli	CFU	0/100 ml	0 col /100 ml	0 col /100 ml	0 col /100 ml	0 col /100 ml	0 col /100 ml	0 col /100 ml	0 col /100 ml	0 col /100 ml

5.4 Ecological Environment

5.4.1 Ecological Zones

Gilgit-Baltistan (GB) is located in extreme north of Pakistan beyond the effective reach of monsoon rains (between 35-37°N and 72-75°E) amidst Himalayas, Karakoram, Hindukush & Pamir mountain ranges. GB has a total geographical area of 7.04 million hectares, dominated by mountains (34%) and natural rangelands (46%), and followed by natural forest (3.58%). Cultivated agriculture lands, farm forests, cultivable waste and uncultivated waste constitute 10% geographical area (GBFD, 2016). In general Gilgit-Baltistan can be defined by 5 ecological zones (**Figure 5-16**).



Source:https://forestrypedia.com/suitable-species-for-different-silvo-ecological-zones-in-gilgit-baltistan/

Figure 5-16: Ecological Zones of Gilgit - Baltistan

Ecological environmental description of the project area is mentioned below:

1) Dry Alpine zones & Permanent Snowfields with glaciers, boulder fields and sheer cliffs at higher elevations in the northern parts of Hunza, Nagar and Baltistan.
2) Alpine Meadows and Alpine Scrub of wildflowers, grasses and sedges dispersed through the region between high valleys and permanent snowfields around 3,000-3,800m.
3) Sub-Alpine Scrub mostly in the south and western parts in Gilgit, Skardu, Ghizer and Astore, consists of small deciduous plant species.
4) Dry Temperate Coniferous Forest on inner slops of Himalaya between 1,500-3,400m in the central and southern parts of Gilgit-Baltistan.
5) Dry Temperate Evergreen Oak Scrub lying between 1,500-2,500m in the southern parts of Astore and Diamer.

5.4.2 Flora of the Area

The forest covered area in Diamer district is more than any other district in Gilgit-Baltistan. The forest cover about 217, 000 hector, which constitutes more than 75/% of total forest in Gilgit-Baltistan. All the forest has been classified as private and communal forest. Unfortunately, the forest reserve is depleting very rapidly due to uncontrolled cutting of forest. The forests of the region are owned by local people.

To overcome poverty and to fulfill needs people are cutting trees and selling in down country. Another reason of deforestation is non-availability of alternate fuel for cooking, heating and lighting. The area is rich in forests and vegetation is comprised of pine, spruce and other trees. From the satellite image it can be seen that upper part of the valleys is very rich in vegetation and looks very green. During summer the area becomes green and in winter season all the leaves of trees fall down and area exposed (**Figure 5-17**).

Figure 5-17: A View of natural vegetation cover in Project area.

The main crops are grown on the projects is potatoes, pea, wheat and barley. A special importance is given to the cultivation of fruits. Fruits are grown for household consumption as well as for market sale in the dry form. Fruits include apricot, walnut, grapes, apples, pears and mulberry. There may be some variation in the farm size or in the status of minor crops in the overall cropping practices but the general combination of crops; livestock and other farm related activities are more or less the same. Majority of the trees are grown on the field boundaries and banks of watercourses.

The flora of the valley can be divided in to three categories: weeds, desert type, native plants and high alpine plants. Weeds are mostly found near the cultivated fields. Desert type native plants grow on cliffs, sandy soils below springs and along streams.

Satellite image of Forest Area in Tangir and Tangir valleys is shown in **Figure 5-18**. The Land cover of District Diamer is presented in **Table 5-17** and **Figure 5-19** and **Figure 5-20**. Common trees of Tangir Valley including medical and important plants available in District Diamer are presented in

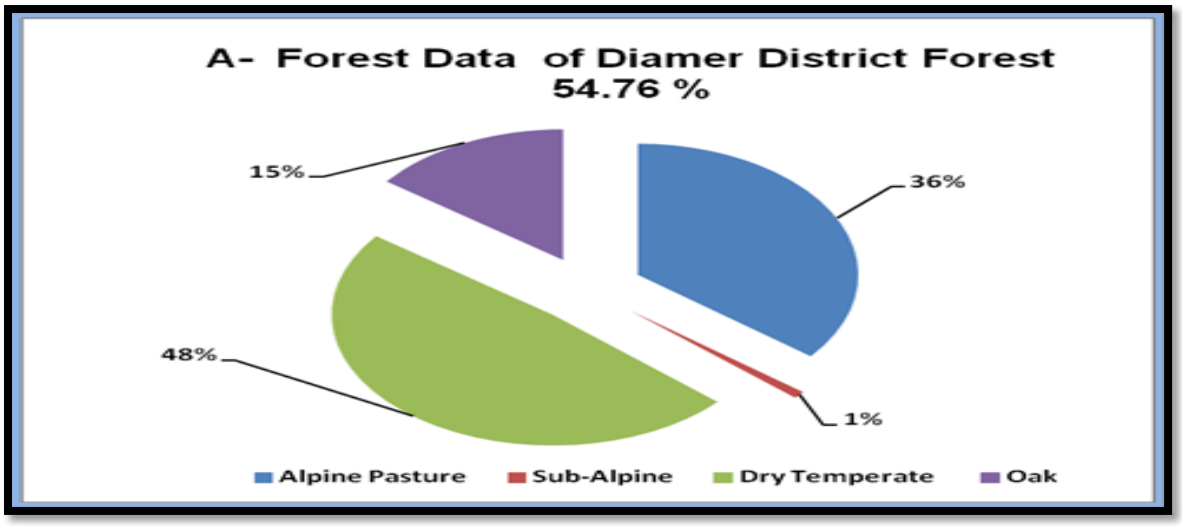


Figure 5-19: **Forest Data of Diamer District Forest 54.76 %**

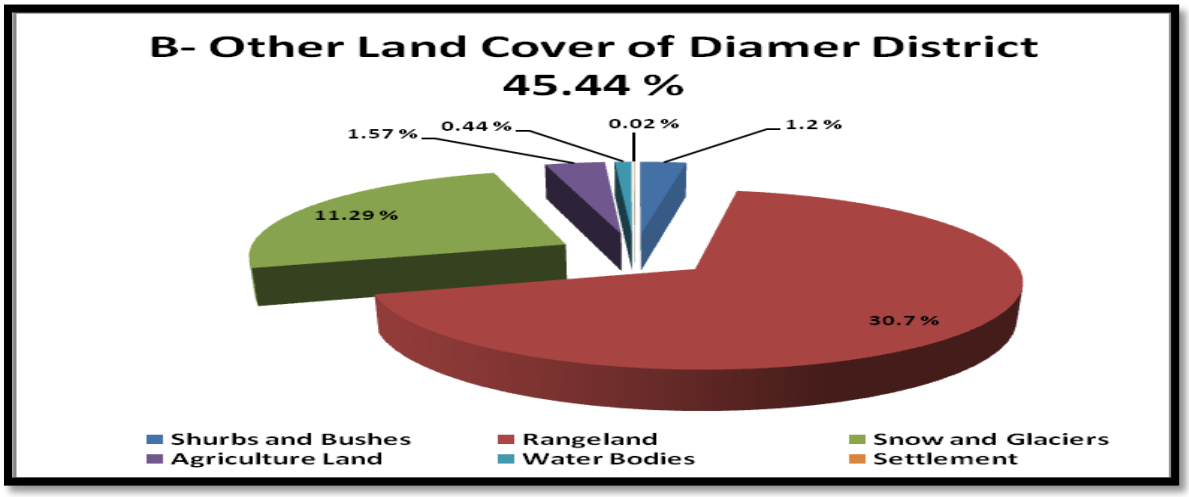


Figure **5-20: Other Land Cover of Diamer District 45.44 %**

Table 5-18 and **Table 5-19**.

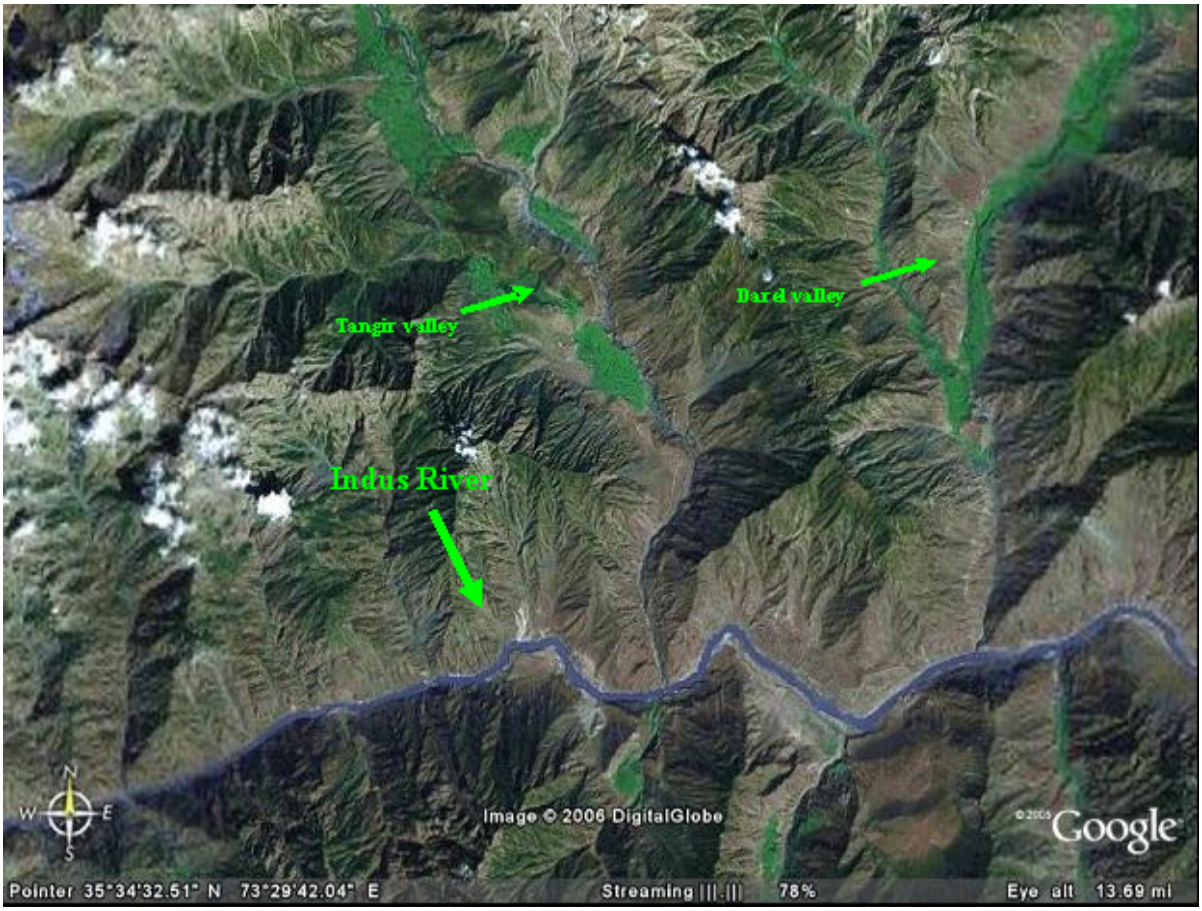


Figure 5-18: Satellite Image of Forest Area in Tangir and Darel valleys

Table 5-17: Land Cover of District Diamer-GB

Sr. No	Land Cover	Area (H)	%
	A-Forest		
1.	Alpine Pasture	136, 222	19.54
2.	Sub-Alpine	3,429	00.49
3.	Dry Temperate	185,760	26.65
4.	Oak	56,317	08.08
	Sub-Total	**381,728**	**54.76**
	B-Other Land Cover		
1.	Shrubs and Bushes	8,265	01.20
2.	Rangeland	214,189	30.70
3.	Snow and Glaciers	78,725	11.29
4.	Agriculture Land	10,978	01.57
5.	Settlement	158	00.02
6.	Water Bodies	3,061	00.44
	Sub-Total (B)	**315,376**	**45.44**
	Total (A+B)	**697,104**	**100.00**

Source: PFI Peshawar 2012

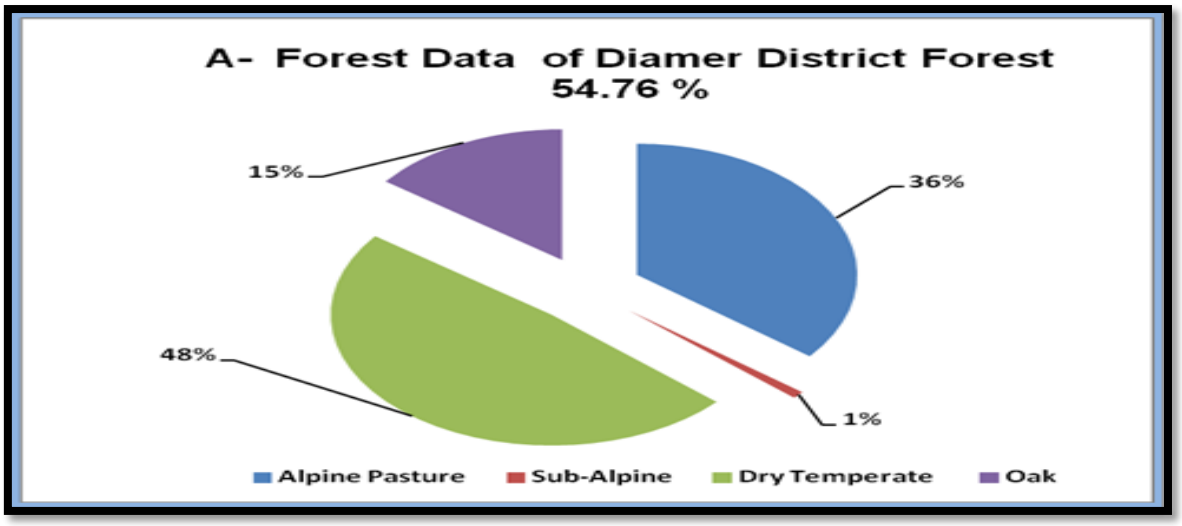


Figure 5-19: **Forest Data of Diamer District Forest 54.76 %**

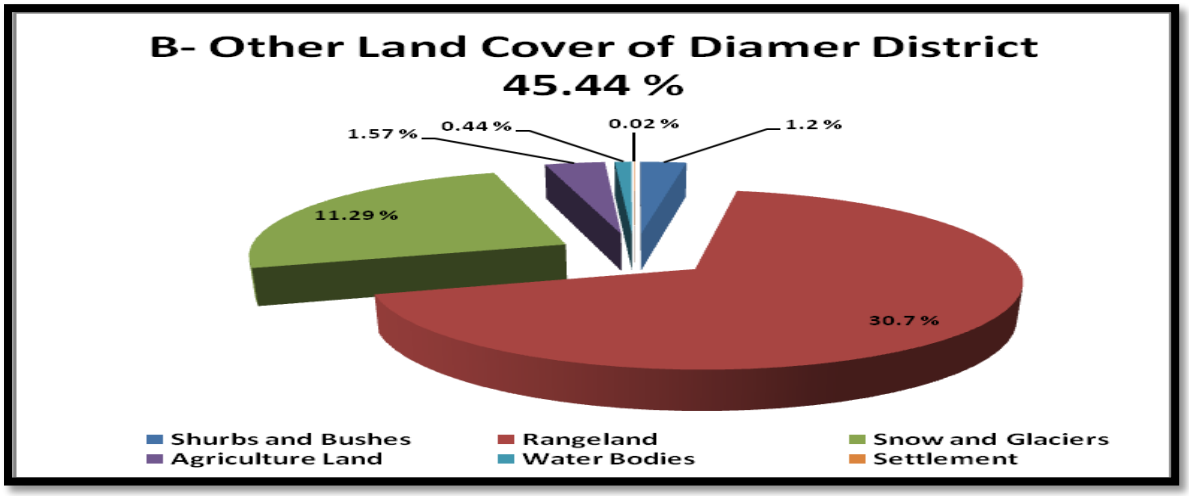


Figure 5-20: Other Land Cover of Diamer District 45.44 %

Table 5-18: Common Trees of Tangir Valley [2]

Sr. #	Botanical	Local Name	English Name	Type
1.	*Dalbergia sisso*	Sheesham	Sisso	Tree
2.	*Populus euphratica*	Frash	Himalayan poplar	Tree
3.	*Salix spp*	Bisee	Willow	Tree
4.	*Prnnusporsica*	Aroo	Peach	Tree
5.	*Pinus gerardiana*	Chalghoza	Pine	Fruit Tree
6.	*Jaglans regia*	Akhrot	Walnut	Fruit Tree
7.	*Amjgdaluscomnnis*	Badam	Almond	Fruit Tree
8.	*Mours alba*	Shahtoot	Mulberry	Fruit Tree
9.	*Vitis venifera*	Angoor	Grapes	Fruit Tree
10.	*Prnnusarminica*	Khubani	Apricot	Fruit Tree
11.	*Pyrus malus*	Seb	Apple	Fruit Tree

Sources: Forest Department, District Diamer-GB

[2] Forest Department, District Diamer-GB

Table 5-19: Medical and Important Plants available in District Diamer [3]

S. No.	Scientific Name	Local Name
1.	*Aconitum heterophyllum*	Atees
2.	*Artemisia marimia*	Afsantin
3.	*Carum spp*	Zeera Saffed
4.	*Cumium cyminum*	Kamsal Zeera
5.	*Ephedra spp*	Som (Asmanibuti)
6.	*Ferula foetida*	Hing
7.	*Glycyrrhiza glabra*	Mulathi
8.	*Hippophae rhamnoides*	Buru (See Buckthorn)
9.	*Onosma spp*	Goazaban (Raanjot)
10.	*Picrorhiza kurroa*	Karru (Katki)
11.	*Podophyllym*	Bankakri
12.	*Rheum emodi*	Revand chini
13.	*Saussurea lappa*	Kuth
14.	*Thymus serpyllum*	Tumuro
15.	*Valeriana wallichii*	Mushbala

Source: EIA DBDP-2010

5.4.3 Fauna of the Project Area

5.4.3.1 Wildlife

Diamer has the highest avian-diversity in Gilgit-Baltistan with 321 bird species are found in the district, with the highest number (175 species) being Passeriformes (perching birds). Some snapshots of different birds in Project Area are presented in **Figure 5-21**. This group includes a variety of flycatchers, finches, warblers, corvids, buntings, redstarts and pipits, with some lowland and Himalayan species.

According to Virk, et al. (2003), the Gilgit Baltistan area has one of the most diverse avifauna of the mountain region of the world. However, there is a lack in the biological data on the distribution, status, diversity and ecological distribution of biodiversity. Some researchers have documented the biodiversity of certain parts of Gilgit Baltistan. A number of globally significant species of mammals and avifauna such as the flare-horned Markhor or Astore Markhor (Capra falconeri falconeri) and Ibex have been reported on top of the hills. Simultaneously, Blake Bear has also been reported in upper valleys area. Its appearance is reported in winter season). Other common animals are the Leopard, Jungle cat, Jackal and Foxes are also reported. The Wildlife of the project area is mentioned in **Table 5-20**.

[3] EIA DBDP-2010

Table 5-20: Name of Mammals of the Project Area [4]

Sr. No.	Name	Scientific Name	Status
1.	Black Bear	*Ursus americanus*	Available in Upper Valleys
2.	Markhor	*Capra falconeri*	Endangered Species
3.	Ibex	*Capra aegagrus*	Endangered Species
4.	Fox	*Vulpes bengalensis*	Lower Valleys Common
5.	Red Fox	*Cannisvulpes*	Common
6.	Jackal	*Canis sp.*	Least Concern
7.	Rabbit	*Rodentia sp.*	Least Concern

Figure 5-21: Snapshots of Different Birds in Project Area

5.4.3.2 Terrestrial Fauna

Terrestrial fauna of the area comprised of domestic animals including dogs, sheep, goats, cows, donkeys and yaks. The wildlife in Project area and its surrounding is famous for its faunal diversity (mammals, residents and migratory). List of wild animals found in the area is given in **Table 5-21**.

Table 5-21: List of Wild Animals found in Project Area.

Sr. No.	Scientific Name	Common Name	Local Name
1	Capra ibex ibirica	Himalayan Ibex	Kill Mayaroo

[4] Forest and Wildlife Department, District Diamer-GB

Sr. No.	Scientific Name	Common Name	Local Name
2	Vulpes vulpes montana	Red fox	Loee
3	Lepus capensis	Cape hare	Ushayoo
4	Uncia uncia	Snow Leopard	Dee
5	Felis lynx	Himalayan lynx	Bug bayaro
6	Canis lupus	Wolf	Shahaal
7	Ursus arctos	Brown bear	Ich

5.4.3.3 Avifauna

Many bird species have been reported in and around the Project Area. These include passage migrants, vagrant, resident, breeding and irregular visitors. The migratory birds descend from higher altitudes during the winter months. The data of avifauna observed and reported in the project area are given in **Table 5-22**.

Table 5-22: Avifauna of Tangir valley

Sr. No.	Common Name	Scientific Name	IUCN Status
1.	Red-legged Partridge Chakor	*Alectoris Chukar*	Threatened
2.	Monal pheasant	*Lophophorus impeyanus*	Endangered
3.	Hawk cuckoo	*Cuculus varius*	Least Concern
4.	House sparrow	Passer domesticus	Common
5.	Grey tit	*Parus major*	Least Concern
6.	Ring Dove	*Zenaida* sp.	Vulnerable
7.	Rock Pigeon	*Columba livia*	Threatened
9.	White cheeked bulbul	*Monticola solitaries*	Least Concern
10.	Myna	*Acrido therestritis*	Least concern
11.	Koel	*Coturnix coturnix*	Threatened
12.	Crow	*Corvous corone*	Threatened
13.	Paddy bird/ Pond Heron	*Ardeola grayii*	Threatened

5.4.3.4 Endangered, Threatened and Vulnerable Species of Fauna

The IUCN red list of Endangered, Threatened and Vulnerable Species in Gilgit-Baltistan is shown in **Table 5-23**.

Table 5-23: The IUCN red list of Endangered, Threatened and Vulnerable Species in Gilgit-Baltistan.

Category	Species	
	Scientific Name	Common Name
Endangered Species	Capra flconeri	Markhor
	Eupegaunus cinereus	Wolly flying squirrel
	Ovis vigneri	Ladakh Urial

Category	Species	
	Scientific Name	Common Name
	Unica Unical	Snow Leopard
Vulnerable Species	Ursus thibetanus	Asiatic black bear
Threatened Species	Naemorhedus goral	Grey goral
	Moschus chrusogaster	Musk deer
	Matmota caudate	Long-tailed marmot
	Pseudois nayaur	Blue sheep

5.4.3.5 Insects

Gilgit-Baltistan is rich in biodiversity of insects including butterflies found in the project area, particularly during humid month of July and August. In addition, caterpillars, bugs, beetles, black bees, weevils, mosquitoes, ants, green aphids, codling moths, leaf miners, mitts, fruit flies, woody aphids, stray grass hoppers, leaf hoppers, mealy/ wooly bugs, peach leaf curling aphids, scale insects, walnut weevils, blister mites, and dusky veined aphides etc. are found in Gilgit-Baltistan **(Figure 5-22)**.

Figure 5-22: Photo album of insects and butterflies found in project area.

5.4.3.6 Fisheries

All the streams of the regions are protected by the local government and using of explosive devices and nets are strictly banned. Sport fishing is allowed by angling and obtaining of license is prerequisite. Tangir Nullah is very steep and short. The stream is fed with snow melting and springs. The bed is comprised of big boulders. Nullah is characterized by, steep gradient, crystal clear water during winter season, turbid in summer, channel bed with large boulder and gravel bars. The water has little organic matter. pH is quite within the range of 6.5 to 8.0. There is limited information available about fish catch and consumption within the river communities.

Schezothorax plagiostomas (Brown Trout) locally known as Gahi Chumo and Cyprinus carpio Common carp locally known as chumo are the most abundant and common in the Tangir valley **(Table 5-24)**. Tangir Nullah is perennial stream fed by snowmelt. The quality of water is good as anthropogenic pollution at present is bare minimum. The use of fertilizer and pesticides is no common. The construction of the project will not have any significant adverse impact the aquatic life of the stream.

Table 5-24: Fish Fauna of Tangir River

Sr. No.	Common Name	Scientific Name
1.	Gahi Chumo (Brown Trout)	*Schezothorax plagiostomas* (Brown Trout)
2.	*Cyprinus carpio*	Common carp (Desi Chumo)

5.4.3.7 Ecological Sensitive Area

In District Diamer, two Environmentally Managed Conservation Areas (EMCA) are Nanga Parbat National Park and Himalaya National Park. These areas are managed for the protection and conservation of wildlife, particularly the Ladakh Urial and musk deer, respectively. Both parks are located in Diamer and Astore districts.

5.5 Socio-economic Environment

5.5.1 Overview

The socio-economic baseline has been developed in line with tasks outlined in the Terms of Reference for the assignment. Socio–economic baseline of the project area has been established by utilizing both primary and secondary data sources. In addition, baseline was strengthened by ''Focus Group Discussion'' conducted within the project area of the proposed project. During FGDs, primary data has been collected from selected random sample villages/communities through formal and informal consultation with primary and secondary stakeholders.

Socio-economic baseline has been developed with the aim of having information about main socio-economic characteristics prevailing in the project area. The study will also serve the purpose of providing knowledge about the livelihood and other main conditions of the primary stakeholders of the project area which will help to plan the project which will be socially acceptable and beneficial for the area. Baseline information consists of both secondary and primary sources of data. Main sources of secondary data are various projects reports about Gilgit-Baltistan as well as project documents. While primary data was collected from villages through a field survey by the consultants.

There were two basic aims of the survey; firstly, to inform and consult the local communities about what is the proposed project and what would be the likely interventions and impacts and secondly to carry out an in–depth socio economic survey of the communities living within the area of the proposed project to establish the baseline and socio-economic parameters of the study area will be recorded. Some basic objectives of the study presented as under;

- To know about the socio-economic conditions, depth and associated social characteristics of the communities in the targeted area.
- To assess the existing situation of the proposed project area.
- To analyze the socioeconomic impact of the proposed project on the adjacent communities.
- To collect the community's expectations and fears about proposed project.
- To specify the issues to cater during the project implementation.
- To build a prior trust between stakeholders of project and concerned communities.

5.5.2 Approach and Methodology for Socio-economic Survey

The following two approaches has been adopted for data collection:

- Consultative approach
- Participatory approach

A consultative approach has been adopted with the aim of completing a survey for information collection, which based on shared expectations and joint ownership. The process has been started with review of the previous data/studies/investigation/survey reports for the need of the project. A participatory approach advocates actively involving 'the community' in decision-making processes, whereby the relevant 'community' depends upon the topics addressed during the consultation. The community can be informant persons, average citizens, the stakeholders of a particular project or policy, experts and even members of government and private industry. In general, policy processes can be seen as a three-step cycle of planning, implementation and evaluation, whereby a participatory approach may be used in some or all of these steps.

Consultation data was collected from settlements, which is located alongside the proposed roads. The settlements were randomly selected in such a way that the selected sample is the true representative of the project area. The community member's responses and feedback have provided valuable information on perceptions and opinions on socioeconomic conditions in the project area.

5.5.3 Important Socioeconomic Features

Important features of the socio-economic baseline of the Diamer district have been described as following:

- Administrative Setup
- Demographic Status
- Races and Tribes
- Historical Significance
- Tourism and Economic Importance
- Social and Religious Life
- Sports / Fairs / Festivals
- Economic Condition
- Infrastructure and Services
- Mechanism for Resolving Disputes

5.5.3.1 Snapshot of the Diamer District [5]

The district is bounded by the Ghizer and the Gilgit districts in the north, on the east by the Astore District, south by the Naran District of Khyber Pakhtunkhwa Province and the Neelum District of Azad Kashmir, and on the west by the Upper Kohistan District of Khyber Pakhtunkhwa Province. Diamer District's areas is about 6,780 sq. kms, and compared to other districts of Gilgit-Baltistan, Diamer is mostly covered by Western Himalayan subalpine temperate coniferous forests, with highest forest cover in the region. Higher elevations are predominantly alpine shrub and meadows of montane grasslands and shrublands. Overall, the district has more than 25% land under forest or tree cover (including farm forests and plantations), with 20% of the land comprising of alpine and winter pastures. Less than 1% of the land is used for agricultural and settlement purposes. More than 53% of the remaining land area is either barren or permanently snow covered.

5.5.3.2 Administrative Setup

Like other Districts the Deputy Commissioner supervises the activities of all the departments at district level. Whereas at sub-divisional level, the Assistant Commissioner and Additional Assistant

[5] https://www.birdsofgilgit.com/districts/diamer

Commissioner are responsible for the smooth running of the activities of all government departments in the sub-divisional level. The major concern is the maintenance of law and order and development in the district as District Magistrate/Administrator. Deputy Commissioner is the District Collector and in charge of district record room and treasury.

5.5.3.3 Demographic Status [6]

According to Gilgit-Baltistan at a Glance 2020 Report, the population of District Diamer is 0.26 million with household size is 8.1 including 3.13 growth rate. The area is 7234 km².

5.5.3.4 Races and Tribes [7]

There are two types of tribes living in the proposed project area: local; and non-local. The main local tribal clans are Sheen, Syeds, Yashkun and Kameen. The other population in the inner project area are 'so called' non-locals and comprise: Soniwals; Gujar; and Swatis besides the settler tribes of Kohistani, Pattan, Woolmaker, Jalkoti, Lohar and Kashmiri. Community is divided along the lines of tribes. The tribal system in the project areas follows its own codes of conduct and justice. A very important self-governing community vehicle is the Jirga. This is an assembly of the aldermen, which deals with all aspects of social life of the entire community including conflicts about land, water, family and religion. etc. The tribes are very closely organized and bounded through kinships. Tribal leadership is still intact and codes are rigidly implemented. Efforts made previously by the Government to bring socio-economic changes have been largely unsuccessful for the simple reason that basically the physical power was used as an intervention.

Even 'Non-Local Tribes' arrived in the area from different parts of the country centuries ago. However, in the project area, majority of these ethnics have less land, limited work opportunities, lower incomes, inferior housing, and more afflicted by mal-nutrition and poor physical and mental health. The non-local tribes are generally engaged in cultivation and animal husbandry. Their status of the ownership is only limited to few purchase(s) or land leases from local tribes. However, the majority of relatively effluent shopkeepers in the project area belong to non-local clans. Particularly in Chillas, there is a group of rich Soniwals, who are the owners of business properties such as hotels, shops, petrol pumps, workshops and saw machines.

5.5.3.5 Historical Significance

Diamer has a rich history dating back thousands of years. The region has been inhabited by various ethnic groups over the years, including the Dardic peoples, who are believed to have migrated to the region from Central Asia. Throughout its history, Diamer has been ruled by various empires and dynasties, including the Maurya Empire, the Kushan Empire, and the Mughal Empire. The region was also an important center for trade and commerce, with the ancient Silk Road passing through the area. The region is home to several historical landmarks and structures, including ancient forts, palaces, and temples.

5.5.3.6 Cultural Significance

Diamer is home to a diverse range of cultures and traditions. The region has a rich musical heritage, with traditional music and dance forms such as the dhamal and the damal being popular among locals. Religion also plays an important role in the culture of Diamer, with Islam being the predominant religion.

[6] Gilgit-Baltistan at a Glance 2020 Report.
[7] EIA report of Diamer Bhasha Dam.

5.5.3.7 Tourism and Economic Importance[8]

Tourism has become an important industry in Diamer, with the region attracting thousands of visitors each year. The development of the tourism industry has had a significant impact on the local economy, providing employment opportunities and generating income for local businesses. However, there are also concerns about the impact of tourism on the environment and the local community. Some of the most popular tourist attractions in the region (**Figure *5-23***) include the Darel Valley, Chillas Valley, Thalpan Petroglyphs, Babusar Pass, Fairy Meadows and Nanga Parbat.

Darel Valley

Chillas Valley

Thalpan Petroglyphs

Babusar Pass

Fairy Meadows

Nanga Parbat

Figure 5-23: Popular Tourist Attractions in the Region

[8] https://visitgilgitbaltistan.gov.pk/district/id/4

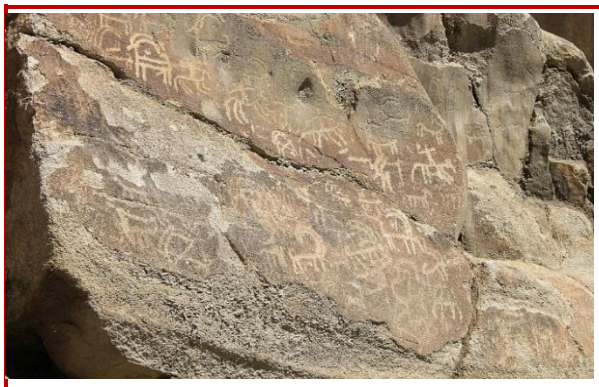
5.5.3.8 *Social and Religious Life* [9]

Religious leaders, as compared to other areas in Pakistan, have large influence on the local population. Most of the people belong to Hanfi Sunni Sect. Local religious leaders have strong hold on the social set-up of the area. There prevails a sense of suspicion about outsiders, particularly, about development agencies and NGOs having some hidden agenda of social change. In particular, NGOs are considered as a threat to the existing social structure and traditions. Thus, the information disseminated through Imams of the mosques is considered more reliable. Due to influence of Islamic leaders and the distance from other parts of the country, dissemination of daily general information is very limited. Electronic media such as television is still very much abhorred by the local religious leaders. Newspapers are not easily available in the villages. Anyway, due to the high illiteracy rate only few people would be able to read them. Thus, most of the information is disseminated by the Imams through sermons of Friday prayers.

5.5.3.9 *Archeological and Historical Sites*

Following is the list of cultural heritage sites in District Diamer (**Figure *5-24***);

- Rock carvings at Butogah near Chillas.
- Rock carvings at Thalpan near Chillas.
- Rock carvings at Thor near Chillas.
- Rock carvings at Ziarat (near Talpan).
- Buddhist complex with images of Buddha and stupas c. 4th or 5th century AD.



Rock carvings at Butogah

Rock carvings at Thalpan

Images of Buddha

Rock carvings at Thor

Figure 5-24: Cultural heritage sites in District Diamer

[9] EIA report of Diamer Bhasha Dam

5.5.3.10 Sports / Fairs / Festivals

At the point when the yields, a couple of months prior, are prepared for reap, a celebration is held. Local people praise the yielding season to say thanks to God for his favors. With unrecorded music playing, the ranchers celebrated in the dance, and everybody imparted their satisfaction to one another through food and greetings.

One more polo celebration in the district is the Babusar Polo Championship held in August consistently at the most elevated polo arena on the planet. Groups from various GB locales participate in the opposition and gave a useful encounter to guests from everywhere in the country. The celebration additionally incorporates back-and-forth rivalries, tent plunging, paragliding, photography shows, jewel shows, handiwork shows, horseback riding and huge bonfire parties (**Figure *5-25***)

Figure 5-25: Cultural Events of the Project Area

5.5.3.11 Economic Condition

a) Livelihood

Livelihood of the population of the project area mainly depends on agriculture and livestock raring. People here are mostly farmers as the land is very fertile for certain crops such as Wheat and Maize. Moreover, fruit production is remarkable like Peer, Peach, and Apple. Goat farming and cattle rearing also generate major cash flows for the inhabitants here. Milk production is comparatively higher here than in other cities. Same is the story of wheat production. People over here are greatly dependent on agriculture production: their marriages, their house construction plans, their celebrations (Eid) and even their moods and behaviors are closely connected to their agricultural income and outputs.

b) Main Occupations

Main occupation of the project area is agriculture. Tenure system includes non–cultivating owners, cultivating owners, tenants and agricultural laborers. However, educated persons are also engaged in public and private service. People of concerned area are also employed in Pakistan Armed Forces. The majority of the people in the project area are working in nearby cities. Small businesses, shop keeping, private or government services are the other occupations of the people in the project area. Poor segment of population mainly counts on agricultural and unskilled Labor activities.

c) Crops

Agriculture has historically played an important role in providing sustenance to large part of GB population despite the limited amount of irrigated arable land. Around 1.2% of total GB area is currently cultivated. All productive lands are either mountain side terraces or fields carved out of alluvium deposits along the rivers and streams that are watered through glacial melt-based gravity flow water channels. Land ownership is quite small at an average of 0.6-0.8 acres per household and being further fragmented due to inheritance divisions and erosion by water bodies. Through the opening of KKH in 1980s, the improved connectivity to outside world has induced a rapid transition in agriculture from traditional staple crops to cash crops and higher value fruits. The natural agro-climatic advantages of the area, which allows it to produce rest of country's winter crops during the summers and sell them as "off-season" products at a premium, offers great promise for further development. However, this would require further investments in expansion of current limited irrigated area, improved productivity and better connectivity to markets.

Irrigated cropping pattern in the area is dominated by wheat (winter) and maize (summer) as can be seen from the related statistics for the entire Diamer district listed in **Table 5-25**.

Table 5-25: Estimated Cropped Area and Yields in Diamer District

Crop	Area (Hectares)				Average Yield (t/ha)
	Winter Crop	Summer Crop	Total	(%)	
I. Winter					
Wheat	6,678		6,678	50.0	1.8
II. Summer					
Maize		5371	5371	40.3	2.0
Barley		253	253	1.9	1.6
Potato		520	520	3.8	25.0
Vegetable		530	530	3.9	20.0
Sub-Total (II)	**6,678**	**6,674**	**6,674**	**100.0**	
Annual Total (I+II)	**6,678**	**6,674**	**13,352**	**100.0**	

Source: IUCN, (Gilgit-Baltistan) Strategy for Sustainable Development

Main winter crop of wheat is grown between November and April-May. Moisture is only needed at pre-planting stage in autumn after maize harvest. Later on, winter rain feeds the wheat plants. Wheat is the staple food of the population and its straw is also used as fodder in dry form.

Immediately after wheat harvest, the summer crops are sown. It can be seen from Table Above that in summer most (around 80%) of the cultivated land is covered by maize, which is also used for flour production including fodder stock for the domestic animals in winter. Some of the other crops are barley and potatoes. Besides home consumption, the farmers with relatively large land holdings also sell

potatoes in the market for export to Abbottabad, Mansehra and Islamabad. Different types of beans such as Soya, Mung and Mash are sometime also grown in maize as intercrops.

Essentially, a similar cropping pattern is followed in all the valleys, with minor variation in areas under different vegetables. During field investigations, a healthy wheat crop was noted in Bunar Das Valley with resultant increased yield through good management.

Vegetables such as tomato, potato, spinach, okra (ladyfinger) onions, and chilies are grown successfully in the area. Due to the small size of land holdings, only nominal surplus of vegetables is marketed in Chillas. In addition, there are serious limitations in transportation and marketing. These conditions prohibit growing of vegetable on a commercial scale. Following table evidenced the statistics of different vegetables **Table 5-26**, and **Figure *5-26***.

Table 5-26: Area, Production, Consumption and Marketing of Different Crops in Diamer Division

District	Crop	Area (Hectares)	Production (Tons)	Consumption (Tons)	Marketed (Tons)	Estimated revenue (RS. Millions)
Diamer	**Green Pea**	600	3900	117	3783	265
	Capsicum	200	8000	240	7760	776
	Potato	456	9120	274	8846	442

Source: Agricultural Statistics GB 2014

Figure 5-26: Photograph taken from the office of agricultural department Chillas showing Area, Production, Consumption and Marketing of Different Crops in Diamer Division

d) Livestock

Some livestock like bullocks, goats and sheep are kept by the residents in the project area. Bullocks are used for agricultural farming, whereas cows, goats and sheep are reared for milk and meat and hides. Some of the stock goats and sheep (5-10%) are sold from time to time to meet the financial needs of the family. Some donkeys are also seen in the area and used to carry small loads including carriage of grains to the nearby flourmills. Health standard of livestock is generally very poor. Probably, the farmers cannot afford to put sufficient areas under fodder at the expense the staple crops of wheat and maize.

The goats and cows are the main livestock of the project area and are kept in large numbers. The goat herds are variable having different number of heads. Generally, a herd consists of 50-200 heads. The herds are looked after by the shepherds throughout the year. Some poultry is also raised by the farmers which mostly meets requirements of the family. Taking care of poultry is the responsibility of females while livestock rearing is the responsibility of males. Mostly the poultry birds belong to some local breed with egg laying capacity of 60-80 eggs per year against 120-150 eggs per year in some hybrid breeds. In low lying valley of Hodar, ducks are also raised with egg production as low as 20-40 per year.

e) Irrigation

Since no irrigation water can be extracted from the Indus River, communities have constructed irrigation channels in the side valleys. The water in the Nullahs at higher elevations is diverted from the stream in order to bring it on to the cultivated lands in downstream locations. Due to limited irrigable land in the narrow valleys, most of the irrigation channels are small. The intakes are made up of stone masonry. The local people have knowledge and experience from ages as to how the intakes can operate under fluctuating water level in the stream. However, these small channels are often in an ill state of repair and maintenance.

f) Mineral Resources and Gold Washing

The geological conditions due to the dominant, though highly folded, ultra-basic rocks are unsuitable for mineral resources such as coal, oil and gas. Even limestone or marble for production of cement or other construction materials are not available in the project area. Only rocks, gravels and sand suitable for construction of small houses, walls and fences between the cultivated plots are found in abundance. The only mineral resource, sold on the local markets, is some precious stones such as opal, aquamarine, emerald, and ruby.

The alluvial sediment between Bunji and Shatial, seasonally deposited along the banks of the Indus River (coming from upstream sources), contains a very small proportion of gold. Gold occurs in small sand like grains and has an extremely low concentration in the sediments. Therefore, from industrial point of view, this extraction is uneconomical. However, gold washing from the local point of view is a significant occupation and an important income source of about 500 Soniwal households, predominantly from villages such as Nima, Sine Huch, Soniwal Hit and Chillas. Opposite to Ges Pain, directly on the left bank of the Indus River Soniwal people have erected 20 very poor kacha houses since the last few years. This location is now-a-days permanently settled and named Yashokal Hit.

Soniwal gold extractors washers are well experienced to search the locations of gold extraction through a difficult and laborious procedure. During collection season along the Indus River banks from September up to the rise of water level in spring and early summer, the entire families of Soni wals are moving with tents along the river sand banks.

5.5.3.12 Social Infrastructure and Services

a) Health Facilities[10]

Health is the most important factor which plays the key role in determining the human capital. Better health improves the efficiency and the productivity of the Labor force and thus ultimately contributes the economic growth and leads to human welfare. Healthcare in project area is the responsibility of Diamer District Administration. During MMP's socio-economic survey we have witnessed in the project area, that many weaknesses and challenges have been identified in the current health facilities including poor access to and utilization of health services, low quality and effectiveness of care, limited managerial capacity and weak accountability at all levels, systematic underfunding of the public health system, inefficient and inequitable resource allocation, low financial protection, and fragmented and discontinued reform initiatives in the project area. Although dispensaries and hospitals prevail but there is shortage of staff, medicine and equipment's. In the project area health care services are not at their best according to focus group respondents. They have access to health care facilities' however there are problems such as an inadequate supply of drugs, very few health personnel, lack of modern facilities for proper diagnosis and the distances to the health centers being far away from their homes. Health facilities can be accessed at nearby cities. Due to poor unhygienic living conditions and lack of potable water in the project area are the root cause of many diseases. Most common diseases prevalent in the area are malaria, diarrhea, hepatitis and skin diseases **(Table 5-27)**.

Table 5-27: Health Facilities

Sr. No.	Health Facilities by Type	Numbers
1.	A Class Dispensaries (ACD)	05
2.	Civil Dispensaries (CD)	45
3.	First Aid Post (FAP)	17
4.	TB/Leprosy Center	05
5.	Basic Health Units (BHU)	03
6.	10 Bed Hospital	02
7.	Tehsil Headquarter Hospital	01 (Tangir)
8.	Civil Hospital	01 (Darel)
9.	District Headquarter Hospital	01 (Chillas)
10.	Private Hospitals	04

b) Education Facilities[11]

Education is a prerequisite for good governance and sustainable national development because it transforms people into good citizens, equipped to contribute to the social-economic transformation of the nation. In general, the educational facilities in the District Diamer comprises Primary, Middle and High schools for boys and girls. However, to avail higher secondary level education facilities locals have to go nearby areas. There are number of educational institutions exist in private and public sector in nearby areas. In the villages the primary schools are only for boys, which due to the tradition. The girls are almost excluded from any education. Most of the parents, particularly men in the project area are not convinced about sending their daughters to the school.

According to Alif Ailaan's Pakistan District Education Ranking 2016, Diamer is ranked 92 out of 145 districts in educational attainments. On a scale of 0 to 100, in the year 2016, district Diamer scored 28

[10] Health Department, Chillas
[11] Education Department, Chillas

in enrollment (access), 82 in learning outcomes (test scores), 56 in retention (survival rate up to class 5), and 53 in gender parity (equity). As compared to last year, the overall school enrollment score has decreased from 39 to 28, and the retention score has decreased from 78 to 56. Nevertheless, as compared to last year, the gender parity and the learning scores of Diamer have improved, but still, there is a long way to go to abridge this gap and bring them on par with the regional and national average (**Table 5-28**).

Table 5-28: Education Facilities

Sr. No.	Education Facilities by Type	Numbers	
		Boys	Girls
1.	Primary Schools	195	28
2.	Middle Schools	12	08
3.	High Schools	26	02
4.	Collages	02	01
5.	Madrassa	35	05

Following are the best educational institutions in the District Diamer;

- Diamer Educational institute – Chillas.
- Cadet College Chillas – Chillas.
- CIT Chillas – Chillas Institute of Technology.
- Sarhad University Distance Education Centre Chillas.
- Karakoram International University, Diamer Campus.

5.5.3.13 Solid Waste and Sewerage System

In the Tangir Valley and project study area, neither any standard and nor any state of art solid waste management system exists. The major constituents of solid waste in the area are paper, plastic, and organic waste (food waste, garden waste, animal waste). The organic and livestock waste is used to prepare compost utilized by farmers in their agriculture fields as a fertilizer.

The areas have no any state-of-the-art sewerage system; every home and residential area have constructed septic tanks in the vicinity for the discharge of wastewater.

5.5.3.14 NGOs and Social Organizations

Existence and functioning of NGOs in any area play vital role in the socio-economic development of the area because these NGOs mobilize, provide credit facilities, organize communities and provide awareness to communities for their basic socio-economic needs. Most importantly NGOs provide opportunities to the rural communities. There are 21 national and international NGOs are functioning in the project area.

The famous NGOs working in the project area are Agha Khan Rural Support Program, G.B Rural Support Program, Karakoram Disable Welfare Society, Manzoor Welfare Society, Karakoram Environmental Welfare Society, Diamer Development Organization, Babusar Development Welfare Society, Sun Rise Educational and development Association, Nanga Parbat Educational and Welfare Foundation, The North Pakistan Welfare Organization, Diamer Arts Culture and Welfare Council, Social Development Drive and so many.

5.5.3.15 Mechanism for Resolving Disputes

According to normal social practices in the society, people have various disputes / conflicts on different issues like other parts of the country. The people in the project area have two options available for conflict resolution. First is the government judiciary system and second is tribal Jirga (Council of Tribal elders) system. The people of project area are believed to be peaceful but sometimes a dispute between two individuals, from two casts, may generate problems. Usually, the individuals go to government Judiciary system if they are not satisfied with their Jirga award. Ordinarily, whenever there is a dispute between two persons /parties, the notables of one side go for reconciliation to the other party and sit together to resolve the issue. Sometimes the dispute is resolved through imposition of penalties in the form of cash, land and kind. In case of serious matters local political influential intervene to settle the dispute. Police and court of law is the last option.

5.5.4 Gender Issues in the Project Area

Gender approaches focus on men as well as women, and on the relations between them. Gender refers to the socially or culturally established roles of women or men. Although gender is universally one of the key ways in which societies and cultures demarcate rights and responsibilities.

Gender issues are gaining importance in development projects because female members of the community are generally neglected while designing, assessing and implementing such projects. Females are generally more vulnerable than male members of the society. Policies which really seek to close the gender gap among the poor do not take a "warm and cuddly" approach to women. They adopt the same criteria for economic and social sustainability, the same environmental impact criteria, the same laws and regulations governing access to and control over resources used in production, and the same standards for conditions of work, markets, quality control, etc. as they would apply to male activities. When they do this, a large percentage of "women's projects" are, or should be, reclassified as not viable. This project is also no exception to it.

5.5.4.1 The Consultation with Women

The FGDs with female members of communities was the main source of data collection for the women folks of the village falling within the project area. The village female is horizontal bonding within social capital, whose opinion and decisions are always considered as vital and final on gender aspects of socio–economic issues, therefore, women were taken on board in FGDs. Ten groups of women within concerned village were consulted.

5.5.4.2 Status of Women in the Project Area

In general, the project area reflects a male dominated society. Women face difficulties in getting education and are not consulted for most of the decision–making processes. The gender situation is affected by early marriage of girls, restriction on women's mobility and many household chores. Women in project area have been victim of patriarchy, male chauvinism, social discrimination, resource deprivation and denial of human rights. Despite constitutional and legislative provisions, the customary law often prevails making it difficult for women even to claim their legal rights which are supposedly guaranteed. Although Islamic laws of inheritance provide a share to daughter in father's property but the custom does not allow it. The following paragraphs have been showed the real situation of the women in the project area.

- The economic participation of women in the project area is different from that of men. Women participate in both indoors and outdoors duties which are considered to be a free labor. Women fetch water, collect fuel wood, look after animals, fetch fodder for cattle, process milk into butter,

sour milk and cheese, and work with wool. Mostly women in project areas they performing house hold activates cooking serving foods and washing clothes and other dependent members. Whereas participation of rural women in agricultural activates is very low. Women are very good at producing handicrafts they made traditional cloths, handmade crochet, Cushion and bed sheets. The traditional polygamy keeps them victim of inferiority complex. Mostly women practiced Pardah (Segregation) and overall women Autonomy is very weak. The women without children are treated as an outsider by the family including her husband.

- According to survey results, women tend to be more vulnerable to poverty as they often stay in the rural areas, while men look for jobs in urban areas. Study further indicated that women are poor, and for this reason they depend on agriculture activities for subsistence and income. Because women's economic opportunities are relatively limited, women are left with no option but to work for the survival of their families. The decline of men workers also encourages women to participate in agriculture as a means of securing their livelihoods, especially among unemployed women.
- The majority of the respondents told us that the advantages of projects and programs for delivering many changes. Advantage of project is an effective way to deliver and to improve the status of livelihood, financial position, children education and satisfaction with project intervention as well.
- Decision making powers are vital for women's development. If women are not effectively influencing decisions at the household and community level their priorities will continue to be submerged within a national development context. According to the traditional social setting, women were not allowed to make any decisions in the household while their husbands were still alive. However, the findings for this study reveal that most women are able to make decisions related to farming activities, including the use of revenues, despite men's presence at home. Some married women still experience problems in terms of the use of revenue; however, it is easy for unmarried women to make their own decisions as they head their households. These findings can be attributed to a cultural trend in taking advice and obtaining permission from elders or male members of the family.
- Almost all of the interviewed women said that, they no longer have to seek permission from their male family members to go out of the house, as they are seen to be more independent and capable of dealing with the outside community. However, most of these women also said that although they can go out of the house without permission, they choose not to do so due to cultural norms, which dissuade women from travelling alone without a male family member, especially after sunset. Furthermore, there was no change observed in women being allowed to travel or take public transport alone. Customarily, a male family member, who can even be a younger brother, accompanies the women.

6 Consultation and Information Disclosure

6.1 Introduction

The Government of Pakistan (GOP) and Government of Gilgit Baltistan (GB) places great importance on involving primary and secondary stakeholders for determining the environmental and social impacts associated with project implementation. In order to gather local knowledge for baseline, understand project affected person's perceptions regarding impact significance, and propose meaningful mitigation measures, participation of stakeholders has been taken as integral part of the environmental and social assessment process of Darel and Tangir Expressway Project. An attempt has been made to consult with a full range of stakeholders to obtain their views on project interventions and anticipated impacts thereon.

The logic behind public consultation is that a project proponent has shared with all stakeholders' relevant information on the project interventions and potential environmental and social, (positive and negative) impacts. The consultation process consists of initiating dialogues among all the stakeholders. The process covers, starting from awareness campaign to the identification, inclusion and participation of Project affected communities. Stakeholders including concerned communities are generally able to understand the implications of the Project activities **(Figure 6-1**).

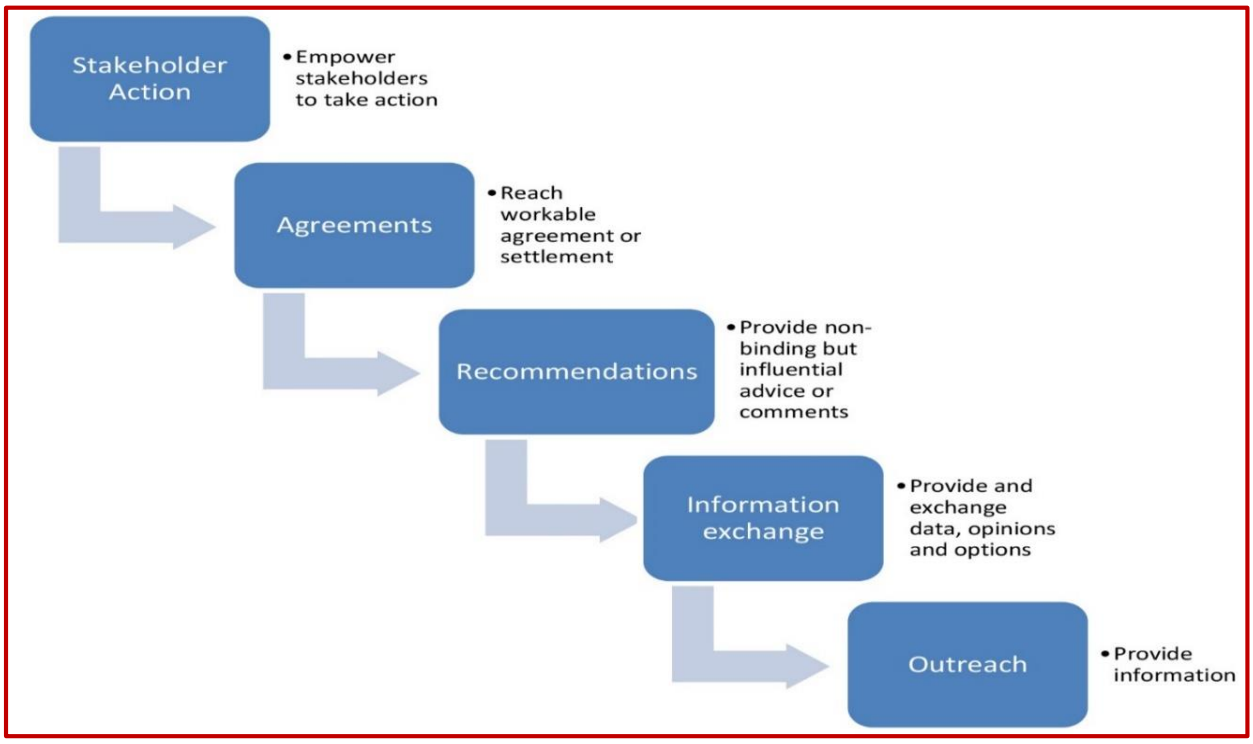


Figure 6-1: Information Discloser and Stakeholder Consultation Process

The report has been prepared by consulting with local communities, NGOs and concerned government departments/ organizations dealing particularly with related fields and to ensure that their views and concerns have been taken into account in the study.

6.2 Consultant's Perspective

The review of the present assignment suggests that the fundamental logic behind the present multi-

sectorial and multi-dimensional strategy for the project rests on the consultation process including participation, inclusion, ownership and equity of genuine development of national resources on a sustainable basis. The EIA has been designed keeping in view the following essentials;

a) Social acceptability;
b) Technical appropriateness;
c) Financial viability;
d) Environmental friendliness;
e) Pro-poverty reduction;
f) Gender positive; and
g) Long-term sustainability prospects.

6.3 Specific Objectives of Consultation Process

The consultation process provided a meaningful understanding of local social issues for the social impact analyses. The consultation process helps to minimize adverse social impacts and reduce the expected conflicts at every stage of the project, minimizes the risk of project delays, and enables to make the project more economical and socially acceptable. Moreover, public consultations create a sense of ownership among the stakeholders regarding the project and ensure the transparency in project activities. The consultative process for the socio-economic studies has been included not only the institutional stakeholders, but also the local community of the area as well. Meetings with institutional stakeholders like government departments, NGOs and line agencies has been organized and conducted to discuss project interventions and potential impacts on the local communities and environment. Public consultations have been carried out with the stakeholders keeping in view the overall objective of evolving their participation. The public consultation aimed to achieve following specific objectives.

- Information disclosure to create awareness among various stakeholders about project development objectives and proposed interventions.
- To start interaction process with stakeholders.
- To elaborate environmental and social impacts to the stakeholders.
- To establish communication and an evolving mechanism for the resolution of social and environmental issues at local and project level.
- To involve project stakeholders in an inclusive manner at every stage of project implementation.
- To receive feedback from all types of stakeholders on adopting mitigation and enhancement measures for environmental and social impacts.

6.4 Identification of Stakeholders

Stakeholders include all those who can affect and are being affected by policies, decisions or actions while implementing any development project. Stakeholders can be individuals, group(s) of people, organizations and institutions. During consultation meetings stakeholders reveal their concerns, apprehensions and demands regarding the adverse project impacts mitigation and enhancement of

project benefits to the stakeholders. Stakeholders can be broadly divided into primary and secondary stakeholders.

6.4.1 Primary Stakeholders

The primary stakeholders are the intended beneficiaries or communities expected to be affected directly by the project interventions. In this case, people living alongside the Tangir and Darel, Roads are considered as Primary Stakeholders. Primary stakeholders identified and consulted include local leaders/influential, community members (men and women), local representatives, imams, teachers, union council and village council members.

6.4.2 Secondary Stakeholders

This category of stakeholders pertains to those who may not be directly affected but have interests that could contribute to the initiation, implementation at some stage, or affect decision making on Project aspects. The Secondary Stakeholder include, NGOs and federal/provincial government departments and organizations dealing with education, health, irrigation, agriculture, forest, wildlife, fisheries, and transport etc. Stakeholder consultations meetings were conducted in two stages:

6.5 Stakeholder Consultation

The EIA preparation stage of the consultation process included conducting social and environmental focused group discussions with local community members for primary data collection, identification of positive and negative impacts and needs assessment for social enhancement. In addition to consultative sessions, in depth discussions / consultative meetings were held with communities, NGOs, government departments and line agencies to get their response on the project interventions.

A variety of scientific techniques were adopted including an interview guide, focused group discussion, informal discussion and consultative sessions to collect relevant and reliable facts (empirically verifiable observations) on the subject of EIA. These sessions were informal to encourage friendly social environment in which participants were comfortable in raising questions, expressing their opinion and concerns about the project besides seeking clarifications. The FGDs were instrumental in the process, whereas one–to–one meeting were held with the institutional stakeholders. These discussions were held with project beneficiaries and other local communities.

The consultation process provided a meaningful understanding of local social issues for the social impact analyses. Meetings with institutional stakeholders like government departments, NGOs and line agencies were organized to discuss project interventions and their potential impacts on the local communities and environment.

6.5.1 Information Discloser and Consultation with Primary Stakeholders (Public Consultation)

Consultations mainly in form of “Focus Group Discussions” (FGD) with Primary Stakeholders in concerned settlements alongside the proposed Tangir and Darel Roads were carried out at public places. It was important to provide meaningful input for the public into the decision-making process through consultation. It was also helpful to create a strong foundation for long-lasting and trustful relationships between the project and the stakeholders. Local and traditional leaders, representatives of the communities, potential vulnerable groups such as women and youth have been consulted to understand their specific issues and concerns. The findings and recommendations have been

discussed and disclosed in an open and transparent manner with the communities in order to solicit their comments and suggestions in the studies.

Participants were first briefed about the project objectives and major interventions associated with the project implementation. Afterward, people were asked to express their views regarding the proposed project. In general participants appreciated the project and offered comments & suggestions to enhance the expected environmental and social benefits and to mitigate the adverse impacts. The community perception of the project is very good but most of the people wish to enhance the availability for water through sustainable and safe water without the damage of concerned farmer's livelihood, which is obviously "Agriculture". They also are worried about the shortage of water. The digest of major issues raised by communities during meetings are given below in **Section 6.5.2** and **Table *6-2***. The place of consultation meetings and pictorial view are presented in **Table 6-1** and **Figure 6-2** below. The detail list of participants is presented as **Annexure** II**: Drinking Water Quality Test Report**

Table 6-1: Consultation with Stakeholders

Sr. No	Villages	Area	District	Number of Participants
1.	Korrangay	Tangir	Diamer	16
2.	Lurak			12
3.	Tangir Bazar (Jaglot)			23
4.	Darkile Payan			10
5.	Darkile Bala			08
6.	Gabbar (Kahopot)			10
7.	Gumari	Darel	Diamer	31
8.	Samigal Payan			24
9.	Phogage Bala			06
10.	Kot Phogage			06
11.	Phogage Payan			11
12.	Kabosh			12
13.	Laati			17
14.	Giayal			10

Information Discloser and Consultation at Tangir Bazar

Information Discloser and Consultation at Gabbar

Information Discloser and Consultation at Darkile Bala

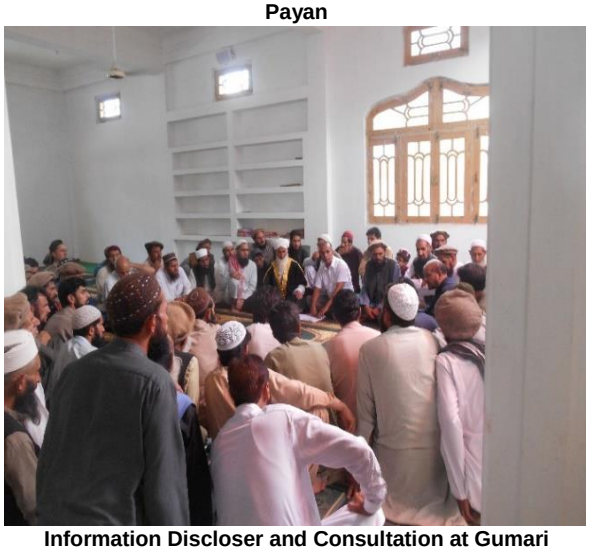
Information Discloser and Consultation at Tangir

Information Discloser and Consultation at Lurak

Information Discloser and Consultation at Tangir Bazar

Information Discloser and Consultation at Darkile Payan

Information Discloser and Consultation at Korrangay



Information Discloser and Consultation at Gumari

Information Discloser and Consultation at Laati

Information Discloser and Consultation at Giayal

Information Discloser and Consultation at Kabosh

Information Discloser and Consultation at Phogage

Information Discloser and Consultation at Phogage Bala

Information Discloser and Consultation at Kot Phogage

Information Discloser and Consultation at Bashey Chowk

Figure 6-2: Pictorial View of Public Consultation

6.5.2 Feedback and Concerns from the Community

Table 6-2: Feedback and Concerns

Feedback and Concerns	Proposed Measures to address the Stakeholders' Concerns
❖ Participant worried about the land which will used for proposed project and they requested the ES team that this land is the only source of their livelihood. So, they requested the fair compensation for their land.	❖ The detail compensation matrix will be prepared and compensation will pay to the affectees before the construction.
❖ Construction impacts, particularly in regard to amenity.	❖ The contractor will put in place measures to minimize effects and provide regular information to local residents on construction activities and their impacts. ❖ Comment has been incorporated in the EIA report

Feedback and Concerns	Proposed Measures to address the Stakeholders' Concerns
	❖ Chapter 6 and 7 of the EIA and Table: 7.1 covers the impacts and mitigation.
❖ Equal and fair job opportunities for local residents.	❖ The contractor will be contractually bound to disclose the "Recruitment Policy" that specifically includes a requirement to prioritize local employment for unskilled and semi-skilled positions that become available.
❖ HSE awareness should be provided to the local public being directly affected by the construction activities.	❖ It should be the implemented during the construction activities to save local community spatially women, old people and children. ❖ Comment has been incorporated in the EIA report
❖ What is the objective of this consultation?	❖ This consultation process was held with the objectives of sharing information with stakeholders on proposed improvement works and expected impacts on the physical, biological and socio-economic environment; understanding stakeholder concerns regarding various aspects of the project; providing an opportunity to the public to influence project design in a positive manner; and creating a sense of ownership of the proposal in the mind of the stakeholders.
❖ People were also concerned that the workers and laborers will be brought by The Contractor from outside the project area and an opportunity of employment generated locally shall be availed by the people from other areas.	❖ The contractor will be contractually bound to disclose the "Recruitment Policy" that specifically includes a requirement to prioritize local employment for unskilled and semi-skilled positions that become available. ❖ Comment has been incorporated in the EIA report
❖ Is there a grievance redress mechanism system in place and will it be effective?	❖ There is a grievance redress mechanism in place which with cooperation from the proponent is expected to handle any issues fairly.
❖ One of the participants told that before start of construction activities for the project, The Contractor will inform residents of the area about detail of work, likely disturbances and their duration and as to whom they should address their complaints.	❖ Prior to starting of work, the contractor shall prepare a method statement for major construction activities and share with all stakeholders. This shall be simple and explain the contractor's work process that is actually conducted on site, with safety and safeguard concerns. ❖ Comment has been incorporated in the EIA report
❖ One of the participants said that the safety of the public at all stages of the construction will be ensured.	❖ During the project implementation stage, measures will be prepared that will include GRM and institutional arrangements. ❖ Comment has been incorporated in the EIA report
❖ What is the objective and scope of the EIA?	❖ Identify and assess the potential environmental and social impacts that the Project may have on the environment and communities within its area of influence (AOI). ❖ To help avoid, or where avoidance is not possible, minimize, mitigate or compensate for adverse impacts on the environment and communities

Feedback and Concerns	Proposed Measures to address the Stakeholders' Concerns
❖ Safety while crossing the road especially students/pupils, old and women.	❖ To avoid any safety related incidences and ensure well-being of the local residents, the construction work will be fenced at the edge of the RoW to prevent any pedestrian and animal crossings through the passages. ❖ To facilitate the movement of locals across the road, adequate number of underpasses at appropriate distances will be provided. ❖ Chapter 7 and table 7.1 covers impacts and mitigation
❖ It was also mentioned that the relevant Government personnel must ensure the Contractor staff is cooperative with the general public and maintain the right attitude and try to facilitate them instead of being confrontational.	❖ During the project implementation stage, measures will be prepared that will include GRM and institutional arrangements.
❖ The construction of the Darel Road will be beneficial for the entire area and also beneficial for social and a significant environmental enhancement is also expected.	❖ The project team committed to providing local residents for effective, comfortable and healthy environment through the implementation of this project. ❖ Comment has been incorporated in the EIA report
❖ People were of the strong apprehension that upon completion of the project, the local crossings available on the road may be disturbed and they will be put to trouble by way of long distances for crossing or otherwise.	❖ The Contractor will take proper safety measures (placing warning tapes around excavations) to avoid people, especially children, accidentally falling into excavations and during all the construction activities. ❖ Environmental impacts on local communities related to traffic, air quality and noise have been assessed and mitigation measures in detail in the chapter 6 and 7 of the EIA and Table: 7.1.
❖ What are the potential risk and impacts?	❖ The risks and impacts of the Project have been summarized in the chapter 6 Environment and social impact assessment covers all impacts and their mitigation and also see **Table 8-1.**

6.5.3 Consultation with Secondary Stakeholders (Institutional Consultation)

The consultant environmental and social team visited various organizations and offices located in the project area for information disclosure and to get feedback. Institutional stakeholder consultations were more formal as they involved government personnel and non-governmental organization, who were consulted. They were briefed on the EIA process, the proposed project, proposed interventions and the potential negative and positive impact of the project on the area's environment and concerned communities. It was important not to raise community expectations unnecessarily or unrealistically during the stakeholder consultation meetings in order to avoid undue conflict with local people or government administration. The issues recorded in the consultation process were examined and validated, and are addressed in the EIA report. The discussion with Secondary Stakeholders was mainly focused on following topic:

- Baseline environmental and socio–economic conditions of the project area

- Expected impacts of project on natural and social environment
- Mitigation of adverse impacts associated with project

The public sector representatives of the different line departments expressed their complete support and efforts towards the project development and mentioned the intent to ensure the project was completed at the earliest to the highest quality standards. In addition, these officials expressed the commitment to ensuring the support and would adhere to all environmental and social compliance standards with no leniency in this regard to be expected from the relevant Government line departments. The digest of comment and suggestions received is given as under, whereas, complete list of offices visited, official consulted, pictorial view and feedback received is provided in **Table 6-3**, **Table *6-4*** and **Figure 6-3.**

Table 6-3: Consultation with Institutional Stakeholders

Sr. No	Department/Organization	Name	Designation	Contact No.
1.	**Communication & Works Department**	Engr. Noor Hayat & Muhammad Tariq Khan	Project Directors	0300-9362295
2.	**Environment Protection Agency**	Syed Munawar Hussain	Deputy Director	0312-9730340
		Sheraz Hussain	Assistant Director	0345-9236950
		Syed Waqar Hussain	Scientific Officer	0312-9903139
3.	**Wildlife Department**	Ijlal Ahmed	Conservator	0355-5556999
		Khursheed Aalam	D.F. O	0346-5494214
4.	**Forest Department**	Aftab Mahmood	Conservator	0355-4411000
		Shehzad Aalam	Divisional Forest Officer	0355-5222196
5.	**Agriculture Department**	Abdul Khabir	Director	0301-8800068
		Shafiullah	Board Member (PARC)	0355-5402188
6.	**Health Department**	Dr Riaz Muhammad Khan	D.H. O	0355-4408985
		Naib Allah	Assistant Officer	0355-5177731
7.	**Education Department**	Israr Ahmed	Deputy Director	0346-7865996
		Johar Ali	D.D.E	0355-5142020
8.	**Local government and Rural Development**	Malik Mushtaq Ahmed	Director	0346-5749757
		Mehboob Allah	Project Manager	0355-5442635
		Ishtiaq Ahmed	Sub Engineer	0346-9444410
9.	**Social Welfare & Community Development Department**	Akbar Hussain	Social Welfare Officer	-
		Akhtar Hussain	A.L. O	0355-5113124
10.	**GBRSP (NGO)**	Fazal-e-Haq	Regional Manager	0355-5060669
11.	**AKRSP (NGO)**	Naeem Allah	A.C.R. O	0355-5723899
		Jahanzaib	Social Mobilizer	0355-4171469
		Syed Jamil Hussain	Admin/HR Officer	0312-9781190
12.	**WWF**	Rehmat Ali	Coordinator	0346-9751659

Sr. No	Department/Organization	Name	Designation	Contact No.
13.	**Social Welfare Organization (NGO)**	Saif ur Rehman	Social Worker	0355-4166655
14.	**NHA**	Syed Muhammad Ahmed	A.R.E	0355-4402738

Information Discloser and Consultation with Project Director

Information Discloser and Consultation with Deputy Director of the EPA

Information Discloser and Consultation with Conservator of the Wildlife Department

Information Discloser and Consultation with Conservator of the Forest Department

Information Discloser and Consultation with Official of the Agriculture Department

Information Discloser and Consultation with Divisional Forest Officer

Information Discloser and Consultation with Board Member of the PARC

Information Discloser and Consultation with DHO of Health Department

Information Discloser and Consultation with Regional Deputy Director of Education Department

Information Discloser and Consultation with DDE of Education Department

Information Discloser and Consultation with Deputy Director of Local Government and Rural development

Information Discloser and Consultation with official of Social Welfare & Community Development Department

Information Discloser and Consultation with officials of AKRSP

Information Discloser and Consultation with official of WWF

Information Discloser and Consultation with Social Worker of Local NGO

Information Discloser and Consultation with official of NHA

Figure 6-3: Pictorial View of Public Consultation

6.5.4 Feedback and Concerns

Table 6-4: Feedback and Concerns

Feedback and Concerns	Proposed Measures to address the Stakeholders' Concerns
❖ If the land is required for the project, then what about the compensation?	❖ Most of the alignment is along the old road and acquisition may be required from private property. ❖ Due consideration will be given to minimum or no land acquisition. ❖ Land will be acquired according to National and Provincial laws. ❖ Compensation will be given as per National and Provincial laws.
❖ What are the mitigation measures for emission control?	❖ All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition, properly tuned and maintained in order to minimize the exhaust emissions; ❖ Proper maintenance and repair of power generators and construction machinery is needed to minimize the hazardous emissions;
❖ What are the benefits of the project on the local population?	❖ With the improvement in road infrastructure improvement in business, time saving will also be observed.
❖ Where are the project activities to be implemented during the construction?	❖ Project activities will be implemented within and outside the existing residential and commercial areas. In order to avoid restricting the mobility of the local stakeholders, construction vehicles will remain confined within their designated areas of movement;
❖ What are the solution of traffic problem during the construction?	❖ All necessary measures will be taken to ensure the safety of traffic during construction, including barricades (including signs, pavement markings, flags, and lights). All such barricades will be set up to facilitate the local traffic.
❖ What is the procedure to address grievances?	❖ The most of the concerns raised by stakeholders have been incorporated into the project's environmental and social assessment and EMP. In addition, a Grievance Redress Mechanism/Complaint Handling Mechanism will be developed at the implementation level by forming Grievance Redress Committee which will receive and resolve complaints of the project affected persons and other stakeholders of the project area.
❖ Cutting of trees should be avoided at the maximum level	❖ Incorporate technical design measures to minimize removal of these trees, as far as possible
❖ Efforts should be made to transplant the trees according to the available facilities.	❖ A tree plantation plan to compensate for the anticipated loss of vegetation during the construction activities, and to help abate pollution caused by emissions, dust, and noise during the operation;
❖ There is no sensitive area near the project interventions.	❖ Comment has been incorporated in the EIA report

Feedback and Concerns	Proposed Measures to address the Stakeholders' Concerns
❖ Overall, the Projects interventions will have positive impacts on environmental and social conditions, including the positive impacts on environmental, aesthetics of the area.	❖ Yes improvement of the infrastructure will create a healthy lifestyle in the area.
❖ The official of Wildlife department desire to receive regular updates on the project development.	❖ Definitely, the consultation process will be on-going process and World's best disclosure policy will be adopted.
❖ The construction activities and vehicular movement at construction sites and access service roads may also result in road side accidents particularly inflicting local communities who are not familiar with presence of heavy equipment and machinery.	❖ Efforts will be made to create awareness about road safety among the drivers operating construction vehicles; ❖ Timely public notification on planned construction works; ❖ Close consultation with local communities (residential areas along the project alignment) to identify optimal solutions for diversions to maintain community integrity & social links; ❖ Provision of proper safety signage, particularly at sensitive/accident-prone spots;
❖ Minimize the effects of noise, dust, vibration, traffic and lightening associated with construction activities on the communities living near the project area that can cause disturbances and emotional stress	❖ Construction machinery will be placed in an adequate location away from the sensitive areas to minimize the impacts related to the noise; ❖ The chapter 6 Environment and social impact assessment covers all impacts and their mitigation and also see Table: 7.1.
❖ Solid waste produced due to construction activities should be disposed of properly	❖ Solid waste generated during construction and at camp sites will be disposed of safely at the waste disposal sites approved by the relevant Government authority;
❖ Sprinkling of water should be regular in the morning, noon and evening on the daily basis.	❖ It is the liability of the contractor to save local environment. ❖ The chapter 6 Environment and social impact assessment covers all impacts and their mitigation and also see Table: 7.1.
❖ Utilities disturbed at the site should be restored as early as possible.	❖ The utilities to be shifted due to the construction of proposed project will be relocated on priority basis to minimize the impact on the stakeholders;

6.5.5 Women Stakeholders Consultation

Gender issues are gaining importance in development projects because female members of the community are generally neglected while designing, assessing and implementing such projects. Females are generally more vulnerable than male members of the society. This project is also no exception to it. Conducting women consultations in the project area was a challenging task mainly due to tribal area of concerned districts. However, the process has been carried out by holding consultation sessions with women of local communities randomly. A participatory and consultative approach has been employed for information gathering and data collection. The fundamental principles have been adopted during current public consultation process are:

- **Free and Participatory-** Identification and assessment of stakeholder concerns about different aspects of the project, and gathering their ideas about the mitigation measures.

- **Anticipation and Opportune-** To incorporate the stakeholder's contribution into the ESMP.
- **Informed and Transparent-** A proactive, open, and transparent process, the result of which will be documented.
- **Focusing on people –** recognizing that people are at the center of development;
- **Being humble –** realizing that local knowledge is as valid as "expert' knowledge;
- **Learning to listen -** accepting that stakeholders have wisdom and a right to be heard;
- **Sharing control –** sharing influence and control with project stakeholders;
- **Empowering others –** focusing on building the capacity of marginalized stakeholders to find their own solutions to development problems, enabling beneficiaries to become active owners rather than passive recipients of development and;
- **Valuing process –** understanding development as a "process", not just a "product".

6.5.6 Background and Feedback

In general, the project area reflects a male dominated society. Women face difficulties in getting education and are not consulted for most of the decision–making processes. The gender situation is affected by early marriage of girls, restriction on women's mobility and many household chores. Women in project area have been victim of patriarchy, male chauvinism, social discrimination, resource deprivation and denial of human rights. Despite constitutional and legislative provisions, the customary law often prevails making it difficult for women even to claim their legal rights which are supposedly guaranteed. Although Islamic laws of inheritance provide a share to daughter in father's property but the custom does not allow it.

The role of the rural women has not been recognized to the extent they contribute. Their involvement is actually more than men in every segment of agriculture but they are not appreciated due to local social and cultural norms. The traditional culture and practices are negatively influencing women's potential for increasing their gains in agriculture.

Rural women play an important part in agriculture sector activities and they are also responsible for household chores such as food preparation, fetching water and firewood, clothes washing, childcare and care of elder members of the family. They start their farm and non-farm activities along with household chores at sunrise and finish hours after dusk.

Women and men perform different roles in a rural farm set-up. Women are major contributors in all farm related activities in general and crop processing in particular. Women are almost solely involved vegetable production especially kitchen gardening, fetching fodder and water both for household and livestock use, along with fuel wood collection and preparation.

Men are normally responsible for crop production, crop protection, output marketing, water management, herding, and transporting harvested crops. Rural women work with men and are involved in different farming activities including seed preparation, planting, transplanting, weeding, sowing, fodder cutting, threshing, sealing, storage, processing, and selling. In spite of her roles and responsibilities in agriculture, women have minimal role in decision-making due to existing cultural norms. Besides male members consultation with female members of the communities was also carried out in project area during the EIA study preparation. Conducting women consultations in the project is the challenging task. However, the process was carried out by holding consultation sessions with women of local communities randomly. A participatory and consultative approach was employed for information gathering and data collection. A deficiency of suitable capacity, skill and experience, and limited opportunities and time for working in these sectors, remain challenges for women's participation

in agriculture and development. Female participants were first briefed about the project objectives and interventions and then were requested to give their views. Women's main concerns were generally related to the existing hardships they are facing and suggestions, as under:

- Women make essential contributions to the agricultural and rural economies and their roles vary considerably between and within regions and are changing rapidly, where economic and social forces are transforming the agricultural sector.
- It has been revealed that there is an issue of activity segregation in farm activities. Women were not involved in each farming activity. A deficiency of suitable capacity, skill and experience, limited opportunities, and awareness remain challenges for women's participation in agriculture development and household income.
- Uneven division of time is another factor which plays a vital role. Due to more involvement of women in their household activities and care of children they have less time to spare for any job/labor in agriculture against men.
- There are walls barring women's access to the labor market due to gender cultural and social norms. These cultural boundaries or understandings of appropriate gendered behaviors are deeply rooted. These boundaries include women involvement, not allowing them to work, gender biasness, less wages and sometime harassment.
- Women awareness of their rights related to land holding is another cause. People are not giving their due share of land to their sister, daughter, mother and wife etc. Due to which they were not included in shareholder list.
- Women's contribution in agriculture is unrecognized, unpaid, underrated, and overlooked. The contributing factors for less visibility, voice and agricultural gains are physical (child bearing, rearing, lactation and abortions), traditional, institutional and socio-cultural in rural society.
- Lack of access to educational and vocational training facilities and weak vocational training infrastructure that limits women's ability to improve their agriculture productivity and income.
- Increased burden of on-farm and off-farm activities, lack of clean drinking water, appropriate sanitation facilities, low- and poor-quality health services and imbalanced intake of food affects women's health and makes them prone to diseases. Many a times, they do not receive the required medical treatment due to financial constraints or further suffer in the hands of quacks. This has also increased the prevalence of hepatitis in many areas.
- Lack of health facilities, especially for women in the project area.
- Needs of a vocational training center for women in the area.
- Problems of proper disposal of solid waste and sewage issues.
- Ensure that new policies and development programs or projects take into account gender sensitivity and promote the active participation of women at all levels.
- Increasing access for women to professional skills
- Needs to introduce technical education (Embroidery) as a subject in the schools.
- Lack of drinking water in the girls' schools.
- Drinking water in the area is contaminated and people have to use this contaminated water.

7 Impact Assessment and Mitigation Measures

7.1 Overview

Determining the significance of impacts identified is one of the main purposes of an EIA and it enables the identification of necessary mitigation and a determination of environmental and social costs associated with the Project. Environmental and Social Impacts of any project are identified taking into account all phases of project cycle, including planning, construction, operation and decommissioning. The environmental issues and impacts of a project depend upon nature of the project activities, types and extent of interventions involved. It is not easy to assign a relative value or overall significance to an impact, since every impact has a different and multi-dimensional nature, and also because it involves personal and subjective judgment for many attributes. An environmental or social impact can be either beneficial or adverse and is assessed by comparing the quality of the existing environment with the predicted quality of the environment once the project is in place.

This EIA identifies the impacts likely to arise as a result of construction and operational activities and assesses the likely magnitude of the impact in order to provide some indication as to which impacts are likely to be most significant. A full determination of the significance of the identified impacts, based on an assessment of magnitude in relation to the sensitivity of the receiving environment has been formed part of the EIA. Mitigation and enhancement approach include:

- Propose measures for elimination or to minimize the anticipated adverse environmental & social implications of project interventions. Mitigation may involve all or some of the following actions:
  - Avoiding the impacts altogether by not taking certain actions or part of an action;
  - Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
  - Rectifying the impact by repairing, rehabilitating or restoring the affected environment; and
  - Compensating for the impact by replacing or providing substitute resources.
- Propose measures to enhance the predicted positive environmental & social impacts; and
- Document the proponent and contractor's commitments and responsibilities with respect to environmental and social implications of the project.

7.2 Approach to Screening and Scoping of Environmental Impacts

The approach to screening of environmental impacts for the Project follows the guidance contained in a range of documents relevant to environmental assessment of road projects. Based on knowledge of the existing environment, the project characteristics and experience with the typical potential impacts of road development, those issues for which environmental impacts were likely to occur were identified. Potential impacts were categorized according to the project phases, i.e. pre- construction, construction and operation, in which they occurred. This process was carried out to ensure mitigation measures could be developed which were appropriate to each project phase.

The classification of Environmental Impacts of the project were carried out considering specific conditions of the project site. In this EIA, environmental impacts of the project, deemed to be negative are classified into different levels as under:

a) **No impact:** means unapparent and negligible influence on the natural and socio- economic environments at the project site and its surroundings.

b) **Minor impact** (or small impact): means slight influence on a small portion of population (for example, some households at each commune) or a small area of natural ecosystems (for example, less than 1.0 ha), short-term impact.

c) **Intermediate** (or medium impact): means influence on a portion of population or a relatively large area of natural ecosystems (for example 1.0 – 10.0 ha of forest), short- term impact, mitigable.

d) **Significant impact:** means significant influence on a large portion of population (various communes inside and around the project ROW) or a large area of natural ecosystems (more than 10.0 ha in this project), long-term impact, high discharging volume of waste, no mitigation measures.

e) **Unknown impact:** means influence that is unpredictable as lacking information or data (for instance, impacts due to earthquake, heavy flood, etc. in this project area).

Each impact is also categorized in terms of its duration (short-term or long-term), reversibility (reversible or irreversible). For those identified impacts for which it was possible and/or necessary, mitigation measures were developed. The following hierarchy of mitigation strategies (from highest priority to lowest priority) was implemented:

a) Avoiding the impact (e.g. recommending measures to be implemented during detailed design to avoid impact on biodiversity hotspots);

b) Minimizing the impact (e.g. installing wastewater treatment systems to treat effluent before discharge);

c) Mitigating the impact (e.g. rehabilitating areas where forest has been affected because of the project); or

d) Compensating for the impact (e.g., providing financial compensation for those who will lose land as part of the Project).

7.3 Potential Positive Impacts

Construction of Tangir and Darel Expressways is aimed at providing easy communication within the district as the Chillas City population is growing day by day at a faster rate. Construction of these roads has become an essential need for providing all-weather roads, boosting up local trade and solving traffic problems. Better road sections will be available not only for the people of Chillas city but also for trade in neighboring areas. The key positive impacts identified are outlined in **Table *7-1*** below:

Table 7-1: The key positive impacts of the proposed project

Sr. #	Potential Positive Impact	Justification
1	Improvement of poor road infrastructure in the area	Width of existing roads is too narrow and doesn't comply with standards. Sharp curves, steep downhill and uphill, pavement surface damage, and non-illuminated roads cause traffic accidents. The upgrading and expansion of these roads will provide the users safety and comfort, and minimize the risk of traffic accidents.
2	Enhanced economic growth due to improved road connectivity	Improvement of poor road infrastructure will ease movement of human and goods and thus generate movement of more cargo by road and correspondingly increase economic growth.

Sr. #	Potential Positive Impact	Justification
3	Creation of jobs and employment opportunities	The proposed project will provide direct and indirect employment opportunities to skilled and unskilled manpower both during construction and operational phases. In addition, there will be opportunities for establishing business in project area. A lot of employment opportunities will arise from investment and economic opportunities attributable to improved road connectivity.
4	There will be enhanced productivity, reduced travel times and less stress to road users.	Some of the employment opportunities will arise from improvement in commerce and trade, new jobs in the transport industry, better market access for livestock and livestock products, market access for agricultural products. Travel time to destinations will be greatly reduced. This will be a relief to many tourists to visit the project area.
5	Reduced transport costs	Vehicle drivers will take a much shorter time to reach their destination. This will result in less fuel consumption which will not only be a saving to the transporters but also a saving to the country.
6	Economic and social value addition to the project's area of influence	There exists a close relationship between transport infrastructure and primary production (agriculture, animal husbandry, fishing, forestry and mining). Without good access transportation of production is not feasible. Availability of good transport infrastructure attracts not only traders and transporters, but agriculturalist and other producers as well.
7	Appreciation of property value	Construction of Tangir and Darel Expressways will help in creating influx of investors resulting in high demand for property within the project area.
8	Improved living standards of communities	There will be a general improvement on the living standards of the communities living along and near to the road's alignment.
9	Improved response to emergencies	Darel, Tangir and adjoining areas are presently not well connected with other parts of the region and lacks in basic amenities. Construction of Tangir and Darel Expressways project is expected to aid in rapid response to emergencies which will in turn save human lives and livestock.

7.4 Impacts/risks to be addressed at Design Stage

7.4.1 Road Alignment

Alignment in hill road construction refers to the route or path chosen for the road to traverse through hilly or mountainous terrain. It plays a crucial role in ensuring safe and efficient transportation, considering factors such as terrain conditions, geological stability, environmental impact, and cost-effectiveness.

Mitigations

- Several factors would be considered at design stage, when determining the alignment of project roads, including topography (slope gradient and alignment of the natural terrain), geological conditions (rock stability, landslides, etc.), hydrological considerations (drainage patterns, water flow), environmental impact, land acquisition, and traffic considerations.

7.4.2 Road Drainage System

The primary purpose of a road drainage system is to remove the water from the road and its surroundings. The road drainage system consists of two parts: dewatering and drainage. “Dewatering” means the removal of rainwater from the surface of the road. “Drainage” on the other hand covers all the different infrastructural elements to keep the road structure dry.

The rain falls very heavily on the hills and as the slopes of hills are quite steep, the water reaches the roadside very quickly and creates drainage problems. The water thus collected would be disposed-off in a proper way through the well-planned and designed drainage system. Moreover, the project roads intersect drainage basins that generally modify the natural flow of surface water by concentrating flows at certain points and, in some cases, increasing the speed of flow. Depending on local conditions, these changes can induce flooding, soil erosion, and siltation of streams.

Mitigations

- Road drainage system capacity would be designed to higher intensity and frequency of extreme rainfall events.
- For carrying the surface water, the side drains will be designed only on the hill side of the road. These drains would be designed of such a shape that the vehicles could utilize the space of side drains in case of an emergency for crossing or parking.
- In urban areas, side drains will be shaped with a rectangular cross-section and a cover. This method is chosen to utilize the space next to the road more efficiently.

7.4.3 Sub-Surface Drainage:

The presence of seepage flow can lead to stability issues beneath the roadway, as well as on the hill slope itself. To address these concerns, it is necessary to implement an appropriate sub-surface drainage system.

Mitigations

- Sub-surface drainage system would be designed based on various factors, including the depth to hard strata, the amount and intensity of rainfall, and other relevant considerations. It may involve the incorporation of longitudinal and/or cross drains, strategically placed to effectively manage the seepage flow.
- By implementing a well-designed sub-surface drainage system, the stability of the roadway and the adjacent hill slope will be enhanced, mitigating the potential problems associated with seepage flow.

7.4.4 Cross-Drainage and Protection Works

The project is specially devised for road widening / rehabilitation of existing roads. To drain off rain water collected in side drains and catch drains, the project roads have an extensive network of drainage channels/ Nullahs falling into the Tangir and Darel Rivers (**Figure 7-1**). For the crossing of drains and water courses, small bridges and culverts of proper design would be constructed.

Figure 7-1: A view of waterway crossing existing Tangir road.

Mitigation Measures:

- Proper design of bridges/culverts on Nullahs and waterways to accommodate design flows will ensure prolonged life of road infrastructure and protection of roads from damage due to scouring;
- Drainage structure will be designed by accommodating forecast discharges for disposal of run off to nearest Nullah to keep the road safely useable in rainy seasons and to prolong the life of the project;
- To ensure proper water drainage from catch-water drains and side-drains, cross-drainage works such as culverts, causeways, and scuppers would be strategically placed at reasonable intervals along the roads. These structures will divert water away from the road to a safe location.
- The design for culverts would be adjusted to accommodate higher water volumes within a short period of time.
- Pipe culverts, slab culverts, and arch culverts, as well as minor bridges will be designed at appropriate intervals along the roads to facilitate smooth water flow.
- Turfing on the slopes will be proposed against erosion to maintain the stability and integrity of the project roads.

7.4.5 Land Sliding

Landslides are natural geological phenomena that can be caused by a variety of factors, including heavy rainfall, earthquakes, volcanic activity, and human activities. In mountainous regions, these events pose a significant threat to both human lives and infrastructure. Due to the steepness in the hilly areas, construction of unplanned roads triggers landslides.

Mitigation Measures

- Slope stability will be evaluated to assess the risk of rockfalls, landslides, and subsidence.
- Proper design of the road covering sufficient space between road and top of the slopes.
- Retaining structures such as walls, embankments, and berms will be designed to resist lateral forces and prevent slope failures.
- Provision of drainage galleries / ditches, and provision of catchment ditches.

7.4.6 Blasting Plan Preparation

- Blasting may not be needed if rock breaking can be accomplished in another cost-effective manner. It will be investigated during Detailed Design.
- If blasting is to be used, then a blasting plan must be prepared, including vibration calculations / modelling when details for blasting are clear. This will be a site-specific document as it depends on the type of material to be extracted, the quantity and the ultimate use of the extracted material.
- Such a plan must detail maximum amounts of explosive to be used at any one time, pattern blasting, and use of millisecond delays and means of initiation.
- All of these factors can be modified to ensure the blast is carried out in a controlled acceptable manner.

7.4.7 Aesthetic Impacts

Negative aesthetic impacts can be expressed as a product of the poor consideration of design principles and resulting lack of harmony between the road design and various features of the landscape such as natural relief and morphology of the landscape, hydrology, vegetation, structure and pattern of the landscape, village areas, etc. The roads pass through hilly areas mixed with small valleys with vegetation of food crops, forest, and hence cutting slopes and removal of roadside vegetation is unavoidable and will result in changes in aesthetics and the landscape.

Mitigations

Key following design features to minimize landscape disfiguration were included in the detailed design include:

- Adequate aesthetic feature close to original perceptions of landscaping need to be incorporated in the project design to ensure minimum visual changes, degradation of topography/soil erosion.
- Minimizing vertical re-alignment of the roads to reduce deep cuts and refill works;
- The application of natural materials (rocks, stones, riprap) or greened concrete frames for embankment and slope stabilization.

7.4.8 Excavated Material and Solid Waste Management

The project is expected to generate a large quantity of excavated material. Suitable spoil disposal sites will be identified for excavated soil that can't be used for road embankment.

Mitigation Measures

To minimize the impacts of excavated material and solid waste, following mitigation measures were proposed at design stage of project.

- Minimizing excavation requirements as far as possible at design stage. For this purpose, a balanced cut-and-fill road construction technique would be utilized for road widening.
- Planning for disposal sites with reasonable distance from the human settlements;
- Temporary waste storage areas to be identified and properly designed.
- Incorporate technical design features for refuse collection containers at sites that would minimize burning impacts;
- Devise plan(s) for safe handling, storage and disposal of harmful materials.

7.4.9 Public Utilities

- Provision in the design and budget for the relocation of the existing public utilities wherever required.
- Technical design features would be incorporated to minimize effect on public utilities.

7.4.10 Flora

- The efficient technical design measures would be used to avoid or minimize removal of trees and flora.

7.4.11 Fauna

- The alignment of project and its activities would be designed to minimize the effect on local fauna and biologically sensitive areas.

7.4.12 Surface and Ground Water Contamination

Tangir Expressway will be constructed along the River Tangir, so the surface water may get contaminated due to the surface runoff during construction and operation phase. Ground water may also get contaminated from the wastewater generation from the construction camps.

Mitigation measures

- To control the surface water runoff and sedimentation loading, cut of drains, cascades, chutes and sedimentation ponds would be incorporated in the design;
- Planning of location of construction camps must be at an appropriate distance from the surface water bodies;

- Septic tanks and soakage pits would be designed to cater the wastewater from the construction camps.

7.5 Potential Negative Impacts (Pre-Construction Phase)

7.5.1 Land Acquisition and Compensation

Construction of Tangir and Darel Expressways will require widening of existing roads. As a result, the project will require the acquisition of privately owned land and the resettlement of people. The provincial authorities will do the expropriation of properties for the project. By its nature, expropriation causes economic loss and social and psychological disruption for affected individuals and their families. Naturally, the greater the number of people involved, the greater the disruption and loss.

Though, during planning phase efforts have been made to avoid or minimize relocation of houses and other structures while selecting the alignment of the project roads. But land acquisition for construction of roads is unavoidable. Road package vise detail of land to be acquired, structures & trees falling in RoW are given in **Table 7-2**. The most common impact is loss of businesses (shops). Other impacts include loss of trees, crops and secondary structures.

These impacts are permanent negative with moderate magnitude and high sensitivity therefore overall impact significance is categorized as of major significance. The mitigation measures proposed includes careful alignment and route selection by the designers to minimize the human displacement at first place.

Table 7-2: Road Packages Detail of Land to be Acquired, Structures & Trees Falling in RoW

Road Package No	Number of Trees expected to be cut		Number of Structures requires Compensation		Land to be Acquired (Kanals)	Number of Electric poles requiring shifting
	Wood Trees	Fruit Trees	Residential	Commercial		
I	150	350	25	475	142	230
II	300	400	45	600	109	271
Total	**450**	**750**	**70**	**1075**	**251**	**501**

Mitigation Measures

- Involuntary Land Acquisition and Resettlement Plan (LARP) will be prepared.
- Adequate budget will be provided in the project cost for the compensation to the affected people as per Land Acquisition Act, 1894.
- Landowners will be compensated according to the terms of lease agreements negotiated with them and the restoration actions agreed upon by the Contractor will be duly carried out.
- In the event that displacement is necessary, or that disruptions to livelihoods will occur, a comprehensive assistance strategy will be required. This would go beyond financial compensation to include social and commercial rehabilitation or replacement.
- GRM will be put in place to address community grievances in this regard.
- The design of alternative access to affected properties and the management of temporary works and traffic diversion can also reduce the magnitude of impacts on property and welfare.

- As far as possible, wasteland i.e. areas not under agricultural, residential or forestation use will be used for contractor camp, batching plant, work base area and waste disposal sites.

7.5.2 Public Utilities

Widening of roads project may damage the existing infrastructure and facilities, including few water supply channels and about 501 electricity poles (**Table 7-2**) along roads (**Figure 7-2**). Affected public utilities may create disruption to public services and economics. ***This impact is however temporary and moderate negative in nature.***

Figure 7-2: Views of electric poles and water channel to be relocated falling in RoW

Mitigation measures will include:

- The position of infrastructure will be located and handled with care in cooperation with the relevant institutions.
- All public utilities likely to be affected by the proposed project need to be relocated well ahead of the commencement of construction work.
- Close liaison with local relevant authorities.

7.5.3 Location and inhabitation of Labor Camps

The camp site in populated area may cause the social implication including the security and privacy of local residents, spread of communicable diseases and also environmental problems due to disposal of solid waste, effluents etc. The final location and number of sites will be determined by the construction contractors after approval from the concerned authority. However, it will be a temporary and minor negative impact.

Mitigation Measures:

- Worker's camp site/location shall be at least 500 meters away from settlements and selected in consultation with the consultants' environmental team and the nearby communities.
- The best option is to hire as many as local people for unskilled as well as skilled works.
- If that happens there is no need to establish worker camps. This is a good way to overcome garbage disposal.
- Photographical and botanical inventory of vegetation before clearing the site;
- Contractor must ensure hygiene condition at camp site before the labor mobilization.
- Ensure enough light and proper kitchen facilities at camp site such as sitting arrangement.
- Contractor should provide gas cylinder for cooking purpose and avoid use of wood as a fuel.
- Provision of the pit latrines, septic tanks for camps to treat the sanitary wastewater before its discharge to nearby water bodies.
- The contractor must provide Proper sanitary facilities and adequate supply of water to worker camps
- Compensatory plantation to be done when construction work near ends; and
- The contractor(s) shall ensure removal & rehabilitation of site upon completion.

7.6 Potential Negative Impacts (Construction Phase)

The construction phase impacts are mostly of a temporary nature and their magnitudes are subject to the social, environmental and engineering management practices adopted during construction. Such effects are related to water quality, noise, air quality and disruption to the biological environment, soils (erosion and slope stability), public health, and disturbance of infrastructure, community stability and cultural values. The predictable impacts during the construction phase are discussed below:

7.6.1 Risk of Landslides and Embankment Collapses during Construction

Road construction in the hilly region may be a difficult task, due to the geographical location and geological setting. Therefore, uncontrolled construction cannot be permissible. If the geographical and environmental perspective of the hilly region is ignored for road construction then it can be a major cause of landslides leading towards disasters. Landslides are often a natural occurrence in the mountainous region. The frequency of landslides in the region increases, especially during the monsoon season.

Although there are numerous instances of slope instability along the existing roads, many steep slopes have reached their natural state of equilibrium. Excavating the toes of these slopes for the purpose of road widening can result in instability, triggering new landslides. This will be particularly true for the areas where unconsolidated materials (**Figure 7-3**) are prevalent. Because of their large size, debris slides and debris flows are generally more difficult to control.

The construction activities for the planned project involve in large scale excavation, blasting, cutting of rocks, dumping of soil and other project component may upset the stable geological formation of the area. Owing to seismicity, unsteady geological shapes are main reasons of land sliding. In addition to

those the other project activities like blasting, formation will become wobbly and it will create the risk of landslides.

Figure 7-3: Views of unconsolidated materials, where land sliding may trigger during construction.

Most of the sections of the project roads pass through sloping terrain and there are many places where landslides and bank collapse may occur in rainy season. In addition, the road widening project will decrease the slope from 8% -10% to 7%. These construction activities will temporarily reduce the relative stability of the existing slopes, increase the risk of landslides. Landslides may encroach on agricultural land, endanger construction workers as well as block traffic. ***These impacts are temporary negative with moderate magnitude and high sensitivity therefore overall impact significance is categorized as of major significance.***

Mitigation Measures

To mitigate the risk of landslides and bank collapses during construction, the following measures should be adopted:

- The retaining wall will be constructed on the valley side of the roadway to prevent the sliding of backfilling.
- Blasting should be reduced where possible; if unavoidable then low down strength explosive material should be used instead of high intensity explosive material. This phase shall be investigated during the design of the project by the Contractor.
- The best approach for widening the roads would be to consider fill embankments supported by retaining structures before undertaking any excavations to gain the required width of the roads.

- Minimize removal of stabilizing vegetation on existing slopes. Enhance vegetation cover for sloping roofs;
- Slope protection measures like vegetation, geotextiles, nets, and anchors will be proposed to reduce erosion and rockfall impacts.
- During excavations and levelling the ground for the construction of the road, the excavated material will be filled in other areas where there is need of filling and in case if the material is not in use safe piles of borrowed material would be made.
- The excavation would be started from the top and gradually taken down. It must be stabilized by pre–designed support systems such as mesh and rock bolts prior to the next riser for excavation.
- Construct temporary drainage facilities at all excavated areas to divert surface runoff and to avoid runoff water flowing over bare and unstable areas.
- Closely monitor potentially unstable sites throughout construction period and temporary halt construction activities as needed.
- After the slope is finished, establish longitudinal ditches to ensure longitudinal drainage while simultaneously removing the soil and rock during the excavation on the sloping side, ensuring the drainage of the surface when it rains.
- Regularly check open drainage ditches and horizontal drainage along the route to avoid long-standing waterlogging and soil erosion.
- In cases where erosion or bank collapses occur, mobilize the means to repair in time to ensure the traffic flow is not disrupted.
- Install final slope stabilization works as defined in the detailed design as soon as possible to minimize the period of risk of landslides and slope collapses.

7.6.2 Topography

The topography in the project area would change but only to some extent due to the construction of project related structures such as embankments, bridges, culverts, retaining walls etc. Road widening work may involve blasting, cutting and filling of the land in the ROW. Visual changes to the topography would be of permanent but slightly adverse in nature and need no mitigation measures except that the project design must consider aesthetic concerns.

7.6.3 Impact on Soils and Soil Erosion

Soil erosion will mainly occur during the construction period due to excavation, dredging, slope grading, cutting and filling, removal vegetation cover and unplanned temporary storage of gravel and soil along the roadsides. The top soil is directly exposed to showers when trees and vegetation cover is removed reducing infiltration and increasing surface runoff. Due to the presence of surface runoff, not only does erosion occur in the construction site and soil erosion leads to indirect impacts on the quality of surface water, aquatic animals and plants.

During the construction process, the soil is likely to be contaminated by grease or spillage from the maintenance of machinery, dismantling and transportation equipment; storage of oil and grease. This will cause negative impact on animals and soil microorganisms. The soil is disturbed by oil and grease, which makes the plant grow poorly.

The impact on soils and soil erosion may be categorized as Minor, Mid-Term, and Partly Reversible Impact. To minimize these impacts, the following mitigation measures needs to adopted during construction stage:

Mitigations

- Limit the extent of excavation to reduce soil erosion potential.
- Soil stabilization shall be a priority. Temporary landfill and waste rock from excavation and construction work will be concentrated in separate dumps. Dumps will be located away from surface waters.
- Removal vegetation cover should be minimized by considering alternative locations and paths.
- The natural drainages in the construction area must not be blocked to facilitate free flow of water.
- Carry out construction works in any erodible area during dry season as much as possible
- If any civil works are to be carried out during rainy days, enough silt traps, sludge pumps and interceptor drains should be incorporated in the construction site.
- Cut areas should be treated against flow acceleration while filled areas should be carefully designed to avoid obstruction or destruction to natural drainages
- In areas with strong sheet flow, high embankments will be provided with chutes and drains/culverts to minimize soil erosion. Stone pitching and retaining walls will be made at high embankments in critical areas;
- As applicable and needed, plantation of grasses and shrubs will be done for slope protection;
- Where the use of agricultural land is unavoidable, the top 1 ft of the plough layer will be stripped of and stockpiled for redressing the land after the required burrow material has been removed;
- Where deep ditching is to be carried out, the top 1m layer of the ditching area will be stripped and stockpiled. The ditch will initially be filled up with scrap material from construction and then levelled with the stockpiled topsoil;
- Low embankments will be protected from erosion by planting indigenous grasses that can flourish under relatively dry conditions;
- Ditches or burrow pits that cannot be fully rehabilitated will be landscaped to minimize erosion and to avoid creating hazards for people and livestock; and
- Soil contamination by asphalt will be minimized by placing all containers in a bunded area away from water courses;
- Decanting and or controlled disposal of oil and grease as collected at collection tanks of maintenance yard and chemical storage areas;
- All spoils will be disposed of as desired and the site will be restored back to its original conditions before handing over.

7.6.4 Blasting

Blasting may be required at some locations when hard rock is encountered (**Figure 7-4**). Blasting will cause short term impacts like vibration, dust generation and emissions such as CO, CO_2, SO_2 etc., and long-term potential impacts on land stability. Immediately after blasting, large amounts of dust and emissions are released. However, this amount of waste is local and the concentration of dust and exhaust gases generated by blasting will decline as distance from the explosion increases. ***The impact may be categorized as Moderate, Short-Term, Localized Impact.***

Figure 7-4: Blasting will be required to remove such hard rocks while constructing Tangir and Darel Expressways.

Mitigation Measures

- To minimize the short-term impacts:
  - Control blasting should take place at predetermined times notified to communities and local residents.
  - Blasting should also be conducted in accordance with best international practices, in which the explosive charges are controlled to minimize the vibrations and noise.
  - No blasting will be allowed at night.
- To minimize the long-term impacts:
  - Geological and soil conditions should be carefully assessed to avoid blasting in sensitive locations.

- Blasting Management Plan must be prepared for the project (**Annexure IV**).

7.6.5 Air Quality

In general, the amount of dust and waste generated by earthwork (excavation, transportation and backfill) is expected to impact air quality. The fugitive dust, particulate matter and emissions (such as SO_2, NO_2, CO, etc.) will affect air quality during the construction phase from the construction machinery, vehicular traffic and equipment that will directly and temporarily impact ambient air quality. Emissions may be carried over long distances, depending on wind speed and direction, the temperature of the surrounding air, and atmospheric stability. This will also have negative impact on air quality and aesthetics of the area. ***This impact is Site-specific, Temporary, reversible, Likely and Medium Significant.***

Mitigation Measures

- All project plant (including generators & batching plant) and vehicles must be serviced as per manufacturer's guidelines to reduce gaseous emissions.
- Turn off the engines of machinery and equipment if these vehicles stay in place for more than 5 minutes.
- Incineration of any solids which may release toxic chemicals on combustions, such as plastics, shall be prohibited.
- Absolutely no burning of solid waste such as plastic, cloth, tar, etc. and other hazardous wastes are allowed on the construction site and near other residential or sensitive areas.
- Burn pits shall be visually monitored and the quantity of burning waste and incineration temperature controlled to minimize smoke emissions.
- Monitoring of ambient air against NEQS should be carried out. Where NEQS are exceeded at generators or batching plant, control technologies shall be required to reduce emissions to within acceptable levels.
- Regular tuning and maintenance of vehicles and other machinery.
- Set up and maintain a high fence of 2.5m in site locations with large excavation or embankments or near sensitive sites.
- Erecting the windshield walls on three sides of the material stockpiled at least 0.5 m above the top of the pile.
- Covering the stockpile with tarpaulin or thick plastic sheet to prevent dust.
- Provide dust masks for construction workers and ask them to use them when working in dusty conditions.
- Seeding stockpile surface with the grass if stockpile is to remain in situ for a prolonged period
- Construction material that is susceptible to dust formation will be transported only in securely covered trucks to prevent dust emission during transportation.
- Spraying of water on all exposed surfaces to suppress emission of dust. Frequency of sprinkling shall be kept such that the dust remains under control.

- Construction material will be stored in a designated area close to the asphalt plant. Sand and clay shall be covered with plastic sheets to prevent dust blows.
- An Air Quality Management Plan (**Annexure V**) should be prepared and implemented by the contractor to mitigate above mentioned impacts.

7.6.6 Noise and Vibration

The sources of noise and vibration during construction will be the machines such as excavators, generators, compactors, rollers etc. and other construction machinery and vehicles. Increased noise and vibration levels during construction activities can be a source of nuisance for locals and a source of disturbance to wildlife. Blasting operations will also cause excessive noise and vibrations. Noise from blasting is a significant factor and can be disturbing to neighboring residents or other workers in the area.

The main potential impact of high noise levels (85dBA or more) will be on construction site workers. There are also occupational risks associated with the use of some construction equipment from the perspective of vibration emissions. Appropriate occupational health and safety measures will therefore be employed during construction works.

Noise generated by the construction machinery is likely to affect the project area particularly sensitive receptors like schools, health care centers and wildlife. However, given the limited use of heavy machinery to be used for excavation and also the distance of the settlements from the construction works impact of noise on the receptors are not expected to be a significant***. Following the criteria for assessing environmental impacts, the impact is assessed to be Moderate, Short-term, And Reversible***.

Mitigation Measures

The cumulative noise from construction activities is not expected to exceed NEQS. However, the following mitigation actions are recommended as precautionary measures:

- Contractors to limit the number of machines operating simultaneously to reduce cumulative noise. For example, during excavation and transport, the truck engine is switched off when the bulldozer is operated. The Contractor shall provide latest equipment required for completion of each task.
- Speed of the project vehicles will be kept low and horns will be restricted while passing through or near the communities.
- Movement of all project vehicles and personnel will be restricted to within work areas, as far as possible.
- The contractor shall provide equipment only of the size/power required to complete each task.
- The contactor shall ensure provision of acoustic guards, covers and doors on plants and vehicles.
- Fitting of muffler with construction machinery that produces noise in excess of 85 dB.
- Avoiding the unnecessary revving of vehicle engines.
- Conduct inspection and regular maintenance of construction machinery and equipment.

- The contractor will monitor the noise levels regularly at the nearby sensitive receptors to ensure that these do not exceed NEQS.

7.6.7 Dust Emission

Potential sources of dust are construction material stockpiling and loading, transportation and unloading, areas cleared for road upgradation, preparation of camp sites and access tracks for operations, off road vehicular traffic on unpaved roads during construction, open storage of solid materials and exposed soil surfaces. Generation of dust from these activities is likely to be significant if not mitigated, and given the prevailing wind direction from the north to north-east. Following the completion of the preparatory works, the generation of dust from construction sites may reduce, but will be elevated above the baseline due to removal of ground vegetation and unused material including aggregates. An increase in particulate matter is expected in the vicinity of haulage routes. Following the works to each section, the material shall be compacted, reducing any dust generation. ***Following the criteria for assessing environmental impacts, the impact is assessed to be Short Term Moderate Adverse.***

Mitigation Measures

- The contractor shall be required to minimize double handling of material during earthworks operations. This shall also be in the interest of the contractor as this shall reduce his costs.
- Water sprinkling at batching plants shall be required as a dust suppression method. Wet scrubbers for batching plants can also be used.
- The training program for excavator operators shall include the need to reduce drop height when loading trucks in order to reduce dust emissions (& noise).
- Access roads shall be adequately compacted and/or regularly sprinkled with water as a dust suppression measure.
- Clearing of vegetation for site clearance will be kept to a minimum.
- Vegetation clearance for camps and access roads will be kept to the minimum required.
- Clearing of vegetation beyond the Corridor of Impact (CoI) and RoW shall be avoided.
- Existing tracks shall be favored for haulage of material.
- During construction the preparation of new access tracks will be minimized. Where improvement of existing tracks or development of short lengths of new tracks is unavoidable the width of the access track will not exceed 3 m.
- Vehicle speeds will be regulated and monitored to avoid dust emissions.
- Off-road travel will be minimized observance of this restriction will be monitored during the operation.
- Periodic trainings will be provided to drivers on mitigation measures related to off-road travel and speeds limits.
- During construction movement of construction equipment will be restricted to work areas and established access tracks to avoid unnecessary disturbance to soils in the project area.

- Spoil heaps (whether temporary or permanent) will be protected from erosion by trimming and grading.

7.6.8 Flora Impact

Widening and construction of the project roads will be accompanied by clearance of vegetation within the ROW of the road's alignment. Activities such as construction of camps, temporary roads & mobility of construction staff may also damage the local vegetation/trees. However, the project area is having less covers of vegetation and free from trees***.*** Around 450 wood trees and 750 fruit trees are estimated to be cut or removed within the ROW of the proposed project roads (**Figure 7-5**). The details are given in **Table 7-2**. ***The impact of vegetation clearance for road construction project is likely to be moderate significance, which can be minimized by adopting following mitigation measures:***

Figure 7-5: Views of structures and trees to be removed falling in RoW.

Mitigation measures

- The camps, mobility of machinery and construction of temporary roads should be proper planned to avoid any loss to trees and vegetation.
- The location of construction camp will be selected so as to have limited environmental effect during construction phase.
- Vegetation should only be cleared only where it interferes with road construction.
- Construction workers should be encouraged to use alternative sources of cooking fuel.
- Dumping of construction material must avoid in vegetation areas.
- In general, adverse impacts will be mitigated by planting ten times more plants than the number of trees cut down to accommodate the Project impact on flora.
- Compensation of damaged to flora could be by way of systematic plantations along the ROW of project roads.

- Use of native and fast-growing species where possible.
- Using nursery plants (grasses) which assist stability in open patches especially in service areas.

7.6.9 Fauna Impact

Wildlife diversity and population is rather low in the project area and no endangered or rare species have been reported in the project COI. During construction, movement of heavy machinery and induced human activities may impose negative impacts on fauna in the surrounding area. The routes of wildlife may be affected due to camps and machinery movements & installations. Although, the area is free from any wildlife corridors. Temporary roads may also affect the habitat of locally available fauna. ***However, all these impacts will be temporary in nature and will vanish with the completion of construction phase.***

Mitigation measures

- The project should minimize on the number of access roads in order to avoid affecting a significant proportion of wildlife habitats, food sources and forage for livestock through destruction of vegetation and soil compaction.
- Construction vehicles and machinery should be driven at moderate speed to avoid disturbing wildlife in their habitats, particularly in access roads to quarries and camp sites.
- Wildlife movements and routes must be considered during project activities and should be avoided to their maximum level.
- The alternate routes and points are recommended to avoid any damage to locally available fauna as well as local livestock.
- Waste and rotten food of the camps shall be properly disposed of to prevent it being eaten by wildlife and livestock.
- Used chemical, other wastes and their containers should be kept way from wildlife and livestock to avoid exposing them to possible poisoning.

7.6.10 Impact of Excavated Material and Inert Waste

While cut-and-fill balance will be targeted through optimized design at detail design stage. In addition, the upgrade and rehabilitation of the existing roads will generate significant amounts of inert waste (road surface and parts of road subgrade). Large amounts of spoil and inert waste are expected to be generated during construction. It is difficult to design for balances between cut and fill volumes of earth at each location, and haulage to disposal sites may be expensive. This creates a need for environmental management of inert material and excavated soil.

Improperly managed spoil can result in (i) soil erosion and sedimentation of downslope water bodies, potentially leading to interference of river hydrology, deterioration of water quality, and induced flood risks; (iii) impact on ecological resources and natural habitats if disposed at inadequate locations; and (iii) reduction of agricultural productivity if spoil is applied wrongly. ***Impact may be categorized as Significant, Long-Term and Partly Irreversible.***

Mitigation Measures

- All excavated material should be handled in a manner that minimizes the release of fugitive dust (especially during hot and dry weather) and where possible the movement of material should be kept to a minimum.
- Trucks transporting spoils shall be tightly covered with tarpaulin or other suitable materials to minimize dust emission and spills.
- Road surfaces shall be regularly cleaned of spilled spoil.
- Earthwork and spoil disposal shall not cause sedimentation and obstruction of flow of watercourses, damage to agricultural land and densely vegetated areas.
- The spoils disposal site shall be adequately protected by avoiding formation of steep slopes and grassing to prevent erosion to surface watercourses.
- An Executed Material Dumping Plan (**Annexure VI**) must be prepared by the contractor to mitigate the impacts of excavated material and inert waste.

7.6.11 Impact of Demolition Waste

Proper solid-waste collection is important for the protection of public health, safety, and environmental quality. If solid waste such as metal, gravel, asphalt etc is accumulated alongside of the road it will cause public inconvenience by dust dispersion, reduced visual quality, and health hazard. The project is expected to require removal of 1145 structures (**Table 7-2**). However, most of the demolition waste will be re- used or recycled by the affected households by which, the volume of solid waste from this activity will be significantly reduced. ***Hence, the impact may be categorized as Minor, Short-term, Irreversible.***

Mitigation Measures

- To avoid these impacts such waste must be removed from the construction site immediately after the construction work and dumped in an approved site according to the current rules and regulations.
- Contractor must identify and select suitable and safest locations for the dumping or land fill sites with sufficient capacity and approvals should be obtained.
- Reuse or recycle demolition where possible.
- Non-re-usable parts shall be disposed of in an approved disposal site.
- Training will be provided to personnel for identification, segregation, and management of waste.

7.6.12 Flood Condition

During the period of construction, civil works may lead to flood conditions due to blocking of drains, drainage paths and culvert openings. The contractor shall take every measure to keep all drainage paths, drains & openings clear at all times.

Mitigation Measures:

- If flooding or stagnation of water is caused by civil works, contractor shall provide immediate means to prevent loss of access to any public or private land/property & to prevent damage to public or private land/property.
- Surplus soil and cleared vegetation will be disposed of so as to avoid disturbing the natural drainage.
- All sections of the road close to or on steep slopes will be closely monitored for any signs of soil erosion or land slippage.

7.6.13 Traffic Impact

During construction, large volumes of materials will need to be transported to the road construction areas and removed to the disposal sites. The roads to be upgraded and rehabilitated under the project are at the same time the main material transport routes. Transportation of materials by large trucks could further damage these roads, disrupt traffic and increase the risk of traffic accidents. Moving sand, stone and gravel materials in vehicles may cause spillages on the road which may be hazardous for cars and two-wheel vehicles.

Although the current traffic pressure on the project roads is very low, however, it is anticipated that an overall increase and traffic hindrance would occur as a consequence of the proposed construction. It will be very dangerous to maintain the traffic on the road especially during excavation work. For this purpose, a traffic plan must be issued that the road will be completely closed and open for traffic from such to such time.

The project will also require replacement of existing bridges to build new, higher grade and climate-proof bridges. Where new bridges will be located at the identical site as existing bridges, the construction of temporary bridges to avoid traffic interruption will be required. ***These impacts are temporary negative with moderate magnitude and high sensitivity therefore overall impact significance is categorized as of major significance.***

Mitigation Measures:

- Set up clear traffic signal boards and traffic advisory signs at the roads going in and out the road and bridge construction sites to minimize traffic build-up.
- Communicate through local officials to the public the scope and schedule of construction, as well as specific construction activities causing disruptions or access restrictions.
- Coordinate with local traffic authorities to implement traffic diversion schemes to avoid inconvenience to road users, ensure smooth traffic flow and avoid or minimize accidents, traffic hold ups and congestion.
- Limit transporting materials during the rainy season and avoid overloading vehicles compared to the load of the structure existing roads and bridges.
- Repair damaged pavement of local road.
- Traffic management plan will be prepared by the contractor after consultation with RE for its implementation (***Annexure-VII***).
- GRM will be put in place to address community grievances in this regard.

7.6.14 Impacts on Surface and Ground Water

The local population of project area fulfil their water requirements from the water flowing in nullas and rivers. Surface and ground water sources might be polluted by pollutants produced from construction activities such as solid and liquid wastes produced from worker's camps and leakage of oil, grease, and spill of toxic chemicals, and poor management of batching plants. Waste generated from bridge construction (**Figure 7-6**), if discharged directly into the stream, will degrade water quality due to increased suspended solids and turbidity

Figure 7-6: Views of Tangir and Shafakul Bridges showing the possibility of surface water pollution from construction activities.

A significant amount of wastewater will be generated during this cement-concrete mix, casting abutments, piers and beams. This type of wastewater contains high levels of total suspended solids (TSS). Spillage of wastewater from above all activities could pollute rivers and streams near construction sites in turn of affecting the local communities and aquatic biodiversity.

By taking mitigating measures, ***water pollution from construction is expected to be Medium (low volume of discharge, low concentration of pollutants), temporary (during construction time), short-term (not permanent).***

Mitigation Measures:

- No untreated effluents will be released to the environment. For the toilet waste, the contractor will establish / install appropriate waste treatment system (such as septic tanks and soaking pits– appropriately sized and located) at the site facilities (offices, camps, others). The waste water from kitchen and toilets can be released in soaking pits or used for plantation/water sprinkling.
- Use of water should not disturb public water availability and source of water should be selected carefully
- Avoid dropping fuel oil, grease, and chemicals into the surrounding environment to avoid overflowing rainwater.

- Lubricants shall be stored in dedicated enclosures with a sealed floor at least 50 m from water bodies.
- Solid waste from construction activities shall not be thrown in rivers.
- Construction storage/stockpiles shall be provided with bunds to prevent silted run-off.
- Stockpiled materials shall be covered to reduce run-off.
- Bare slopes shall be stabilized immediately after works are completed.
- Washing of machinery and vehicles in surface waters shall be prohibited.
- Firmly consolidate river banks using stones, concrete and other suitable retaining measures at each bridge construction site and ensure that water courses (rivers, canals, etc.) shall be kept free of excavation spoil and construction debris, floating and submerged.
- Work in rivers will be scheduled during dry season.
- Disposal of slurry from bridge construction in the water body shall be forbidden.
- The contractor shall not place car wash, maintenance of machinery, near surface water sources.
- Lined wash areas will be constructed within the camp site or at site, for the receipt of wash waters from construction machinery.
- The operation of horizontal culverts and drainage channels along the route should be inspected and cleared for good drainage.

7.6.15 Impact on Aquatic Ecosystems

During the construction phase, the most important impact on the aquatic ecosystem is sedimentation, which together with the water that is swept from the surface when entering the waterways causes increased turbidity, with high suspended solids. This will affect the photosynthetic capacity of aquatic plants, bury the benthic species, and reduce the amount of dissolved oxygen in the water, leading to adverse impacts on aquatic life. The construction of bored piles may lead to bentonite discharge into surface water at bridge construction sites, leading to declining fisheries resources. The spill-over of solid domestic wastes, construction solid wastes and hazardous solid waste from construction sites to surface water systems creates risks of polluting the aquatic environment and affecting habitats of aquatic species. The discharge of untreated domestic wastewater and construction machinery wastewater will pollute receiving water sources. ***The impact may be categorized as moderate, short-term, generally reversible.***

Mitigation Measures:

- The measures defined earlier to minimize surface water pollution will directly contribute to the protection of aquatic ecosystems.

7.6.16 Impacts of Borrowing Sites

Additional soil may require for the strengthening / extension of the road sections and establishing contractor's facilities. The additional soil will be excavated from the designated area (Borrowing Site). If the contractor desires to excavate the soil from outside the suggested borrowing area then approval must be obtained from the Supervision Consultant's Environmental Specialist and

concerned authority. Erath cutting may also likely to be required at some part of road section. The excavating activities could have adverse environmental impacts including soil erosion, drainage problem, land productivity, threaten existing structure stability, and impact the health and safety of the workers and local population.

Mitigation Measures:

- The earth required for construction of road embankments and other works would be preferable used out of the available government land or the land acquired under this project. If earth is required to be lifted from private own land, then the owner(s) of the land will be duly compensated. Contractor will be responsible to make an agreement with land owner to excavate and restore the borrow area.
- The contractor will not leave the borrow pits in an unusable condition such that it could be filled with rain water and cause problems for the community e.g. breeding place for mosquitoes etc.
- The contractor will ensure that the selected borrow areas are clearly demarcated, and indicate the maximum allowable depth of the pit i.e. 3 feet before the soil is excavated.
- No soil will be excavated outside the demarcated ROW area. If unexpected soil or strata is found during excavation at the site then the excavation must be stopped immediately, and the environmentalist and construction contractor must be informed as soon as possible.
- Barrow area development and restoration plan will be prepared by the contractor after consultation with RE for its implementation (**Annexure VIII**).

7.6.17 Impact of Domestic Waste

Improper management of domestic Waste generated from labor camps may produce unpleasant smell, discomfort to the community, potentially causing water and soil pollution. If not properly managed, solid waste can affect the health of workers and people living near the camp. As solid waste collection services are not available in most residential areas along the project roads, measures need to be taken to prevent the adverse effects of domestic waste. ***The impact may be categorized as Moderate, Mid-Term, and Reversible.*** To reduce the above-mentioned impact the following measures are proposed:

Mitigation Measures

- The contractor should provide adequate facilities to manage wastes in accordance with the guidance given by the EPA.
- Implement Waste Management (Executed material) Plan (**Annexure IX**) to ensure safe handling, storage, collection and disposal of construction wastes and the training of employees who handle waste.
- There should be proper solid waste disposal procedure to enhanced sanitation of workers in camps. Dust bins in different colors must be provided to separate out food, glasses and other solid waste at the worker camp.
- All the waste from worker camps should be removed every day and dumped in approved site to prevent contamination of soil and water bodies as well as prevent from disease out breaks.
- Burning of waste will not be allowed in any case.
- Disallow waste dump sites, in a distance closer than one (1) kilometer to any inhabited areas.

- Monitoring the worker camps regularly in consultation with Public Health Inspector (PHI).
- These conditions could be incorporated into the contractor's documents for better sanitation conditions and waste disposal at temporary worker camps.

7.6.18 Impact of Hazardous Waste, Hazardous Materials

Hazardous substances such as oils and lubricants can cause significant impacts if uncontrolled or if waste is not disposed correctly. Hazardous waste generated in the project includes waste oil, oil-based mop and grease. In addition, the project will install several different locations to store fuel oil and asphalt, where there is potential for leakage and spills.

Poor management of hazardous waste and hazardous materials could lead to significant soil and water pollution. These substances are highly toxic and insoluble in water, so when they enter the environment, they spread widely and long lasting. As such, these substances combined with runoff will cause adverse environmental impacts in natural flows in the project area. ***The impact may be categorized as Medium, Long-Term, Potentially Irreversible Impact.***

Mitigation Measures

- Hazardous wastes must be collected separately, placed in containers marked as hazardous waste with sealed lids and identification labels as prescribed.
- Vehicle maintenance and refueling areas will be confined to designated areas in construction sites designed to contain spilled lubricants and fuels.
- Fuel and other hazardous substances shall be stored in areas provided with weather shielding lightweight roof, impervious flooring and curbs to contain spilled liquids. Absorbent materials such as sand should be provided to mop up spills.
- There must be appropriate information and training programs in the workplace that help the workers to be aware of and have a way to deal with hazardous chemicals in the workplace.
- Asphalt or asphalt products that cannot be reused must be returned to the supplier.
- A Hazardous and Explosive Material Management Plan (**Annexure X**) must be prepared and implemented by the contractor to mitigate above mentioned impacts.

7.6.19 Worker's Health and Safety

Health risks and worker's safety problems may result at the workplace if the working conditions provide unsafe and/or unfavorable working environment due to storage, handling and transport of hazardous construction material. Workers will be provided with safe and healthy working environment taking into account risks inherent to the particular sector and specific classes of hazards in Project area.

Mitigation Measures:

- Layout plan for camp site, indicating safety measures taken by the contractor, e.g. firefighting equipment, safe storage of hazardous material, first aid, security, fencing, and contingency measures in case of accidents (**Annexure IX**);
- Obligatory insurance against accidents for laborers/workers;

- Providing basic medical training to specified work staff and basic medical service and supplies to workers;
- Work safety measures and good workmanship practices are to be followed by the contractor to ensure no health risks for laborers;
- Protection devices (ear muffs) will be provided to the workers doing job in the vicinity of high noise generating machines;
- Provision of adequate sanitation, washing, cooking and dormitory facilities including light up to satisfaction;
- Mechanism for supply of drinking water for workers (**Annexure XI**) should be prepared and implemented by the contractor.
- Proper maintenance of facilities for workers will be monitored;
- Provision of protective clothing for laborers handling hazardous materials, e.g. helmet, adequate footwear for bituminous pavement works, protective goggles, gloves etc.;
- Ensure strict use of wearing these protective clothing during work activities;
- Elaboration of a contingency planning in case of major accidents;
- Instruct foremen to strictly enforce the keeping out of non-working persons, particularly children, off work sites;
- Adequate signage, lightning devices, barriers, yellow tape and persons with flags during construction to manage traffic at construction sites, haulage and access roads.

7.6.20 Community Health and Safety

The construction activities and vehicular movement at construction sites and access service roads may result in road side accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. This is a temporary and minor negative impact. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents etc. The labor works with different transmittable diseases may cause spread out of those diseases in the local residents. The borrow pit areas located near the residential, settlements, may cause accident for the people moving near to those areas.

Mitigation Measures:

- There should be proper control on construction activities and Oil spillage leakage of vehicles;
- The Borrow areas should be fenced properly and banned for the movement of the residents;
- The labor works with different transmittable diseases should be restricted within the construction site;
- Efforts will be made to create awareness about road safety among the drivers operating construction vehicles;
- Timely public notification on planned construction works;
- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity & social links;

- Seeking cooperation with local educational facilities (school teachers) for road safety campaigns;
- Provision of proper safety and diversion signage, particularly at urban areas and at sensitive/accident-prone spots;
- Setting up speed limits in close consultation with the local stakeholders; and
- If identified, consider additional guard rails at accident-prone stretches and sensitive locations (schools);
- The communicable disease of most concern during construction phase, like sexually-transmitted disease (STDs) such as HIV/AIDS, should be prevented by successful initiative typically involving health awareness; education initiatives; training heath workers in disease treatment; immunization program and providing health service;
- Reducing the impacts of vector borne diseases on long-term health effect of workers should be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which includes;
  - Prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat close to human settlements;
  - Eliminate any unusable impounding of water;
  - During construction work, pedestrian and vehicular passages should be provided for crossing near settlement;
  - Bridges and other structures have to be structurally stable enough to bear maximum ground acceleration recorded for the area in past;
  - Fencing should be strong enough so that it cannot be broken easily by local people for making passages;
  - Discharge of any wastewater at upstream of the point of public supply should be restricted;
  - Batching plants should be installed away from settlements;
  - Use of water should not disturb public water availability. Source of water should be selected carefully.

7.6.21 Construction activities affecting local business

At the densely populated areas along the project roads, business activities of people primarily include food sellers, groceries, petrol stations, motorbike repairs, catering and catering services. Due to the proposed Project, entry/exit problems and bifurcation of settlements, shops and agricultural land/fields may occur for the residents as well as hindrance in movement and transportation. This will result in causing inconvenience to the residents/farmers and affect their daily activities; also reducing the frequent interactions between families. This could affect income of the people. Impacts on livelihoods are addressed through the land acquisition and compensation. During the planning and design phase of the Project it is anticipated that there will be adverse impact on the socio-economic environment especially in Tangir Bazar on Tangir Expressway and Gumari Bazar on Darel Expressway (Error! eference source not found.). Location of settlements on Tangir and Darel Expressways are given in **Table 7-3**.

Table 7-3: Location of Settlements on Tangir and Darel Expressways

RDs From	RDs To	Settlements
Tangir Expressway (Package – I)		
7+00	8+00	Chinese camp
8+00	9+00	Lurrak village
11+00	12+00	Sheikhu Village
15+00	16+00	Juglot village
16+00	17+00	Tangir Bazar
25++00	26+00	Kout village
28+00	29+00	Dubas Village
30+372	31+100	Choti korrangi
Darel Expressway (Package – II)		
0+000	1+000	Shafakul Village
8+000	9+000	Seminal Village
15+000	16+000	Semigal Village
19+000	20+000	Gumari Bazar
24+000	25+000	Marrakel Village

Mobilization of labor, installation of machinery may also create temporarily disturbance to locals. ***This impact can be categorized as indirect, low, site-specific, short term, Probable and reversible.*** However, continuous consultations will be required to ensure that potentially affected business owners and farmers are aware of project activities and schedule.

Figure 7-7: Views showing impact on populated areas coming in RoW of Tangir and Darel Expressways.

Mitigations

The following measures shall be implemented by the Contractors prior to and during construction to minimize the impact of construction on local businesses.

- Consult with shop owners and farmers at least two weeks before construction starts to agree on and provide temporary access to their businesses/production areas. Inform on the planned construction activities and likely impacts;
- Consult shop owners and farmers regularly to seek their feedback on impacts such as emissions, dust, noise, traffic safety at least two weeks prior to commencement of construction;
- Do not store raw materials or waste within 20m of businesses or shops.
- Arrange traffic control staff for loading and unloading of raw materials and wastes;
- Provide compensation for products and properties damaged by the project activities;
- Resolve immediately any inconvenience caused by project activity.
- Excellent social and engineering practices are required to avoid and reduce these low adverse impacts.

7.6.22 Impacts on Physical Cultural Resources

There are no archaeological, historical, culturally important sites or sites of religious significance known to exist in the direct area of impact of the project area, which may be affected by the project interventions. However, if cultural heritage (e.g. graves, cemeteries, sacred trees, etc.) are discovered the contractor must stop work and contact BID. BID will then contact Archaeological department for further investigation. The Contractor also must use the Chance Finds Procedures provided in **Annexure XII**.

7.7 Impact Analysis during Operation Phase

There are significant negative as well as positive impacts during the operation period of the project. Encroachment on the roads, air and noise pollution and increasing the risk of road accidents are the anticipated long-term negative impacts. The positive impacts are mainly on the socio-economic benefits associated with increase in trade and services along the roadside which create micro economic benefits to local people. In addition, reduced travel time and cost, efficient transport from farmlands to markets reducing cost of productions directly contribute to the economic development.

7.7.1 Land Sliding

There may be occasions when landslide may take place due to unusual earth quakes and heavy rains in project area. This would cause damage to the road and pose risks to the vehicle and human life. ***The impact can be considered as a negative with moderate magnitude, high sensitivity and local in nature. Thus, the overall impact significance is categorized as of moderate.***

Mitigation Measures

- Early warning systems will be introduced that will indicate when cracks appear on road and

allow any widening to be monitored. This system will not be of use in unpredictable scenarios, such as earthquakes. The system will use numbered, glass strips positioned strategically across key areas. These will be monitored on a weekly basis for any breakage. Should a breakage occur, the gap will be measured and monitored for any widening that will provide an early warning of a potential land slide.

7.7.2 Air Quality and Noise

Increase vehicle movements will affect air and noise quality. There will be some local air and noise pollution. Planting of trees along the road and increase in vegetation cover on the embankments will absorb CO_2 emitted from vehicles.

On the other hand, the proposed project will create positive impact on air quality by reducing emissions. Wide carpeted roads with proper alignment will allow smooth run of vehicles considerably in higher speeds with minimum accelerations and decelerations. Therefore, the emissions will be reduced and consequently the air quality would not be adversely affected by vehicle emissions.

During the operational phase, the noise levels are anticipated to increase due to traffic related noise pollution; vibrations from engines and tires and mainly use of pressure horns. ***This impact is permanent and moderate negative in nature.***

Mitigation Measures:

- Setting up of a system to monitor air quality along project area in accordance with the applicable standards/limits;
- Afforestation should be done immediately along the ROW once the construction phase is completed; plants should be selected in accordance to their ability to absorb emissions;
- Regular road maintenance to ensure good surface condition;
- Speed limits at sensitive locations;
- Regular vehicle check to control/ensure compliance with NEQS; and
- Enforcement and penalties against traffic rules violators.
- Signs for sensitive zones (health centers / educational institutions etc.) to disallow the use of pressure horns.

7.7.3 Road Traffic Safety

The upgradation, rehabilitation of the roads will induce high vehicular speed especially the road section from Km 0+000 to 33+400 to (Tangir Bridge & Zumal village to Ghichar Pul). As a result, there will be a risk of increased road accidents. The proposed roads pass small towns, schools, hotels, religious places where students and people gather frequently. These places are susceptible to accidents. Moreover, there are many local restaurants and shops are located closer to the ROW. Therefore, high speed vehicular movements will cause road accidents. However, traffic safety in general is expected to significantly improve due to improved road conditions and clear signage. To minimize road accidents the following measures should be taken:

Mitigation Measures:

- Speed limits, warning and sign boards must be placed near sensitive areas and identified places, which are susceptible to accidents.
- Road furniture and road marking should be done immediately after completion construction work.
- Kerbed footpaths should be preferred to facilitate local inhabitants.
- Speed breaker should be considered in the areas where offices, schools are located or adjacent to the ROW.

7.7.4 Blocking of Road Drainage System

The project will improve the road drainage facilities by constructing proper drains and rehabilitating culverts to facilitate better water flow especially during the rainy season. Blocking of drains and culverts due to sediments, improper disposal of debris or disposing garbage into side drainages by the general public will create overflow of drains and alteration of surface runoff paths causing soil erosion and health hazards.

Mitigation Measures:

- The drainage structures such as catch water drains, catch pits, side drains and culverts are to be periodically inspected and cleaned off all the debris and blockages which prevent the smooth flowing of water in such structures during rains.

7.7.5 Road Maintenance Works

During the operational phase, different maintenance works will be carried out throughout the project life. Laborers or the staff involved in these maintenance works are exposed to health and safety issues. Poor implementation of HSE plans or noncompliance of personal protective equipment (PPE) can lead to personal injuries and accidents. Moreover, application of poorly maintained equipment and material can lead to air pollution. The maintenance works can also cause traffic problems to the travelers. ***This impact is temporary and minor adverse in nature.***

Mitigation Measures:

- Implementation of HSE Plans during the maintenance period;
- Strict implementation of PPE;
- Use of high-quality equipment and material by the contractor;
- Continuous improvements in the emergency plans; and
- Placement of sign boards for traffic diversions and proper implementation of traffic diversion plans;
- Selection of suitable sites for contractor camps and implementation of all the related important protocols for the management of camp activities in order to avoid environmental and HSE issues;
- Inspect culverts, roadside ditches and drainage system, water bars and outlets after each major runoff event and restore flow capacity as needed.

8 Environmental Social Management & Monitoring Plan (ESMMP)

8.1 Overview

The Environmental Social Management & Monitoring Plan (ESMMP) is prepared to ensure that the recommendations made in the EIA to mitigate the negative impacts and to enhance the positive impacts are implemented at the time of implementation of the project. The ideal ESMMP should include amongst other things a set of institutional measures to be taken during planning, implementation and operation of the project. The ESMMP also identifies feasible and cost-effective measures that may reduce potentially significant environmental impacts. The mechanism to ensure the implementation of proposed mitigation measures during and after implementation of the project will also be discussed.

The proposed ESMMP for the GB Roads Project consists of a combination of operational policies, procedures, practices, actions to address identified impacts and risks. It will favor the avoidance and prevention of impacts over minimization, mitigation, or compensation, wherever technically and financially feasible. Where risks and impacts cannot be avoided or prevented, mitigation measures and actions will be identified so that the project operates in compliance with applicable laws and regulations. The ESMMP for the construction and operation phases will define desired outcomes as measurable events to the extent possible, with elements such as performance indicators, targets, or acceptance criteria that can be tracked over defined time periods, and with estimates of the resources and responsibilities for implementation.

The ESMMP is designed to take into account the impacts identified in previous section and the result of consultation with stakeholders including affected communities. The ESMMP will be managed through a number of tasks and activities and site-specific management plans. One purpose of the ESMMP is to record the procedure and methodology for management of mitigation identified for each negative impact of the project. The ESMMP will clearly delineate the responsibility of various participants involved in planning, implementation and operation of the project.

8.2 Inclusion of ESMMP in Contract Documents

Experience suggests that some contractors may not be familiar with environment related issues and will be reluctant to carry out mitigation measures as proposed in this chapter of the EIA. In order that the contractors are fully aware of the implications of the ESMMP and to ensure compliance, it is recommended that environmental measures be treated separately in the tender documentation and that payment milestones are linked to environmental performance, measured by execution of the prescribed environmental mitigation measures.

The contractors must be made aware through contract documents of the importance of the environmental and social components of the project. They should be prepared to co-operate with the executing agency, project management, supervising consultants and local population for the mitigation of impacts. Furthermore, the contractor must be legally bound through the contract to implement the ESMMP in full and be ready to engage trained environmental management staff to monitor the implementation and effectiveness of the mitigation measures as the project proceeds.

8.3 Institutional Requirements

It will be the responsibility of Project Proponent to implement and monitor the mitigation measures proposed in this chapter. The following institutional arrangements will be necessary to implement the ESMMP and to deal with other environment related issues.

8.3.1 Establishment of Project Environmental and Social Management Unit (ESMU)

It is proposed to establish a Project Environmental and social Management Unit (ESMU) as the senior environmental body of the project to take care of environmental issues of the project and to take policy decisions at project level. The client should assign the necessary responsibilities to ESMU through Project Director C&W, which should be responsible for implementation of the ESMMP. The Project Director will be assisted by an Environmental Expert and a Social Expert in implementing the mitigation measures proposed in ESMMP. The Contractor will be responsible for the implementation of the proposed project under the supervision of ESMU. The Contractor should be bound to follow the provisions of the contract documents especially about environmental protection and apply good construction techniques and methodology without damaging the environment. Obligation of the contractor, to safeguard, mitigate adverse impacts and rehabilitate the environment should be addressed through environmental provisions in the contract document. The responsibilities of the Project Environmental Management Unit (ESMU) are as follows:

- To ensure implementation of all the proposed mitigation measures proposed in ESMMP during the construction of the project;
- To prepare the final procedures of damage assessment, compensation and their implementation during project execution.
- Ensuring that all contractors follow the GBEPA regulations and other requirements stipulated in the construction contracts concerning dust suppression, solid waste disposal, municipal wastewater disposal, air pollution, noise and vibration, biodiversity and safety, transport, storage and use of flammable and explosive materials.
- Avoiding deforestation by the contractors in the of the project area.
- Liaison with the neighboring communities for their concerns about the construction activities.
- Monitoring wildlife in the Project area.
- Ensuring proper disposal of all the construction spoil (excavated material and construction materials).
- Ensuring proper, timely and transparent compensation to affected persons.

8.3.2 Responsibilities of Design & Supervision Consultant

Environmental Engineer/specialist of DSC would oversee the performance of contractor to make sure that the contractor is carrying out the work in accordance with ESMMP as mentioned in the contract documents. The Environmental Engineer/Specialist would also provide assistance to the Contractor's Staff to implement ESMMP. Package wise Site-Specific Environmental Management Plan (SSESMMP) would be prepared by the contractor under the supervision of EE of DSC. The SSESMMP would be approved by the PWD. EE of DSC would provide guidance to the contractor's EE for implementing each of the activity as given in ESMMP. EE of DSC would be responsible for record keeping providing instruction through the "Resident Engineer (RE)" for corrective actions and would ensure the compliance of various statutory and legislative requirements. EE would maintain the close coordination with the contractor and ESMU for successful implementation with environmental safeguard measures. However, overall responsibilities of EE of DSC are as follows:

- Directly reporting to the RE;
- Discussing various environmental issues and environmental mitigation enhancement and monitoring actions with all concerned directly or indirectly;
- Review contractor's SSESMMP as part of their work program;

- Inspect, supervise and monitor all the construction and allied activities related to the ESMMP for the project;
- Visiting construction sites including incomplete construction work sites, where there are no contractor's activities, active construction work sites, completed areas of work sites as well as ancillary sites such as borrow areas, quarries, asphalt and crusher sites, hot mix plant sites, construction camps and work shop areas etc. to ensure contractors compliance with ESMMP stipulations and conditions of statutory bodies;
- Assist the RE to ensure the environmental sound engineering practices;
- Assisting contractor and ESMU in all matters related to public contacts including public consultation pertaining to environmental and community health & safety issues;
- Assisting ESMU to carry out environmental monitoring;
- Organizing training to the EE of contractor and field staff; and preparing and submitting monthly and quarterly environmental progress/ compliance reports to the C&W.

8.3.3 Responsibilities of Contractor

Site Environmental Engineer of contractor would carry out the implementation of the mitigation measures at construction site. Contractor would be bound through contract documents to appoint the Site Environmental Engineer/Specialist with relevant educational background and experience. The responsibilities of EE of Contractor are as follows:

- EE of contractor would prepare SSESMMP, monitoring plan, traffic control/diversion plan, and asphalt and batching plant area plans and would submit all the plans to the EE of DSC.
- EE of contractor would be responsible for the implementation of ESMMP and to take effective measures against corrective actions plan;
- EE would prepare the compliance reports as per schedule and would submit it to the DSC;
- Provision of proper Personal Protective Equipment (PPEs) to the workers that includes breathing equipment in overalls in dust and blasting areas, face shields for flying particles, helmets, goggles, footwear in areas where expose to falling, rolling and piercing objects, hearing protection like ear buds and ear muffs in noisy areas and train them for their proper use; and
- EE would conduct the environmental and health & safety trainings to the workers /labor.

8.4 Description of Environmental Social Management and Monitoring Plan (ESMMP)

Every project envisages certain impacts to the environment which must be controlled to have a safer and sustainable environment. Gilgit Baltistan Roads Project would affect the physical, socio-economic, biological, air, noise, water and waste disposal of region. The study has been performed to control and monitor the impacts in every possible manner. It results in preparing an ESMMP to monitor impacts identified during design, construction and operational stages in chapter 7; as highlighted in **Table 8-1**.

Table 8-1: Environmental Social Management & Monitoring Plan (ESMMP)

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
A. DESIGN PHASE							
A1. Designing Road alignment	• Road alignment to ensure safe and efficient transportation, friendly environment and cost effectiveness.	i. Design road alignment considering factors like slope gradient, rock stability, landslides, drainage patterns, water flow, environmental impact, land acquisition, and traffic load.	• Road alignment designed as per mitigation measures	Once at start of design stage	Design Office	DSC	PM, ESMU
A2. Designing road drainage System	• The primary purpose of a road drainage system is to remove the water from the road and its surroundings. • The rain falls very heavily on the hills and as the slopes of hills are quite steep, the water reaches the roadside very quickly and creates drainage problems and may induce flooding, soil erosion, and siltation of streams	i. Design road drainage system based on higher intensity and frequency of extreme rainfall events. ii. Design the side drains only on the hill side of the road. iii. Design covered side drains in urban areas.	i. Road drainage system designed based on higher intensity and frequency of extreme rainfall events. ii. Side drains designed on the hill side of the road. iii. Covered Side drains designed in urban areas.	Once at start of design stage	Design Office	DSC	PM, ESMU,
A3. Designing of sub-surface drainage	• The presence of seepage flow can lead to stability issues beneath the roadway, as well as on the hill slope itself.	i. Design the sub-surface drainage system based on the depth to hard strata, the amount and intensity of rainfall. ii. Incorporate longitudinal and/or cross drains, to effectively manage the seepage flow.	• Mitigation measures were considered while designing sub surface drainage system	Once at the end of design stage	Design Office	DSC	PM, ESMU
A4. Designing of cross drainage and protection works	• To drain off rain water collected in side drains and catch drains, the project roads have an extensive network of drainage channels/ Nullahs falling into the Tangir and Darel Rivers. • Proper design of bridges/culverts on Nullahs and waterways to	i. Design drainage structures for disposal of run off to keep the road safely useable in rainy seasons and to prolong the life of the project; ii. Place culverts, causeways, and scuppers along the roads at proper intervals to ensure proper water drainage iii. Propose turfing on the slopes to maintain the stability and integrity of the project roads.	• Compliance as per mitigation measure.	Once at the end of design stage	Design Office	DSC	PM, ESMU,

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
	accommodate design flows will ensure prolonged life of road infrastructure and protection of roads from damage due to scouring.						
A5. Construction techniques for landslide mitigation	• Due to the steepness in the hilly areas, construction of unplanned roads triggers landslides.	i. Evaluated slope stability to assess the risk of rockfalls, landslides, and subsidence. ii. Design the road covering sufficient space between road and top of the slopes. iii. Design retaining structures such as walls, embankments, and berms to resist lateral forces and prevent slope failures. iv. Provision of drainage galleries / ditches, and provision of catchment ditches.	• Compliance as per mitigation measure. • Visual observation for landslide occurrence.	Once at the end of design stage	Design Office	DSC	PM, ESMU,
A6. Assessment for blasting	• Uncontrolled blasting can lead to adverse effects such as land sliding, excessive fly-rock or over breakage, rock mass loosening, damaged rock support etc.	i. Investigate cost-effective rock breaking methods other than blasting. ii. If blasting is to be used, then prepare blasting plan having details; maximum amounts of explosive to be used at any one time, pattern blasting, use of millisecond delays and means of initiation.	Rock breaking methods other than blasting applied.	Once at the end of design stage	Design Office	DSC	PM, ESMU,
A7. Aesthetic change	• Negative aesthetic impacts can be expressed as a product of the poor consideration of design principles and resulting lack of harmony between the road design and various features of the landscape such as natural relief and morphology of the landscape, hydrology, vegetation, structure and pattern of the landscape,	i. Incorporate aesthetic feature to ensure minimum visual changes, degradation of topography/soil erosion. ii. Minimize vertical re-alignment of the roads to reduce deep cuts and refill works; iii. Use natural materials (rocks, stones, riprap) or greened concrete frames for embankment and slope stabilization.	Compliance as per mitigation measure.	Once at the end of design stage	Design Office	DSC	PM, ESMU,

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
	village areas, etc.						
A7. Excavated Material and Solid Waste Management	• Improperly managed spoil can result in soil erosion and sedimentation of downslope water bodies, deterioration of water quality, and induced flood risks; • impact on ecological resources and natural habitats if disposed at inadequate locations; • Reduction of agricultural productivity if spoil is applied wrongly.	i. Minimize excavation requirements by utilizing a balanced cut-and-fill technique for road widening. ii. Plan disposal sites with reasonable distance from the human settlements; iii. Incorporate technical design features for refuse collection containers at sites to minimize burning impacts; v. Devise plan(s) for safe handling, storage and disposal of harmful materials.	i. Cut-and-fill road construction technique was applied for road widening. ii. Disposal sites were planned with reasonable distance from the human settlements; iii. Waste storage areas were designed properly. v. Plan(s) for safe handling, storage and disposal of harmful materials were devised.	Once at the end of design stage	Design Office	DSC	PM, ESMU,
A8. Relocation of Public Utilities	• Affected public utilities may create disruption of public services and economics.	i. Make provision in the design and budget for the relocation of the existing public utilities wherever required. ii. Incorporate technical design features to minimize effect on public utilities.	Compliance as per mitigation measure.	Once at the end of design stage	Design Office	DSC	PM, ESMU, PGRC
A9. Tree cutting	• Unplanned project activities may lead to removal of trees	i. Use efficient technical design measures to avoid or minimize removal of trees and flora.	Compliance as per mitigation measure.	Once at the end of design stage	Design Office	DSC	PM, ESMU, PGRC
A10. Impact on fauna.	• Negative impact on fauna due to unplanned project construction activities	i. Design the alignment of project and its activities to minimize the effect on local fauna and biologically sensitive areas.	Compliance as per mitigation measure.	Once at the end of design stage	Design Office	DSC	ESMU
A11. Surface and ground Water contamination	• Surface water may get contaminated due to the surface runoff during construction and operation phase. Ground water may also get contaminated from the wastewater generated from the construction camps.	i. Incorporate in the design, the cut of drains, cascades, chutes and sedimentation ponds to control surface water runoff and sedimentation load. ii. Plan the location of construction camps at an appropriate distance from the surface water bodies; iii. Design the septic tanks and soakage pits to cater the wastewater from the construction camps.	i. The cut of drains, cascades, chutes and sedimentation ponds were Incorporated in design. ii. construction camps were planned at an appropriate distance from the surface water bodies; ii. Designed septic tanks and soakage pits in construction camps.	Once at the end of design stage	Design Office	DSC	ESMU

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
B. PRE-CONSTRUCTION PHASE							
B1. Land Acquisition and Compensation	• Construction of Tangir and Darel Expressways will require widening of existing roads. • As a result, the project will require the acquisition of privately owned land and compensation of affected people.	i. Prepare Involuntary Land Acquisition and Resettlement Plan (LARP). ii. Provide adequate budget in the project cost for the compensation to the affected people as per Land Acquisition Act, 1894. iii. Implement GRM to address community grievances. iv. Implement alternative access, management of temporary works and traffic diversions to reduce the magnitude of impacts on property and welfare. v. Use wasteland areas for contractor camp, batching plant, and waste disposal sites as far as possible.	i. Involuntary Land Acquisition and Resettlement Plan (LARP) prepared. ii. Compensation cost provided in the budget of project cost. iii. Implemented GRM to address community grievances. v. Contractor camp, batching plant, and waste disposal sites were arranged at barren land.	Once before construction	Design Office	DSC	PM, ESMU, PGRC
B2. Relocation of Public Utilities	Widening of roads project may damage the existing infrastructure and facilities, including water supply channels and about 501 electricity poles.	i. Locate and handle with care the position of infrastructure in cooperation with the relevant institutions. ii. Relocate all affected public utilities well ahead of the commencement of construction work. iii. Keep close liaison with local relevant authorities.	Precautionary measures designed	Once at the end of design stage	Design Office	DSC	PM, ESMU, NTDC
B3. Location and inhabitation of Labor Camps	The camp site in populated area may cause the social implication including the security and privacy of local residents, spread of communicable diseases and also environmental problems due to disposal of solid waste, effluents etc.	i. Worker's camp site/location shall be at least 500 meters away from settlements and selected in consultation with the consultants' environmental team and the nearby communities. ii. Hire local skilled and unskilled labor as for as possible. iii. Photographical and botanical inventory of vegetation before clearing the site; iv. Ensure enough light and proper	i. Got approval for Worker's camp site. ii. Preferred local skilled and unskilled labor as for as possible. iii. Photographical and botanical inventory of vegetation were made before clearing the site; iv. Ensured proper kitchen facilities at camp site **v.** Sanitary facilities and	Once at pre construction stage	Labor camps	DSC	PM, ESMU,

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
		kitchen facilities at camp site v. Contractor should provide gas cylinder for cooking purpose and avoid use of wood as a fuel. vi. Provision of the pit latrines, septic tanks for camps to treat the sanitary wastewater before its discharge to nearby water bodies. vii. The contractor must provide Proper sanitary facilities and adequate supply of water to worker camps.	adequate supply of water and pit latrines with septic tanks were provided.				
		viii. Contractor shall develop a Code of Conduct to govern behavior of workers, and all staff shall sign	Code of Conduct approved by Engineer	Once	-	Contractor	ESMU
C. CONSTRUCTION PHASE							
C1. Clearing and Grubbing of the Road Construction Area	**Impact on Flora** i. Widening and construction of the project roads will be accompanied by clearance of vegetation within the ROW of the road's alignment.	i. Contactor shall maintain an inventory of cut trees including details of girth, species and height.	Maintenance of inventory records	Monthly	Contractors' office	Contractor	DSC, ESMU
	ii. Around 1200 fruit and wood trees are estimated to be cut or removed within the ROW of the proposed project roads.	i. Compensatory planting & aftercare of saplings of native trees at a ratio of 10 trees for each 1 tree cut. ii. Plant native and fast-growing species in consultation with the local forest department and communities. ii. Implement systematic plantation along the ROW of roads.	Physical verification of compensatory Plantation and its survival rate.	Monthly	RoW of project roads	Contractor	ESMU, DSC
	Impact on Fauna • During construction, movement of heavy machinery and induced human activities may impose negative impacts on fauna in the surrounding area.	i. Minimize the number of access roads in order to avoid affecting on wildlife habitats, food sources and forage. ii. Drive construction vehicles and machinery at moderate speed to avoid disturbing wildlife in their habitats. iii. Consider wildlife movements and routes during project activities.	As per proposed mitigation measures.	Monthly	RoW of project roads	Contractor	ESMU, DSC

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
		iv. Adopt alternate routes and points to avoid any damage to locally available fauna as well as local livestock.					
	Impact on local business • During the planning and design phase of the Project it is anticipated that there will potentially adversely impact on the socio-economic environment especially in Tangir Bazar, Lurak Village area, Korrangay Village. • Business activities of people primarily include food sellers, groceries, petrol stations, motorbike repairs, catering and catering services. • Due to the proposed Project, entry/exit problems and bifurcation of settlements, shops and agricultural land/fields may occur for the residents as well as hindrance in movement and transportation.	i. Consult with shop owners and farmers at least two weeks before construction starts to agree on and provide temporary access to their businesses/ production areas. Inform on the planned construction activities and likely impacts; ii. Consult shop owners and farmers regularly to seek their feedback on impacts such as emissions, dust, noise, traffic safety at least two weeks prior to commencement of construction; iii. Do not store raw materials or waste within 20m of businesses or shops. iv. Arrange traffic control staff for loading and unloading of raw materials and wastes; v. Provide compensation for products and properties damaged by the project activities; vi. Resolve immediately any inconvenience caused by project activity.	i. Shop owners and farmers agreed upon planned construction activities. ii. No complaint related to emissions, dust, noise and traffic blockage etc. iii. Compensation received for products and properties damaged by the project activities; iv. GRM implemented.	Weekly	RoW of project roads	Contractor	ESMU, DSC PGRC
C2. • Excavation and backfilling for road widening.	• Risk of landslides and embankment collapses during Construction	i. Prefer fill embankments supported by retaining structures to gain the required width of the roads. ii. Construct retaining wall on the valley side of the roadway to prevent the sliding of backfilling. iii. Start excavation from the top and gradually taken down. v. Install final slope stabilization works to minimize the period of risk of landslides and slope collapses.	i. Fill embankments supported by retaining structures was preferred for road widening ii. The retaining wall constructed to prevent the sliding of backfilling. iii. Excavation was started from the top and gradually taken down. iv. Slope stabilized to	Monthly	RoW of project roads	Contractor	DSC ESMU

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
			minimize the risk of landslides and slope collapses				
	Blasting Impact • Blasting will cause short term impacts like vibration, dust generation and emissions such as CO, CO2, SO2 etc., and long-term potential impacts on land stability.	i. Control blasting at predetermined times notified to communities and local residents. ii. Conduct blasting in which the explosive charges are controlled to minimize the vibrations and noise. iii. No blasting at night. iv. Assess geological and soil conditions to avoid blasting in sensitive locations. iv. Prepare blasting Management Plan for the project.	i. No complaint from communities and local residents. ii. No blasting at night. v. Blasting Management Plan prepared and implemented.	Daily	RoW of project roads	Contractor	ESMU DSC
C3. Transportation of construction and excavated material and other road construction activities.	• Air pollution/ Emissions	i. Provide service to all project plant (generators & batching plant) and vehicles as per manufacturer's guidelines to reduce gaseous emissions. ii. Don't allow burning of solid waste such as plastic, cloth, tar, etc. and other hazardous wastes on the construction site and near other residential or sensitive areas. iii. Set up and maintain a high fence of 2.5m in site locations with large excavation or embankments or near sensitive sites. iv. Erect the windshield walls on three sides of the material stockpiled at least 0.5 m above the top of the pile. v. Provide dust masks for construction workers. v. Spray water on all exposed surfaces to suppress emission of dust. v. Erecting windshield walls on three sides of the material stockpiles at least 0.5 m above the top of the pile.	i. Project plant (generators & batching plant) and vehicles are provided service as per manufacturer's guidelines. ii. Visual monitoring for dust and vehicular emissions. iii. Monitoring of ambient air against NEQS. iii. Verify the use of mask when working in dusty conditions. iv. Air Quality Management Plan	Daily	Construction sites and Haulage routes	Contractor	ESMU, DSC

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
		vi. An Air Quality Management Plan (**Annexure V**) should be prepared and implemented by the contractor to mitigate above mentioned impacts.					
	Traffic Impact i. It is anticipated that an overall increase and traffic hindrance would occur as a consequence of the proposed road construction. It will be very dangerous to maintain the traffic on the road especially during excavation work.	i. Set up clear traffic signal boards and traffic advisory signs at the roads going in and out the road and bridge construction sites to minimize traffic build-up. ii. Communicate the schedule of construction, as well as specific construction activities causing disruptions or access restrictions. iii. Coordinate with local traffic authorities to implement traffic diversion schemes. iv. Limit transporting materials and avoid overloading vehicles. v. Repair damaged pavement of local road. vi. Traffic management plan (***Annexure-VII***) will be prepared by the contractor after consultation with RE for its implementation. vi. GRM will be put in place to address community grievances in this regard.	i. Existence of signal boards and traffic advisory signs at the road's construction sites. ii. Schedule of construction circulated among local community. iii. Traffic diversion schemes implemented. vi. Traffic management plan prepared and implemented. Community grievances addressed under GRM.	Daily	Entire project area	Contractor	DSC ESMU
	ii. Noise and vibration	i. Bound the contractor to provide latest equipment for completion of each task. ii. Keep speed of the project vehicles low and No horns while passing through or near the communities. iii. Bound the contactor to provide acoustic guards, covers and doors on plants and vehicles. iv. Fitting of muffler with construction machinery that produces noise in excess of 85 dB.	i. Monitor the noise levels regularly at the nearby sensitive receptors to ensure that these do not exceed NEQS. ii. No complaint from local community. iii. Physical cheking of acoustic guards, covers and doors on plants and vehicles.	Daily	Entire project area	Contractor	DSC ESMU
	iii. Dust emission	i. Minimize double handling of material during earthworks operations.	i. Monitor double handling of material during	Daily	Entire project area	Contractor	DSC ESMU

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
		ii. Use wet scrubbers and water sprinkling at batching plants. iii. Reduce the drop height when loading trucks. iv. Sprinkle water on the access roads regularly. v. Avoid clearing of vegetation beyond the CoI/RoW. vi. Minimize the off-road travel.	earthworks operations. ii. Monitor vehicle speeds to avoid dust emissions. iii. Monitor sprinkling of water at batching plants and access roads.				
	iv. Impact on Soils and Soil Erosion	i. Limit the extent of excavation to reduce soil erosion potential. ii. Temporary landfill and waste rock from excavation and construction work will be concentrated in separate dumps. Dumps will be located away from surface waters. iii. Cut areas should be treated against flow acceleration while filled areas should be carefully designed to avoid obstruction or destruction to natural drainages iv. Plantation of grasses and shrubs will be done for slope protection; v. Place all containers in a bunded area away from water courses; iv. Decanting and or controlled disposal of oil and grease as collected at collection tanks of maintenance yard and chemical storage areas;	i. Monitor the distance of dumps from surface water. ii. Monitor the obstruction in natural drainage. iii. Compliance as per proposed mitigation measures	Daily	Quarry and construction sites	Contractor	DSC ESMU
	Impacts of Borrowing Sites i. The excavating activities could have adverse environmental impacts including soil erosion, drainage problem, land productivity, threaten existing structure stability, and impact the health and	i. The contractor will not leave the borrow pits in an unusable condition such that it could be filled with rain water and cause problems for the community e.g. breeding place for mosquitoes etc. ii. No soil will be excavated outside the demarcated ROW area. iii. Contractor will be responsible to restore the borrow area. iv. Barrow area development and	i. Compliance as per proposed mitigation measures ii. Record community complaints regarding borrow sites. iii. Barrow area development and restoration plan prepared and implemented.	Monthly	Borrowing sites	Contractor	DSC ESMU

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
	safety of the workers and local population.	restoration plan (**Annexure VIII**) will be prepared by the contractor after consultation with RE for its implementation.					
	Impacts on Surface and Ground Water and Aquatic Ecosystems ii. Spillage of wastewater from project construction activities could pollute rivers and streams in turn of affecting the local communities and aquatic biodiversity.	i. Avoid dropping fuel oil, grease, and chemicals into the surrounding environment to avoid overflowing rainwater. ii. Store lubricants in dedicated enclosures with a sealed floor at least 50 m from water bodies. iii. Solid waste from construction activities shall not be thrown in rivers. iv. Construction storage/stockpiles shall be provided with bunds to prevent silted run-off. v. Washing of machinery and vehicles in surface waters shall be prohibited. vi. Ensure that water courses (rivers, canals, etc.) shall be kept free of excavation spoil and construction debris, floating and submerged. vii. Work in rivers will be scheduled during dry season. viii. Disposal of slurry from bridge construction in the water body shall be forbidden.	i. Check disposal of solid waste and storage of lubricants. ii. Monitor the blockage of horizontal culverts and drainage channels. iii. Compliance as per proposed mitigation measures.	Monthly	Contractor camp and Construction sites	Contractor	DSC ESMU
	Flood Conditions iii. During the period of construction, civil works may lead to flood conditions due to blocking of drains, drainage paths and culvert openings.	i. If flooding or stagnation of water is caused by civil works, contractor shall provide immediate means to prevent loss of access to any public or private land/property & to prevent damage to public or private land/property. ii. Surplus soil and cleared vegetation will be disposed of so as to avoid disturbing the natural drainage. iii. All sections of the road close to or on steep slopes will be closely monitored for any signs of soil erosion or land	i. Monitor blockage of drains, drainage paths and culvert openings ii. Compliance as per proposed mitigation measures.	Seasonal	Project drainage system	Contractor	DSC ESMU

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
		slippage.					
C4. Disposal of Excavated Material and Inert Waste	**Large amounts of spoil and inert waste are expected to be generated during construction. Improperly managed spoil can result in** i. soil erosion and sedimentation of downslope water bodies, potentially leading to interference of river hydrology, deterioration of water quality, and induced flood risks; ii. impact on ecological resources and natural habitats if disposed at inadequate locations; and iii. Reduction of agricultural productivity if spoil is applied wrongly.	i. Handle all excavated material in a manner that minimizes the release of fugitive dust. ii. Tightly cover trucks transporting spoils with tarpaulin or other suitable materials to minimize dust emission and spills. iii. Keep the road surfaces clean of spilled spoil. iv. Earthwork and spoil disposal should not cause sedimentation and obstruction of flow of watercourses, damage to agricultural land and densely vegetated areas v. The spoils disposal site should be adequately protected by avoiding formation of steep slopes and grassing to prevent erosion to surface watercourses.	i. Monitor water quality and interference of river hydrology ii. Compliance as per proposed mitigation measures.	Monthly	Disposal sites of excavated material and inert Waste	Contractor	ESMU DSC
C5. Disposal of demolition waste	The project is expected the removal of 1333 structures. • Demolition waste such as metal, gravel, asphalt etc accumulated alongside of the road will cause public inconvenience by dust dispersion, reduced visual quality, and health hazard.	i. Reuse or recycle demolition where possible. ii. Non-re-usable parts shall be disposed of in an approved disposal site. iii. Training will be provided to personnel for identification, segregation, and management of waste.	i. Implementation of waste management Plan. ii. Compliance as per proposed mitigation measures.	Monthly	Tangir Bazar and other structure coming in RoW.	Contractor	ESMU DSC
C6. Disposal of domestic waste	• Improper management of domestic waste generated from labor camps may produce unpleasant smell, discomfort to the community, potentially causing water and soil	i. Implement Waste Management Plan to ensure safe handling, storage, collection and disposal of construction wastes and the training of employees who handle waste ii. Provide dust bins in different colors to separate out food, glasses and other	i. Waste Management Plan implemented. ii. Training to employees who handle waste. iii. Dust bins provided in the worker camp. iv. Remove all the waste	Monthly	Contractor labor camps	Contractor	ESMU, DSC

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
	pollution. If not properly managed, solid waste can affect the health of workers and people living near the camp.	solid waste at the worker camp. iii. Remove all the waste from worker camp very day and dump in approved site. iv. Burning of waste will not be allowed in any case.	from worker camp very day and dump in approved site. v. Burning of waste will not be allowed in any case. Provision of bins in labor camp and bins are properly used vi. These conditions could be incorporated into the contractor's documents for better sanitation conditions and waste disposal at temporary worker camps. vii. Monitoring the worker camps regularly in consultation with Public Health Inspector (PHI)				
C7. Management of hazardous waste and hazardous materials	• Poor management of hazardous waste and hazardous materials could lead to significant soil and water pollution.	i. Collect hazardous wastes separately, in containers marked as hazardous waste with sealed lids and place in a non-permeable floor, a roof, and fire insulation. They should be stored at least 100m away from any water source. ii. Confine vehicle maintenance and refueling areas to designated areas in construction sites designed to contain spilled lubricants and fuels. iii. Arrange training programs for workers to deal with hazardous chemicals in the workplace. i. A Hazardous and Explosive Material Management Plan (**Annexure X**) must be prepared and implemented by the contractor to mitigate above mentioned impacts.	i. Compliance as per proposed mitigation measures. iii. Training programs arranged to deal with hazardous chemicals in the workplace. ix. Hazardous and Explosive Material Management Plan prepared and implemented.	Monthly	Contractor labor camps	Contractor	ESMU DSC

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
C8. Worker's Health and Safety	• Health risks and worker's safety problems may result at the workplace if the working conditions provide unsafe and/or unfavorable working environment.	i. Ensure safety measures taken by the contractor in layout plan for camp site, ii. Obligatory insurance against accidents for laborers/workers; iii. Provide basic medical training to specified work staff and basic medical service and supplies to workers; iv. Provide protection devices (ear muffs) to the workers doing job in the vicinity of high noise generating machines; v. Provide protective clothing for laborers handling hazardous materials, vi. Elaborate contingency plan in case of major accidents; vii. Provision of Doctor viii. Adequately stocked dispensary shall be provided. ix. Mechanism for supply of drinking water for workers (**Annexure XI**) should be prepared and implemented by the contractor.	i. Monitor safety measures in layout plan for camp site, ii. Monitor obligatory insurance against accidents for laborers/workers; iii. Provided basic medical training to specified work staff and basic medical service and supplies to workers; iv. Provided all protection devices to the workers doing job in risky places, v. contingency plan designed to address unexpected events; vi. Doctor visiting camps regularly vii. Adequately stocked dispensary is available. viii. Mechanism for supply of drinking water for workers prepared and implemented	Weekly	Contractor labor camps	Contractor	ESMU DSC
C9. Labor Influx	• Sexual Exploitation and Abuse (SEA), Sexual Harassment (SH) and gender-based violence (GBV) Incidents	i. Contractor shall employ more locals in skilled, semi-skilled, and unskilled work. ii. Contractor will proactively manage the potential impacts from labor influx and potential cultural conflicts between local communities and workers, which include following: a. Camps will be constructed at the designated areas; b. The Contractor's training program will cover topics related to respectful attitude while interacting with the local	Establishment of GRM. Complaints register set up & maintained	Daily	Contractor's and Engineer's Offices and Worker Camp	Contractor	ESMU, DSC

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
		communities; c. Contractor shall provide on-site anti-harassment trainings to create awareness of the harmful effects of GBV, as well as consequences if GBV occurs according to the anti-harassment policies. d. Construction crew will avoid entering settlements. e. The routes/places used by the women will be avoided as far as possible. If unavoidable, alternate routes will be identified for the communities. i. Use of drugs and alcohol will not be allowed at the work/construction site;					
C10. Hunting	Loss of fauna	Ban on hunting, poaching and trapping of all fauna by all project personnel	Hunting reported/observed	Monthly	Project area	Contractor	ESMU
C11. Security	Conflict with local communities, attacks on staff	i. Fencing & security shall be provided by contractor at camp entrance to camps shall be monitored and restricted.	Provision of fencing to camp and deployment of security	Monthly	Construction camps	Contractor	ESMU
		ii. Contractor shall provide all staff with identity cards showing their association with the project	All staff issued with identity cards	Monthly	Project Area	Contractor	ESMU
C12. Community Health and Safety	• The construction activities and vehicular movement at construction sites and access service roads may result in road side accidents. • Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents etc. • The labor workers with different transmittable	i. Ensure proper control on construction activities and Oil spillage leakage of vehicles; ii. The Borrow areas should be fenced properly and banned for the movement of the residents; iii. Restrict the labor workers with different transmittable diseases within the construction site; iv. Timely public notification on planned construction works; v. Ensure community integrity & social links; vi. Carry out road safety campaigns; vii. Provide proper safety and diversion signage, particularly at urban areas	i. Rare cases of oil spillage leakage of vehicles; ii. Proper fencing of the borrow areas iii. Schedule of construction activities is notified iv. community integrity & social links are ensured; v. Road safety campaigns are launched; vi. Proper safety and diversion signage are provided at urban areas and at sensitive/accident-prone spots;	Weekly	Construction camps	Contractor	ESMU PGRC

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
	diseases may cause spread out of those diseases in the local residents. • The borrow pit areas located near the residential, settlements, may cause accident for the people moving near to those areas.	and at sensitive/accident-prone spots; viii. Reduce the impacts of vector borne diseases.	ix. Compliance of proposed mitigation measures				
	• Community Conflicts	ii. Set up of complaints register at contractors and Engineers office	Complaints registers set up & maintained	Monthly	Contractor's and Engineer's Offices	Contractor	ESMU
D. OPERATIONAL PHASE							
D1. Land Sliding	• Landslide may take place due to unusual earth quakes and heavy rains in project area. This would cause damage to the road and pose risks to the vehicle and human life.	Introduce early warning systems	i. The system will use numbered, glass strips positioned strategically across key areas. ii. These will be monitored on a weekly basis for any breakage. iii. On appearance breakage, the gap will be measured and monitored for any widening that will provide an early warning of a potential landslide.	Periodically	Landslide areas	GB C&W	ESMU
D2. Increase vehicle movements	**Air Quality and Noise**	i. Complete afforestation along the ROW immediately after the construction phase is completed; ii. Select the plants in accordance to their ability to absorb emissions; iii. Regular road maintenance to ensure good surface condition; iv. Speed limits at sensitive locations; v. Regular vehicle checks to control/ ensure compliance with NEQS;	i. Setting up of a system to monitor air quality along project area in accordance with the applicable standards/limits; ii. Physical verification of new plantation along road ROW. iii. Compliance as per	Periodically	Road ROW	GB C&W	ESMU

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
		vi. Enforcement and penalties against traffic rules violators. vii. Signs for sensitive zones (health centers / educational institutions etc.) to disallow the use of pressure horns.	mitigation measures.				
	Road Traffic Safety • The proposed roads pass small towns, schools, hotels, religious places where students and people gather frequently. Moreover, there are many local restaurants and shops are located closer to the ROW. • The upgradation, rehabilitation of the roads will induce high vehicular speed. As a result, there will be a risk of increased road accidents.	i. Place speed limit, warnings and sign boards near sensitive areas and identify places, which are susceptible to accidents. ii. Road furniture and road marking should be done immediately after completion construction work. iii. Kerbed footpaths should be preferred to facilitate local inhabitants. iv. Speed breaker should be considered in the areas where offices, schools are located or adjacent to the ROW.	i. Speed limit warnings and sign boards were placed near sensitive areas. ii. Road furniture and road marking were completed. iii. Speed breaker were constructed where offices, schools are located or adjacent to the ROW.	Periodically	Road ROW	GB C&W	ESMU
D3. Blocking of Road Drainage System	Blocking of drains and culverts due to sediments, improper disposal of debris or disposing garbage into side drainages by the general public will create overflow of drains and alteration of surface runoff paths causing soil erosion and health hazards.	The drainage structures such as catch water drains, catch pits, side drains and culverts are to be periodically inspected and cleaned off all the debris and blockages which prevent the smooth flowing of water in such structures during rains.	Compliance as per mitigation measures.	Periodically	Road ROW	GB C&W	ESMU
D4. Road Maintenance	i. Laborers or the staff involved in maintenance works will be exposed to health and safety issues. The maintenance works can also cause traffic problems to the travelers.	i. Implementation of HSE Plans during the maintenance period; ii. Strict implementation of PPEs; iii. Use of high-quality equipment and material by the contractor; iv. Placement of sign boards for traffic diversions and proper implementation of traffic diversion plans;	i. Compliance as per proposed mitigation measures.	Periodically	Road maintenance sites	GB C&W	ESMU

Activity	Issue	Mitigation Measures	Monitoring Parameter	Monitoring Frequency	Location	Institutional Responsibility	
						Implement-ing Agency	**Supervision /** Monitoring
		v. Selection of suitable sites for contractor camps and implementation of all the related important protocols for the management of camp activities in order to avoid environmental and HSE issues; vi. Inspect culverts, roadside ditches and drainage system, water bars and outlets after each major runoff event and restore flow capacity as needed.					

PM: Project Management ESMU: Environmental and social Management Unit PGRC: Project Grievance Resolution Committee GB C&W: Gilgit Baltistan Communication & Works
DSC: Design & Supervision Consultant

8.5 Environmental and Social Management Cost

The implementation cost of Environmental and Social Management Plan is given in the **Table 8-2**.

Table 8-2: Environmental and Social Management Cost

Sr. No.	Description	Quantity	Months	Per Unit Cost (PKR)	Total Cost (PKR)
	1) Staff Cost				
1.1	Environment Safeguard Specialist	01	24	300,000	7,200,000
1.2	Social Safeguard Specialist	01	24	300,000	7,200,000
1.3	Climate Change Expert	01	24	300,000	7,200,000
1.4	Health & Safety Manager	01	24	300,000	7,200,000
1.5	Health & Safety Inspector	03	72	100,000	21,600,000
1.6	Junior Environmentalist	1	24	200,000	4,800,000
1.7	Junior Sociologist	1	24	200,000	4,800,000
				Subtotal (1)	**60,000,000 (60 Million)**
	2) Environmental Monitoring				
2.1	Drinking Water Quality Testing	8 (4 samples/year)		20,000	160,000
2.2	Air quality monitoring covering CO, SO2, O2, NO2, NO, NOx, CO2, PM2.5, and PM2.10, Smoke	8 (4 samples/year)		40,000	320,000
2.3	Noise level Monitoring	8 (4 samples/year)		9000	72,000
				Subtotal (2)	**552,000 (0.55 million)**
	3) Occupational Health and Safety (OHS) Requirements				
3.1	**Purchase of PPEs**				
a.	Safety Shoes Pairs	200 Nos		6000	1,200,000
b.	P. Caps	200 Nos		500	100,000
c.	Hard Hats	200 Nos		500	100,000
d.	Glowing Jackets	200 Nos		500	100,000
e.	Pairs of Gloves	100 Nos		100	10,000
f.	Face Masks	1,000 Nos		20	20,000
g.	Sanitizers	100 Nos		500	50,000
3.2	First Aid Kit	10 Nos		50,000	500,000
3.3	Medicines (LS)	Lump Sum		200,000	200,000
3.4	Misc.	Lump Sum		200,000	200,000
				Subtotal (3)	**2,480,000 (2.48 million)**
	4) Periodic Training sessions with Contractor labor force on ESMP compliance and with local communities at site on code of ethics and GRM etc.				
4.1	Boarding and Lodging	Lump Sum		500,000	500,000
4.2	Transportation	Lump Sum		500,000	500,000
4.3	Training Material	Lump Sum		200,000	200,000
4.4	Entertainment	Lump Sum		200,000	200,000

Sr. No.	Description	Quantity	Months	Per Unit Cost (PKR)	Total Cost (PKR)
4.5	Misc.	Lump Sum		100,000	100,000
				Subtotal (4)	**1,500,000 (1.5 million)**
5)	**Compensation cost of 1200 trees to be cut**			4000	4,800,000 (4.8 Million)
				Subtotal (5)	**4,800,000 (4.8 million)**
6)	**Cost of Compensatory Plantation (10 trees against 01 tree cut)**				
6.1	Cost of sapling Total	1200 Nos		100	120,000
6.2	Cost of fencing, layout, Digging of pits and Planting of sapling	1200 Nos		400	480,000
6.3	Watch and ward after plantation gardeners	10	24	40,000	9,600,000
				Subtotal (6)	**10,200,000 (10.2 million)**
7)	**Cost of Climate Adaptation, Mitigation and Co-benefits etc.**				
7.1	Climate Change Adaptation	Lump sum			1024,000,000
7.2	Risk Assessment, Reduction & Mitigation	Lump sum			10,000,000
7.3	Disaster Management and Resilience Aspects	Lump sum			10,000,000
7.4	Co-benefits	Lump sum			10,000,000
				Subtotal (7)	**40,000,000 (40.0 Million)**
				Grand Total (1+2+3+4+5+6+7)	**Rs.133.032 Million**

9 Grievance Redress Mechanism

This Section outlines the policy and procedure for documenting, addressing, responding and employing methods to resolve project grievances and complaints that may be raised by the project affectees or community members arising from environmental and social performance, the engagement process, resettlement and/or unanticipated environmental or social impacts resulting from project activities that are performed and/or undertaken by Client. The Section describes the scope and procedural steps and specifies roles and responsibilities of the parties involved in addressing the grievances.

9.1 Principles

A GRM is established to address any complaints or grievances arising during the implementation period of the projects. People of the project area may perceive risks to themselves or their property or their legal rights or have concerns about the possible adverse environmental and social impact that a project may have. Any concerns or grievances will be addressed quickly and transparently, and without retribution to the project affected community members or complainant. The primary principle of GRM is that all complaints or grievances are resolved as quickly as possible in a fair and transparent manner.

9.2 Objectives

The objectives of the GRM are to:

- Develop an organizational framework to address and resolve the grievances of individual(s) or community(s), fairly and equitably;
- Provide enhanced level of satisfaction to the aggrieved;
- Provide easy accessibility to the aggrieved/affected individual or community for immediate grievance redress;
- Ensure that the targeted communities and individuals are treated fairly at all times;
- Identify systemic flaws in the operational functions of the project and suggest corrective measures; and
- Ensure sustainability of the project.

9.3 Type of Complaints

The major complaints that may arise during the execution of the proposed project at site include but not limited to:

- E&S issues (dust, noise, air pollution, social and cultural issues);
- Damage and blockage of public utilities;
- Traffic inconvenience;
- Gender based violence (GBV) and harassment;
- Resettlement issues including loss of livelihood; and
- Issues related to compensation of resettlement impacts.

9.4 Disclosure of GRM

The GRM will be disclosed at PMU office, Communication & Works Department Office, and concerned project engineers, as well as at project sites.

9.5 Structure of Grievance Redress Mechanism

The project will establish a three-tier GRM comprising Community GRC, project GRC; and PMU-GRC. These tiers are described below.

9.5.1 Community GRC (Tier-1)

The community-GRC will provide a platform for project affected community members to raise and discuss their concerns, resolve the E&S including resettlement issues at the community level and coordinate with project management to communicate these issues and concerns. Community-GRC will be established to maintain a close rapport and coordination with affected persons and community members throughout the project implementation. The social development specialist (SDS) of PMU with the assistance of SC will facilitate the establishment of community-GRC that is representative of the ethno-cultural and gender diversity within the community. The community-GRC will comprise the following six members with one as the committee convener:

- Three female members (from the project affected community members); and
- Three male members (from project affected or community members).

The project E&S and engineering staff will coordinate with community-GRC to review and resolve the issue or concern related to resettlement planning or implementation as well as environmental and social concerns preferably within five (05) working days from receipt of the grievance. Any complaints that cannot be resolved at community-GRC will be forwarded to the next tier.

9.5.2 Project GRC (Tier-2)

PMU Communication & Works Department will constitute a GRC headed by concerned Project Manager (PM) at each project site to resolve all grievances and complaints of the project affected or community members received either directly or through the Tier-1. The project GRC will comprise of the following members:

1) Project Manager (PM), as head/convener of sub-project GRC;
2) Environment, SDS and Gender specialists of PMU;
3) E&S specialists of Supervision Consultant (SC)
4) Resident Engineer of supervision consultant;
5) A representative (E&S specialist) of contractor (if required); and
6) A representative of local community.

Representative from any other district government department may be called as and when required by the sub-project GRC. Environmental Specialists of PMU and SC will join sub-project GRC meeting related to environmental issues only.

The project GRC will meet once a month and when the need arises. The sub-project GRC will review grievances involving all E&S issues including resettlement issues that may arise due to project implementation. Sub-project GRC will perform the following functions:

- Record, categorize and prioritize the grievances that need to be resolved by the committee and resolve them within ten (10) working days;
- Invite and hear aggrieved persons/parties to produce evidence of their claims and record their view point;
- Communicate its decisions and recommendations on all resolved issues to PMU and the aggrieved persons for smooth implementation;
- Forward the unresolved cases/ complaints to PMU-GRC within an appropriate time frame with reasons recorded and its recommendations;
- Develop an information dissemination system and acknowledge the aggrieved persons/parties about the development regarding their grievance;
- Maintain a complaint register accessible to the project affected members with brief information about complaints and sub-project GRC decision with status report; and,
- Maintain complete record of all complaints received by the sub-project GRC with actions taken.
- Any complaint that cannot be resolved by the sub-project GRC, will be forwarded to the next tier – the PMU-GRC.

9.5.3 PMU-GRC (Tier-3)

At the third tier, the PMU has already constituted a GRC (PMU-GRC). The PMU GRC will receive complaints either directly or through the Tier-2 GRC. The committee has the following composition:

1) Project Director;
2) SDS, Member
3) Gender Specialist, Member;
4) Concerned Project Manager, Member;
5) SDS of CSC, Member; and
6) Representative of Civil Society.

Representative from any other district government department may be called as and when required by the PMU-GRC. Environmental Specialists of PMU and SC will join PMU-GRC meeting related to environmental issues only.

The PMU-GRC through authorized representative, will acknowledge the complainant about his/her complaint, scrutinize the record, investigate the remedies available and request the complainant to produce any record in favor of his/her claim. After thorough review and scrutiny of the available record on the complaint, field visit will be conducted to collect additional information, if required. Once the investigations are completed, the PMU-GRC will give decision within twenty (20) working days of receipt of the complaint. If the complainant is still dissatisfied with the decision, he/she can go to the court of law, if he/she wishes so. Organization of the GRC is in **Figure 9-1**;

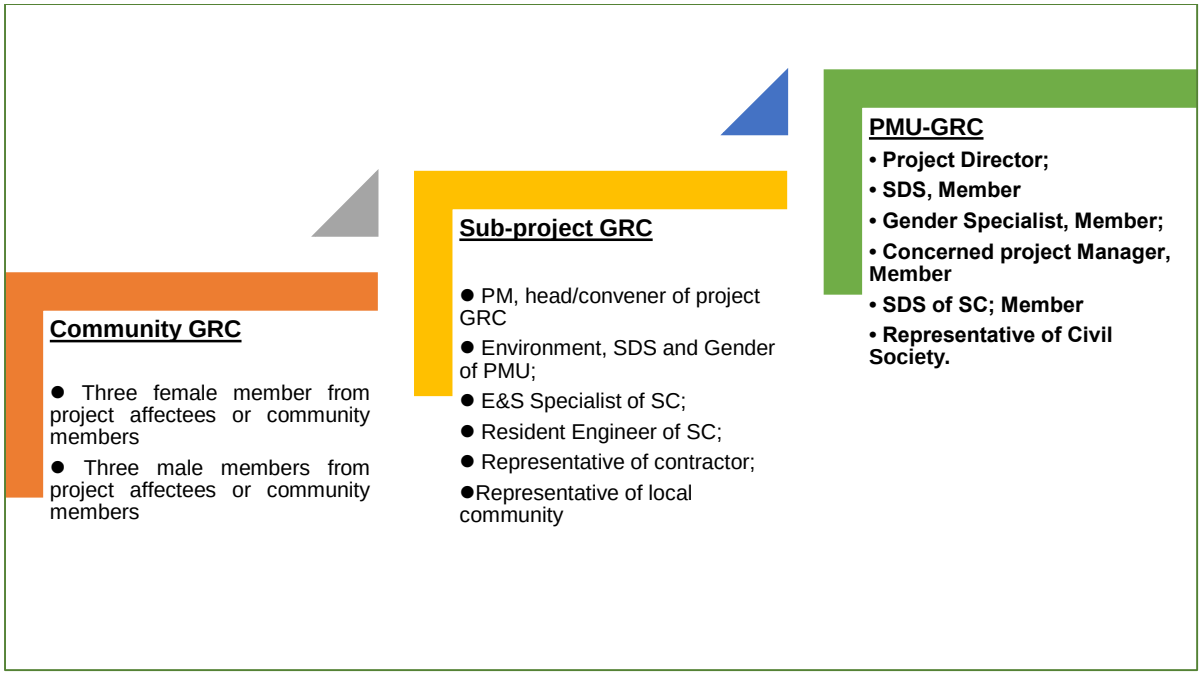


Figure 9-1: Organogram of GRC

Gender representation will be ensured by inducting a female member in all GRCs. The mechanism will ensure the access of project affected community members to a GRM that openly and transparently deals with the grievances and makes decision in consultation with all concerned.

9.6 Gender Based Violence (GBV) Committee

Besides PMU-GRC, a GBV committee has also been established and notified within PMU consisting of the following members:

1) Concerned Project Manager, Head/ Convener of GBV Committee;
2) Gender Expert, PMU, Secretary; and
3) SDS PMU, Member.

The GBV Committee will address the gender related issues caused by the project activities during EIA and project implementation.

9.7 Grievance Redress Procedure/ Mechanism

The intention of GRM is to resolve a complaint as quickly and at as low a level as possible to avoid a minor issue becoming a significant grievance. Irrespective of the stage of the process, a complainant has the option to pursue the grievance through the court as is his/her legal right in accordance with law.

The GRCs will work at site, sub-project and PMU levels. The E&S and engineering staff of PMU, in coordination with site staff will inform the project affected community members about the GRCs and its mechanism through consultations and by posting at prominent places. The complaints received through any media will be screened by type and category. These complaints will be registered in Community Complaints Register (CCR), where the name and address of complainant, date, description of complaint and action taken will be recorded. The following procedure will be used to redress the grievances:

- First, complaint resolution will be attempted to be addressed at community-GRC through the involvement of the field E&S/engineering staff. The community-GRC shall give decision within five working days of receipt of the complaint. If unsettled, grievance can be lodged to the sub-project GRC by the complainant or by the GRC;
- Sub-project GRC will acknowledge the receipt within two working days of lodging of complaint. Initial review and consultation with the sub-project GRC will be conducted within five working days of receipt of complaint. If required, sub-project GRC will advise the E&S/engineering specialists to conduct field visits in consultation with the aggrieved persons/parties and local community and submit a fact-finding report. Preferably, the fact finding will be completed within eight working days from receipt of complaints. Sub-project GRC shall give decision within 10 working days of receipt of the complaint. If unresolved, a grievance will be lodged to the (PMU-GRC) by the complainant or by the GRC; and
- The PMU-GRC shall give decision within 20 working days of receipt of the complaint. If the complainant is still not satisfied, he/she can pursue further by submitting the case to the appropriate court of law.
- All E&S issues will be dealt according to the above GRM procedures. The GRCs will hear and clarify with the complainant (if required so) about the E&S issue and shall conclude and communicate their recommendations for further implementation in due course of time. Complainant will be kept informed during the process and the GRC decision will be communicated to him/her accordingly. In case of any delay, the complainant will be informed on the progress and process about his/her grievance. The GRC proceedings will be documented step by step and all records will be maintained and summarized in the project progress and internal monitoring reports.

9.8 Lodging of Complaint

The complainant(s) can lodge their grievances through a number of ways/channels including online, mail, phone, and WhatsApp, e-mail and complaint box. Moreover, PMU has established an e-Portal for filing and tracking progress of the application online; the details are provided below.

- It is an electronic complaint lodging system (application) that will be accessible through a link on the PMU website;
- The focus of the e-portal is the quick complaint lodging for all types of primary stakeholders;
- Any project affected or community member with internet access can lodge a complaint with option for anonymous complaints. Uploading of photos for better understanding of the problem will also be an option;
- Each complainant will get a unique Grievance Number to track their complaints through the e-portal;
- Each complaint will go through a quick resolution mechanism being managed by a dedicated team at the PMU. Each complainant will be contacted to ensure that his/her issue is resolved;
- The portal will differentiate between types of complaints for targeted decision-making and action on behalf of PMU; and
- The portal will allow a quick and easy method for monitoring of the entire complaint lodging and resolution mechanism.

10 Land Acquisition and Resettlement Aspects

10.1 General

Land acquisition for development projects leads to displacement of the population living in that area. Their lives are affected in more than one ways. The people depending upon the land, forest and other natural resources for their livelihood lose their source of subsistence. The project components, which will cause a change in the land use pattern and other natural resources will have multifaceted effects on the community and public structures, social networks, productive assets, income sources, cultural identities, potentials for quality and quantity of the assets and resources. The Resettlement Aspects have been prepared for undertaking the assessment of the project affected people, identification of categories of impacts, number of affected persons with inventory of affected assets and other losses, entitlement of compensation, and other mitigation.

10.2 Need for the Resettlement Planning

It is widely accepted by the donors that unmitigated involuntary resettlement under development projects often gives rise to severe economic, social, and environmental risks. The production systems are dismantled, people face impoverishment when their productive assets or income sources are lost, people are relocated to environments where their productive skills may be less applicable, community institutions and social networks are weakened, kin groups are dispersed and cultural identity, traditional authority, and the potential for mutual help are diminished or lost.

The Resettlement Action Plan (RAP) will prepare (if required) as per the statutory requirements, which provide guidance in resettlement planning, implementation, and monitoring/evaluation and the World Bank Environmental and Social Framework (ESF) 2018 includes Environmental and Social Standards (ESSs) to address and mitigate these impoverishment risks.

During preparation of the RAP, the potential positive and negative social impacts created by the construction of the road Network in Construction of Tangir Expressway and Construction of Darel Expressway project in Gilgit Baltistan are identified through field surveys, consultation meetings and discussions with PAPs, Government officials and experts. A socio-economic study will carry out to identify potential impacts and affected households and properties located along the route.

The RAP sets out objectives, principles, eligibility criteria and public participation mechanisms to compensate land and other assets, identifies compensation beneficiaries, and provides the results of the consultations which accompanied its preparation. The RAP is based on a comprehensive diagnosis of the socioeconomic context and social analysis within which the PAPs operate. The plan focuses on culturally sensitive socio-legal milieu and administrative systems for land administration and ownership, entitlement provisions, modes of compensation and conflict resolution mechanisms.

The RAP will be endorsed by the Project Executing Agency, prior to initiation of the relevant civil works, and will be publicly disclosed in a manner accessible to the project-affected persons (PAPs).

10.3 Resettlement Policy Framework

10.3.1 Policy Application and Entitlements

This policy will be applicable to all government approved public sector, private sector, joint ventures project etc. that involve land acquisition and/or involuntary resettlement of people who may be physically and/or economically displaced due to the development project. Policy will also be applicable to resettlement and relocation in the event of climate related events/natural disasters (e.g., floods, earthquakes) and to relocate people from disaster/hazard prone locations and forced displacement during AEDs to free public land/Row. It will be effective immediately following the approval by the Gilgit Baltistan Government and will be notified through the Gazette (Extraordinary). Gilgit Baltistan Government will decide about retroactive application of this policy for forced displacements due to AEDs which have happened in the past before the effective date of this policy on a case-by-case basis.

The policy measures are also applicable to all projects financed by multilateral and bilateral development partners. In case of any policy gaps with any International Financial Institutions (IFIs), project-specific additional measures will be adopted under relevant project legal and project agreements.

10.3.2 Entitlement

The proposed project will provide compensation to all affected people eligible for compensation based on nature or category of their losses including physical assets or income affected within a set and communicated cut-off-date. Full replacement cost as compensation is the basic principle guiding the allocation of entitlements, i.e., the project will replace in kind or cash what is lost in terms of land, structures, livelihood, community facilities and services, with special provisions for the improvement of livelihoods of vulnerable displaced persons, sharing of project benefits and unanticipated impacts.

The entitlement matrix for the proposed project will be specific to the types of impacts, losses and eligible persons in the project, while the provisions made in this RPF include a wider range of possible cases, which may rise under the projects. Each individual PAP will be eligible for a combination of entitlements specific to his/her particular loss and property relations to the lost assets. The entitlement matrix in Table 8.1 summarizes the provisions for eligibility and entitlements.

10.3.2.1 Entitlement Matrix

An entitlement matrix derived from the R&R Policy framework is provided in **Table 10-1** for general guidance. This may be tailored to according to the context and needs, and based on the nature of impacts, types of displacements, and mitigation measures. While resettlement is the preferred approach from a sustainable development perspective, cash compensation, based on entitlements, can also be provided if preferred by eligible persons and/or required by the government due to contextual reasons (e.g., non-availability of resettlement sites and/or land and/or resources for developing new resettlement sites that are or can easily be well connected to sources of livelihood and provided requisite services). The decision to provide resettlement or cash compensation may be done on a case-by-case basis.

Table 10-1: Entitlement Matrix

Type of Loss	Unit of Entitlement		Entitlement	Additional Services
1. Loss of Agricultural Land				
1.1 Permanent loss of and/or permanent access restriction to agricultural land (including uncultivated, grazing, or other lands used for agricultural purposes and subsistence) falling under project ROW	(a) Legal owner(s) as per the revenue/land records or customary rights		(i) Land-for-land of the same or better quality for those losing entire agricultural holdings to ensure that economic viability and livelihoods are not negatively affected; or	For land-for- land, project to find alternative land in the
			(i) Cash compensation at replacement cost, plus 15% compulsory acquisition surcharge (CAS) – free of taxes, registration, and transfer costs. (ii) For cases where small parcels of land are required, a negotiated approach shall be preferred overuse of eminent domain to speed up the land-take process.	Locality / district in consultation and agreement with the affected landowners.
	(b) Leaseholders of government land		(i) Compensation for land for legally recognized leaseholders only or land-for-land swap where possible. (ii) Cash compensation equal to market value of gross harvest /agricultural outputs for remaining lease years up to maximum of two years.	
	(c) Sharecroppers / Tenants		(i) Cash compensation equal to market value of gross harvest /agricultural outputs for remaining lease years up to	

Type of Loss	Unit of Entitlement		Entitlement	Additional Services
			maximum of two years.	
	(d) Agricultural workers losing their contracts		(ii) Cash compensation for loss of work, at official daily wage rate, for the remaining part of agricultural season up to a maximum of three months.	
	(e) Informal users of the land/ agricultural workers without contracts		(i) Cash compensation for loss of crops for one year (inclusive of winter and summer) (ii) Provision for additional assistance under vulnerable groups	
1.2 Temporary impact on cultivable or other types of land, typically for 3-4 months (or more in case of large projects)	Titled owners and other categories (ref b to e above)		(i) No compensation to titled owners provided land is rehabilitated/restored to its former state; however, owners are entitled to compensation for loss of crops/trees etc. (if any), plus cash compensation for loss of income for the duration. (ii) For leaseholders, tenants / sharecroppers, agricultural workers, and informal settlers, cash compensation for any crop losses, and cash compensation for income losses during the period	Project to rehabilitate land to its original status
Implementation Guidelines 1. Land owners and users will be informed of the details of land acquisition and compensation processes and payment procedures 2. Replacement cost refers to the method of valuation that help determine the amount sufficient to replace lost assets and cover transaction costs. For land, replacement cost is referred to pre-project value of the land of similar type/quality, plus transaction costs (e.g., administration charges, title or registration fees etc.). The valuation method for determining replacement				

Type of Loss	Unit of Entitlement		Entitlement	Additional Services
cost should be documented and included in relevant resettlement planning document. 3. Identified owners will be assisted by the project to prepare legal documents in support of their ownership for compensation purposes. 4. Project implementing agency/NGOs shall encourage the entitled persons (EPs) for purchasing land or invest the compensation money in productive income generation activities.				
2. Loss of Homestead, Commercial, and Urban/Industrial Land				
2.1 Loss of residential/ homestead, commercial, urban/industrial land due to project interventions	(a) Legal owner(s) as per the revenue /land records or customary right		(i) Land for land through provision of a private plot comparable in value and location to plot lost; or cash compensation at replacement cost, plus 15% compulsory acquisition surcharge (CAS) – free of taxes, registration, and transfer costs. (ii) A residential plot in the resettlement site for those opting for project- sponsored resettlement.	Legal owners will be assisted by project NGO to prepare legal papers necessary to claim compensation
	(b) Renter / Leaseholders		Up to Six months' rent or a value proportion to the duration of the remaining lease, including any deposit, they may lose	
	(c) Informal settlers/occupants of land without title/landless agricultural workers, agricultural tenants without tenancy agreements, and agricultural tenants whose tenancy agreements do not cover the right to reside on the landowners' land		Provision for accommodation in available alternative land/resettlement site or self-relocation allowances equivalent to: For urban areas (per household): (i) Provision for space for accommodation - amount may be provided equivalent to the replacement cost or a plot at the resettlement site, if the project involves a	

Type of Loss	Unit of Entitlement		Entitlement	Additional Services
			resettlement site; (ii) Replacement cost of a plot in the area that they were residing, if the project does not involve a resettlement site. For rural areas (per household) (i) Provision for space for accommodation – amount may be provided equivalent to the replacement cost OR a plot at the resettlement site if the project involves a resettlement site, (ii) Replacement cost of a plot of the land they were occupying if the project does not involve a resettlement site.	
Implementation Guidelines: 1. Affected landowners will be informed of the details of land acquisition and compensation processes and payment procedures 2. Replacement cost will be determined following the principles mentioned earlier. 3. Project NGO to encourage and motivate the entitled persons to purchase alternative residential or commercial/industrial land with compensation money or invest in productive and income generating activities.				
3. Loss of Residential Structures with Titles to Land				
3.1 Loss of residential structures/houses	Legal owner(s) as per the revenue /land record or other legal papers		(i) For Pukka and Semi-Pukka Houses: Cash compensation at replacement cost for affected structures by type of construction, and other fixed assets without depreciation cost; owners will be allowed to take the	Project will provide other resettlement benefits through the project -NGO, including assistance in relocation and reconstruction

Type of Loss	Unit of Entitlement		Entitlement	Additional Services
			salvageable free of cost-plus transfer grant. (ii) For Katcha and Temporary structures (e.g. shacks, jhuggi, huts etc.): Transfer and reconstruction grant calculated based on the C&W approved rates of structure for rebuilding residential structure on plots at resettlement site or elsewhere based on self-relocation option: for urban and rural areas (per family), provision of construction for accommodation – amount may be provided equivalent to C&W rates for construction. (iii) Special assistance of one-time payment equivalent to one minimum wage for female-headed, disabled, elderly and the very poor (those under BPL).	
3.2 Partial loss of residential structures, including boundary walls / minor structures	Legal owner(s) as per the revenue /land record or other legal papers		(i) Cash compensation at replacement cost for the affected part of the structure. (ii) Additional cash compensation to assist in the restoration of the remaining structure	
3.3 Loss of housing or accommodation by tenants/ occupants	Tenants and others with rental agreements/ contracts		(i) Affected tenants will receive cash compensation of a value proportionate to the remaining tenancy period or three months, whichever is higher.	

Type of Loss	Unit of Entitlement		Entitlement	Additional Services
Implementation Guidelines: 1. Applicable to all structures located on affected area at cut-off dates. 2. Affected structure owners/tenants etc. will be informed about the impacts and notified of the compensation value/rates etc. 3. Compensation will be paid prior to dismantling and removal of the structures as per civil works requirements 4. Replacement cost, based on C&W rates, must reflect current material costs, labor etc.; the valuation report by structure types to be annexed in the resettlement planning document.				
4. Loss of Residential Structures without Titles to Land				
4.1 Loss of residential structures/houses by owners without title to land (e.g. informal settlers/landless agricultural workers/ agricultural tenants without tenancy agreements/ agricultural tenants whose tenancy agreements do not cover the right to reside on the landowners' land etc.)	Socially recognized owner(s) of structures on RoW identified during census/ surveys		(i) For Pukka and Semi-Pukka Houses: Cash compensation at replacement cost for affected structures by type of construction, without depreciation cost; owners will be allowed to take the salvageable free of cost-plus transfer grant. (ii) For Katcha and Temporary Structures (e.g. shacks, jhuggis, huts etc.): Transfer and reconstruction grant calculated based on the C&W approved rates of structure for rebuilding residential structure on plots at resettlement site or elsewhere based on self-relocation option: for urban and rural areas (per family), provision for construction for accommodation – amount may be provided equivalent to C&W rates for construction. (iii) Special assistance of one-time	Project will provide other resettlement benefits through the project -NGO, including assistance in relocation and reconstruction

Type of Loss	Unit of Entitlement		Entitlement	Additional Services
			payment equivalent to minimum wage for female-headed, disabled, elderly and the very poor (those under BPL).	
Implementation Guidelines: 1. Applicable to all informal residential structures located in affected during the census/surveys (i.e., cut-off dates) 2. Affected structure owners/tenants etc. will be informed about the impacts and notified of the compensation value/rates etc. 3. Compensation will be paid prior to dismantling and removal of the structures as per civil works requirements. 4. Replacement cost, based on C&W rates, must reflect current material costs, labor etc.; the valuation report by structure types to be annexed in the resettlement planning document.				
5. Loss of Commercial and Urban/Industrial Structure with Titles to Land				
5.1 **Loss of commercial, urban/industrial structures due to project** RoW	Legal Owner(s) of the structures as per legal records		(i) For Pukka and Semi-Pukka structures: Cash compensation at replacement cost for affected structures by type of construction, and other fixed assets without depreciation costs plus transfer grant. (ii) Owners will be allowed to take the salvageable free of cost. (iii) For Katcha and Temporary Structures: Transfer and reconstruction grant calculated based on the C&W approved rates of structure for rebuilding structure at resettlement site or elsewhere based on self-relocation option.	Project will assist owners to find alternative area for relocation, rebuilding and reconstruction
5.2 Loss of rental space or accommodation by tenants / occupants	Tenants and others with rental agreements/ contracts		Affected tenants will receive cash compensation of a value proportionate to the remaining tenancy period or up to six months, whichever is higher.	

Type of Loss	Unit of Entitlement		Entitlement	Additional Services
Implementation Guidelines: (i) Applicable to all structures located in the affected area at cut-off dates. (ii) Affected structure owners/tenants etc. will be informed about the impacts and notified of the compensation value/rates etc. (iii) Compensation will be paid prior to dismantling and removal of the structures as per civil works requirements				
6. Loss of commercial/urban space for businesses without Titles to Land				
6.1 Loss of commercial/ urban space without titles (e.g., shops, stalls) – both temporary or permanent	Owner(s) of structures/ businesses identified @cut-off date during census/surveys		For owners of businesses: (i) cash compensation equal to one-year income, provided the loss is permanent; (ii) in case of temporary losses, cash compensation equal to the period of interruption of the business up to a maximum of 6 months or covering the period of income loss based on construction activity	Eligible to other benefits, including livelihood/ training program
6.2 Loss of employment	Workers/ employees of affected businesses identified at cut-off date during census/surveys.		For workers/employees, indemnity or protection of lost wages for the period of interruption up to a period of three months, based on local wage rates)	
6.3 Mobile informal sector microenterprises (e.g., kiosk, carts, vendors, hawkers etc.) & loss of public space – for example, by cobblers, hair cutter etc. used for businesses.	Owner(s) of kiosks, carts and other businesses identified at cut-off date during census/surveys		(i) Movable structures are unlikely to be affected; however, if affected, shall be considered case by case for cash compensation commensurate to the loss. (ii) Each affected street vendors will be compensated for loss of businesses for three months (or duration of the civil work, whichever is higher) at the wage rates in the locality determined by the local bodies/administration.	

Type of Loss	Unit of Entitlement		Entitlement	Additional Services
			(iii) Any additional losses identified shall be treated case by case.	
Implementation Guidelines: 1. Applicable to all types of informal businesses located in affected area during the census/surveys (i.e., cut- off dates). 2. In case of disputes, the local Grievance Redress Committee (GRC) will verify and determine eligibility for compensation and other benefits. 3. Compensation will be paid during civil works period, depending on the work schedule. 4. Project will provide compensation and other resettlement benefits with assistance from the Project- NGO/field staff.				
7. Loss of Common Property Resources (CPRs)				
7.1 Loss of CPRs such as pumps, wells, ponds, village grazing land, school/religious structures used by community	Local Committee/legal owners or legally recognized entity by revenue administration.		(i) Cash compensation at replacement cost for land and structures by type of construction, and other fixed assets without depreciation costs plus transfer grant (ii) Salvageable materials will be allowed free of cost.	Project-NGO will conduct consultation meeting with concerned committee for new relocation and reconstruction
Implementation Guidelines: 1. Applicable to all types of CPRs located on RoW at cut-off date notification. 2. Project-NGO will engage with concerned communities regarding relocation sites and choices. 3. Compensation for CPRs will be paid prior to dismantling and removal of the structures as per civil works requirements 4. The concerned community will be responsible for reconstruction of the CPR with help and supervision from the project and local administration				
8. Loss of Crops and Trees				
8.1 Loss of standing crops on affected area	Project-affected persons (including squatters) owning standing crops on public land		(i) Crop compensation in cash at full market rate for one harvest season (either winter or summer) by default for impacts caused by project activities. (ii) All other types of crop losses will be compensated at market rate based on actual losses.	
8.2 Loss of trees on RoW	Project-affected persons (including		(i) For fruit trees, compensation	

Type of Loss	Unit of Entitlement		Entitlement	Additional Services
	squatters) owning trees on public land		based on lost production for the entire period needed to re-establish a tree of equal productivity. (ii) For timber/wood trees, compensation will be at market value of trees' wood content	
Implementation Guidelines: 1. Applicable to all types of trees and crops in affected area at cut-off dates notification. 2. For fruit trees that are not yet mature and fruit-bearing, compensation will be based on the gross expenses needed to reproduce the tree to the same age it was cut.. 3. Timber trees will be valued based on market value of their dry wood volume. The wood of the fallen tree will remain with the owner, and its value will not be deducted from compensation.				
9. Loss of Income/Livelihood				
9.1 Loss of income and livelihood	Project-affected persons with impact on livelihood/income, including those physically displaced		(i) For land and non-land-based livelihood, 3 to 6 months of livelihood support, based on official minimum wage per month, as transition to restoration of income. (ii) Temporary or permanent employment during construction and operation of the project that caused displacement	
Implementation Guidelines: 1. Applicable to all project affected person (including women and other vulnerable groups), who experienced loss of income and livelihood. 2. The economic activity data must be analyzed by gender, age group, education, skills, income, households' size, and preferences and options 3. The resettlement planning document must clearly identify the scale of impact by categories such as severe, minor impacts etc. with recommended provisions for multiple income restoration programs 4. A separate NGO to be hired to design/plan and implement Income Restoration and Enhancement Program.				

Type of Loss	Unit of Entitlement		Entitlement	Additional Services
10. Assistance to Vulnerable Groups				
10.1 Vulnerability impact and support	Socially marginalized groups such as (not limited to) households below poverty line, female -headed households, elderly, persons with disabilities, landless agricultural labor, agricultural tenants without tenancy agreements, and the very poor		(i) Lump sum one-time livelihood assistance equivalent to three-month minimum wage in local standards. (ii) Temporary or permanent employment in construction activities where feasible (iii) Provision for any additional support during relocation and resettlement.	Eligible to other benefits, including livelihood/ training program
Implementation Guidelines: 1. Applicable to project affected person, more particularly women and other vulnerable groups, who may experience severe impact due to their pre-project socio-economic status. 2. The resettlement planning instrument must further refine the concept of vulnerability in more inclusive way in view of the project context. 3. In consultation with vulnerable groups, the project will design a social preparation strategy for the vulnerable groups prior to relocation and resettlement.				
11. Unforeseen Adverse Impacts and Losses				
11.1 Households/persons affected by any unforeseen impact during project implementation	Entitlement will be determined in view of the R&R Policy framework		The unforeseen impacts will be identified through due diligence and surveys. The entitlement will be reviewed by Project PMO and approved by the concerned department / agency.	As appropriate
Implementation Guidelines: 1. The unforeseen impact and affected persons will be identified with due care as per the policy framework, and submitted to PMO for review and approval, including the quantity of losses, ownerships, and the proposed entitlements.				

10.4 Vulnerability

During inventory of project affected persons within the beneficiary communities, vulnerable persons will be identified in order for special assistance or measures to be put in place for them. Generally, vulnerable persons will cover:

- The aged (above 70 years);
- Physically and mentally challenged;
- Widows;
- Orphaned children (less than 18 years) and
- Bedridden or seriously sick persons.

10.5 Cut-off Date

The cut-off date is the date when section 4 of LAA is issued. With the issuance of section 4, buying and selling of land in the notified area comes to a stop till land is acquired. However, due to lengthy process of land acquisition and timeline between different sections of LAA (section 4 to land award) the date of census of PAPs is usually considered as the cut-off-date for funded projects. Any person moving into the land located within the specific location of the project after this cut-off date will not be eligible for compensation, relocation and livelihood restoration and rehabilitation entitlements.

10.6 Identification of Project Impacts

The permanent land requirements for the project have been based on the design of the project. The surveys have revealed that the total land requirements on permanent basis and other project impacts package wise are summarized.

10.6.1 Package 1: Construction of Tangir Expressway

The surveys have revealed that the 142 kanal of land requirements on permanent basis, 25 residential, 475 commercial structures, 150 Non-fruit and 350 fruit trees will be impacted by the project which is summarized in below **Table *10-2***.

Table 10-2: Detail of Land, Structures & Trees Falling in RoW of Tangir Expressway

Sr. No	Type Of Impacts	No
1	Impact on Land	142 (kanal)
2	Impact on Residential Structure	25
3	Impact on Commercial Structure	475
4	Impact on non-fruit Trees	150
5	Impact on fruit Trees	350

10.6.2 Package -II-Construction of Darel Expressway

The surveys have revealed that the 109 kanal of land requirements on permanent basis, 45 residential, 600 commercial structures, 300 non-fruit and 400 fruit trees will be impacted by the project which is summarized in below **Table *10-3***.

Table 10-3: Detail of Land, Structures & Trees Falling in RoW of Darel Expressway

Sr. No	Type Of Impacts	No
1	Impact on Land	109 (kanal)
2	Impact on Residential Structure	45
3	Impact on Commercial Structure	600
4	Impact on non-fruit Trees	300
5	Impact on fruit Trees	400

10.6.3 Land Acquisition

The land being affected and acquired for different project components consists of the irrigated agricultural, saline and Banjar land, which is generally private land, and will be fully compensated. The exact ownership of affected land will be established by the relevant Revenue Department and compensated as per their land record. Total 251 kanal land will be acquired for all two projects.

10.6.4 Structure Compensation (Residential/ commercial)

1145 (70 residential and 1075 commercial) structures will be resettled due to, the implementation of these two road Project. The compensation of these houses is based on the prevailed market rate basis.

10.6.5 Trees

In the ROW of these two Project affected area, there are 450 forest/firewood trees and 750 fruit trees found in the ROW of the proposed road project. The compensation cost of these trees will be paid according to the rate from forest department. The salvaged material of the cut trees will be the property of the respective owners.

10.6.6 Resettlement / Transition Period Allowance

Each Project affected family is entitled for relocation allowance, and vulnerable allowance will be paid to vulnerable people in the Project area.

10.7 Resettlement Costs

In the process of investigations, construction, operation and maintenance of any road project, the physical, biological and socio-economic impacts like land acquisition, loss or damage to houses, trees, infrastructure, crops, labor camps, contractor's camps, widening of roads and rehabilitation of construction and waste material disposal areas, etc. are envisaged. All of these impacts need to be compensated/ mitigated/ rehabilitated properly. For mitigation of the adverse impacts on various parameters, cost will be involved. In order to meet the cost of land, rehabilitation of affected areas, crops, infrastructures and land acquisition etc. is estimated in the light of the guidelines, objectives and policies made by Pakistan/Gilgit Environmental Protection Agency and World Bank. Detail of the resettlement cost of all these projects (package wise) is provided in the below **Table 10-4**.

Table 10-4: Summary of Land Acquisition and Resettlement Plan (LARP) Cost

Sr. No.	Description	Affected asset		Units	Rate (PKR)	Total Compensation (PKR)	Total Compensation RS(Million)
Package 1							
A	**Assets**						
1	**Land Acquisition Mandatory Charges**						
1.1	Agricultural Land	142	Kanal*	1,150,000		163,300,000	163.30
1.2	**Compulsory Acquisition Surcharge@ 15%**					24,495,000	24.50
					Sub-total	**187,795,000**	**187.80**
2	**Trees**						
2.1	Tree (Timber)	150	No.	10,000		1,500,000	1.50
2.2	Trees (Fruits)	350	No.	20,000		7,000,000	7.00
					Sub-total	**8,500,000**	**8.50**
3	**Structures**						
3.1	Residential Structure	25	6250	2600		16,250,000	16.25
3.2	Commercial Structure	475	47500	2600		123,500,000	123.50
					Sub-total	**139,750,000**	**139.75**
					Total of A	**336,045,000**	**336**
B	**Allowances**						
1.1	Severity Allowance	175	Nos.	96,000		16,800,000	16.80
					Sub-total	**16,800,000**	**17**
2	**Vulnerability Allowances**						
	OPL/Minimum wage	150		96000		14,400,000	14.40
					Sub-total	**46,462,500**	**46.46**
					Total (B)	**63,262,500**	**63.26**
					Total (A+B)	**399,307,500**	**399.31**
C	M&E @ 5% of the total cost					**19,965,375**	**19.97**
D	Administrative charges@ 1% of the total cost					**3,993,075**	**3.99**
					Total (A+B+C+D)	**423,265,950**	**423.3**
E	Contingencies @ 02% of the total cost					**8,465,319**	**8**
					Grand Total (A+B+C+D+E)	**431,731,269**	**431.7**
Package 2							
A	**Assets**						
1	**Land Acquisition Mandatory Charges**						
1.1	Agricultural Land	109		Kanal	1,150,000	125,350,000	125.35
1.2	**Compulsory Acquisition Surcharge@ 15%**					18,802,500	18.80
					Sub-total:	**144,152,500**	**144.15**
2	**Trees**						
2.1	Tree (Timber)	300		No.	10,000	3,000,000	3.00
2.2	Trees (Fruits)	400		No.	20,000	8,000,000	8.00
					Sub-total:	**11,000,000**	**11.00**
3	**Structures**						
3.1	Residential Structure	45		11250	2600	29,250,000	29.25
3.2	Commercial Structure	600		60000	2600	156,000,000	156.00
					Sub-total:	**185,250,000**	**185.25**
					Total of A	**340,402,500**	**340**
B	**Allowances**						
1	Severity Allowance	225		Nos.	96,000	21,600,000	21.60
					Sub-total:	**21,600,000**	**22**
2	**Vulnerability Allowances**						
	OPL/Minimum wage	200			96000	19,200,000	19.20

	Sub-total:	**46,462,500**	**46.46**
	Total (B)	**68,062,500**	**68.06**
	Total (A+B)	**408,465,000**	**408.47**
C	M&E @ 5% of the total cost	**20,423,250**	**20.42**
D	Administrative charges@ 1% of the total cost	**4,084,650**	**4.08**
	Total (A+B+C+D)	**432,972,900**	**433.0**
E	Contingencies @ 02% of the total cost	**8,659,458**	**9**
	Grand Total (A+B+C+D+E)	**441,632,358**	**441.6**

One Acre is equal to 8 Kanals

11 Findings, Conclusions and Recommendations

11.1 Findings

The potential impacts identified during EIA studies are as under:

11.1.1 Positive Impacts

- Improvement of poor road infrastructure in the area
- Enhanced economic growth due to improved road connectivity
- Creation of jobs and employment opportunities
- There will be enhanced productivity, reduced travel times and less stress to road users.
- Reduced transport costs
- Economic and social value addition to the project's area of influence
- Appreciation of property value
- Improved living standards of communities
- Improved response to emergencies

11.1.2 Negative Impacts (During construction phase)

- Expropriation of properties
- Relocation of Public Utilities
- Risk of Landslides
- Increased Soil Erosion and Degradation
- Degradation in Air Quality
- High Noise and Vibration
- High Dust Emission
- Contamination of Surface and groundwater
- Cutting of Trees and other Vegetation
- Loss of habitat and biodiversity
- Disruption to Public Life during Construction activities

The overall findings of the EIA shows that the Project is environmentally and socially viable subject to the implementation of ESMP.

11.2 Conclusion

The environmental and social study of the Project has identified some potential impacts; but all are not of serious nature and can be ameliorated or mitigated within normally acceptable levels through practicable control and management measures proposed in the ESMP.

11.3 Recommendations

The proponent (GB C&W) will need to follow the procedure for obtaining approval of the project EIA from the GB-EPA before the start of the project.

ANNEXURES

Annexure I: National Environmental Quality Standards (NEQS)

A. NEQS for Municipal – Industrial Effluent

Sr. #	Parameter	Standards		
		Into Inland Waters	Into Sewage Treatment (5)	Into Sea
1	Temperature	≤ 3oC	≤ 3oC	≤ 3oC
2	pH	6–9	6–9	6–9
3	Biochemical Oxygen Demand (BOD)	80	250	80**
4	Chemical Oxygen Demand	150	400	400
5	Total Suspended Solids	200	400	200
6	Total Dissolved Solids (TDS)	3500	3500	3500
7	Oil and Grease	10	10	10
8	Phenolic Compounds	0.1	0.3	0.3
9	Chloride	1000	1000	SC**
10	Fluoride	10	10	10
11	Cyanide	1.0	1.0	1.0
12	An Ionic Detergents	20	20	20
13	Sulphate	600	1000	SC**
14	Sulphide	1.0	1.0	1.0
15	Ammonia	40.0	40.0	40.0
16	Pesticides	0.2	0.2	0.2
17	Cadmium	0.1	0.1	0.1
18	Chromium	1.0	1.0	1.0
19	Copper	1.0	1.0	1.0
20	Lead	0.5	0.5	0.5
21	Mercury	0.0	0.0	0.0
22	Selenium	0.5	0.5	0.5
23	Nickel	1.0	1.0	1.0
24	Silver	1.0	1.0	1.0
25	Total Toxic Metal	2.0	2.0	2.0
26	Zinc	5.0	5.0	5.0
27	Arsenic	1.0	1.0	1.0
28	Barium	1.5	1.5	1.5
29	Iron	8.0	8.0	8.0
30	Manganese	1.5	1.5	1.5
31	Boron	6.0	6.0	6.0
32	Chlorine	1.0	1.0	1.0

B. NEQS for drinking water quality and WHO standards

Properties/ Parameters	Standard values for Pakistan	WHO standards
Bacterial		
All water intended for drinking (e. Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample
Treated water entering the distribution system (E. Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample
Treated water in the distribution system (E. Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12–month period.	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12–month period.
Physical		
Colour	≤15 TCU	≤15 TCU
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable
Odour	Non objectionable/Acceptable	Non objectionable/Acceptable
Turbidity	‹ 5 NTU	‹ 5 NTU
Total hardness as CaCO3	< 500 mg/l	—
TDS	‹ 1000	‹ 1000
pH	6.5 – 8.5	6.5 – 8.5
Chemical		
Essential Inorganic	mg/Litre	mg/Litre
Aluminium (Al) mg/1	<0.2	0.2
Antimony (Sb)	<0.005 (P)	0.02
Arsenic (As)	< 0.05 (P)	0.01
Barium (Ba)	0.7	0.7
Boron (B)	0.3	0.3
Cadmium (Cd)	0.01	0.003
Chloride (Cl)	<250	250
Chromium (Cr)	<0.05	0.05
Copper (Cu)	2	2
Toxic Inorganic	mg/Litre	mg/Litre
Cyanide (CN)	<0.05	0.07
Fluoride (F)*	<1.5	1.5
Lead (Pb)	<0.05	0.01
Manganese (Mn)	< 0.5	0.5
Mercury (Hg)	<0.001	0.001
Nickel (Ni)	<0.02	0.02
Nitrate (NO3)*	<50	50
Nitrite (NO2)*	<3 (P)	3
Selenium (Se)	0.01(P)	0.01
Residual chlorine	0.2–0.5 at consumer end 0.5–1.5 at source	–
Zinc (Zn)	5.0	3

Properties/ Parameters	Standard values for Pakistan	WHO standards
Organic		
Pesticides mg/L		PSQCA No. 4639–2004, Page No. 4 Table No. 3 Serial No. 20–58 may be consulted. ***
Phenolic compounds (as Phenols) mg/L		< 0.002
Polynuclear aromatic hydrocarbons (as PAH) g/L		0.01 (By GC/MS method)
Radioactive		
Alpha Emitters bq/L or pCi	0.1	0.1
Beta emitters	1	1
* indicates priority health related inorganic constituents which need regular monitoring.		
*** PSQCA: Pakistan Standards Quality Control Authority		

Source: http://www.environment.gov.pk/Announces/DWQStd-Adv-29062008.jpg Assessed on 02-03-2016

C. NEQS for noise

Sr. #	Category of Area / Zone	Effective from 1st July, 2010		Effective from 1st July, 2012	
		Limit in dB(A) Leq**			
		Day Time	Night Time	Day Time	Night Time
1	Residential area (A)	65	50	55	45
2	Commercial area (B)	70	60	65	55
3	Industrial area (C)	80	75	75	65
4	Silence Zone (D)	55	45	50	45
		Note:			

Day time hours: 6:00 am to 10:00 pm

Night time hours: 10:00 pm to 6:00 am

Silence zones: zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts.

Mixed category of areas may be declared as one of the four above–mentioned categories by the competent authority.

** dB (A) Leq: Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

Source: http://www.environment.gov.pk/NEQS/SRO-2010-NEQS%20Air-Water-Noise.pdf Assessed on 02-03-2016

D. NEQS for motor vehicle exhaust and noise

D.1 Vehicle In Use Diesel Exhaust

Sr. #	Parameter	Standard (maximum permissible limit)	Measuring Method	Applicability
1	Smoke	40% or 2 Ringlemann scale during engine acceleration mode.	To be compared with Ringlemann Chart at a distance of 6 meters or more.	Immediate effect.
2	Carbon Monoxide (CO)	0.06	Under idling conditions: Non–dispersive infrared detection through gas analyzer.	
3	Noise	85 dB (A)	Sound meter at 7.5 meters from the source.	

D.2 Vehicle New Diesel Exhaust

Type of Vehicle	Category/ Class	Tiers	CO	HC + NOx	PM	Measuring Method	Applicability
For Passenger Cars and Light Commercial Vehicles (g/km)							
Passenger Cars.	M 1: with reference mass (RW) up to 2500 kg. Cars with RW over 2500 kg. to meet NI category standards.	Pak–II IDI	1.0	0.7	0.08	NEDC (ECE 15+ EUDCL)	All imported and local manufactured diesel vehicles with effect from 01–07–2012.
		Pak–II DI	1.0	0.9	0.10		
Light Commercial Vehicles.	NI–I (RW <1250 kg)	Pak–II IDI	1.0	0.7	0.08		
		Pak–II DI	1.0	0.9	0.10		
	NI–I (1250 kg < RW < 1700 kg)	Pak–II IDI	1.3	1.0	0.12		
		Pak–II DI	1.3	1.3	0.14		
	NI–I (RW > 1700 kg)	Pak–II IDI	1.5	1.2	0.17		
		Pak–II DI	1.5	1.6	0.20		
Noise	85 dB (A)	Sound – meter at 7.5 meters from the source.					

D.3 For Heavy Duty Diesel Engines and Large Goods Vehicles (g/Kwh)

Type of Vehicle	Category/ Class	Tiers	CO	HC	NOx	PM	Measuring Method	Applicability
Heavy Duty Diesel Engines	Trucks and Buses	Pak–II	4.0	1.1	7.00	0.15	ECE–R–49	All imported and local manufactured diesel vehicles with the effect 01–07–2012
Large Goods Vehicles	N2 (2000 and up)	Pak–II	4.0	7.0	1.10	0.15	EDC	
Noise	85 dB (A)	Sound – meter at 7.5 meters from the source.						

D.4 Vehicles Pertol Exhaust

Type of Vehicle	Category/ Class	Tiers	CO	HC+ NOx	Measuring Method	Applicability
Passenger Cars	M 1: With reference mass (RW) up to 2500 kg. Cars with RW over 2500 kg to meet N1 category standards.	Pak–II	2.20	0.50	NEDC (ECE 15+ EUDCL)	All imported and new models * locally manufactured petrol vehicles with effect from 1st July, 2009**.
Light Commercial Vehicles	N1–I (RW< 1250)	Pak–II	2.20	0.50		
	N1–II (1250 kg > RW) < 1700 kg	Pak–II	4.00	0.55		
	N1–III (RW > 1700kg)	Pak–II	5.00	0.08		
Moto Rickshaws and Motor Cycles	2 – 4 strokes > 150cc	Pak–II	5.50	1.30		
Noise	85 dB (A)	Sound – meter at 7.5 meters from the source.				

Explanation:

DI: Direct Injection.

IDI: Indirect Injection.

EUDCL: Extra Urban Driving Cycle.

Type of Vehicle	Category/ Class	Tiers	CO	HC+ NOx	Measuring Method	Applicability
NEDC: New European Driving Cycle.						
ECE: Urban Driving Cycle.						
M: Vehicle designed and constructed for the carriage of passenger and comprising no more than eight seats in addition to the driver's seat.						
* New models means both model and engine type change.						
** The existing model of petrol driven vehicles locally manufactured will immediately switch over to Pak–II emission standards but not later than 30th June, 2012.						

Source: http://www.environment.gov.pk/NEQS/SRO742%20I93-SRO1023%20I95-NEQS.pdf Assessed on 02-03-2016

D.5 NEQS for Ambient Air

Pollutants	Time–weighted average	Concentration in Ambient Air Effective from 1st January 2009	Effective from 1st January 2012	Methods of measurement
Sulphur Dioxide (SO2)	Annual Average *	80 µg/m3	80 µg/m3	Ultraviolet Fluorescence method
	24–hours**	120 µg/m3	120 µg/m3	
Oxides of Nitrogen as (NO)	Annual Average *	40 µg/m3	40 µg/m3	Gas Phase Chemiluminescence
	24–hours**	40 µg/m3	40 µg/m3	
Oxides of Nitrogen as (NO2)	Annual Average *	40 µg/m3	40 µg/m3	Gas Phase Chemiluminescence
	24–hours**	80 µg/m3	80 µg/m3	
O3	1 hour	180 µg/m3	130 µg/m3	Non dispersive UV absorption method
Suspended Particulate Matter (SPM)	Annual Average *	400 µg/m3	360 µg/m3	High Volume Sampling (Average flow rate not less than 1.1 m3/minute)
	24–hours**	550 µg/m3	500 µg/m3	
Repairable Particulate Matter. PM10	Annual Average *	200 µg/m3	120 µg/m3	β Ray absorption method
	24–hours**	250 µg/m3	150 µg/m3	
Repairable Particulate Matter. PM2.5	Annual Average *	25 µg/m3	15 µg/m3	β Ray absorption method
	24–hours**	40 µg/m3	35 µg/m3	
	1 hour	25 µg/m3	15 µg/m3	
Lead (Pb)	Annual Average *	1.5 µg/m3	1 µg/m3	ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24–hours**	2 µg/m3	1.5 µg/m3	
Carbon Monoxide (CO)	8 hours **	5 µg/m3	5 µg/m3	Non Dispersive Infra–Red (NDIR) method
	1 hour	10 µg/m3	10 µg/m3	
Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.				
** 24 hourly/ 8 hourly values should be met 98% of the in a year. 2 % of the time, it may exceed but not on two consecutive days.				

Source: www.environment.gov.pk/NEQS/SRO-2010-NEQS%20Air-Water-Noise.pdf. Assessed on 02-03-2016

Annexure II: Drinking Water Quality Test Report

GB-EPA

Government of Gilgit-Baltistan
Gilgit-Baltistan Environmental Protection Agency

Drinking Water Quality Test Report

Bacteriological and Physical Parameters

Doc No: LAB/WQM/001-A
EffectiveDate:01/04/2010
Version No:02
page 1 of 1

Sampling Date: 7/03/2024	Location: Tangir	District: Diamer	Union council:
Methodology / Technique: Membrane Filtration Technique (MF)			

Test Criteria: The water sample is tested against National Standards for Drinking Water Quality of Pakistan.

Bacteriological Parameters	National Standards for Drinking Water Quality of Pakistan (Physical)						
E.coli	pH	Turbidity	Total Dissolved Solids	Electrical Conductivity	Colour	Odour	Taste
0/100 ml	6.5-8.5	< 5NTU	< 1000 ppm	2000 µs	Un Objectionable	Un Objectionable	Un Objectionable

S#	Sampling Point	Test Results								
		Bacteriological Parameters	Physical Parameters							
		E.coli	pH	Turbidity	Total Dissolved Solids	Electrical Conductivity	Temp.	Colour	Odour	Taste
1	Tangir River before merging in Indus	0 col/100ml	8.0	<5 NTU	24.2 ppm	48.4 µs	4°C	Colourless	Odourless	Tasteless
2	Tangir River 10km upstream from Indus	0 col/100ml	7.9	<5 NTU	22.9 ppm	43.8 µs	4°C	Colourless	Odourless	Tasteless
3	Luruk Tangir (Spring)	0 col/100ml	8.1	<5 NTU	42.0 ppm	84.0 µs	4°C	Colourless	Odourless	Tasteless
4	Juglot Tangir (Spring)	0 col/100ml	7.7	<5 NTU	10.9 ppm	21.8 µs	4°C	Colourless	Odourless	Tasteless

Conclusion: Results show that the tested samples are within the National Standards for Drinking Water Quality of Pakistan.

Tested By	Verified By	Approved By
Name: Syed Kashif Hussain	Name: Syed Waqar Hussain	Name: Syed Jarrar Hussain Hussain
Designation: Field Monitoring Assistant	Designation: Scientific Officer (Lab/NEQS)	Designation: Assistant Director (Lab/NEQS)
Signature & Date:	Signature & Date:	Signature & Date: 19/3/24

GB-EPA

Government of Gilgit-Baltistan
Gilgit-Baltistan Environmental Protection Agency

Drinking Water Quality Test Report

Bacteriological and Physical Parameters

Doc No: LAB/WQM/001-A
EffectiveDate:01/04/2010
Version No:02
page 1 of 1

Sampling Date: 7/03/2023	Location: Darel	District: Diamer	Union council:
Methodology / Technique: Membrane Filtration Technique (MF)			

Test Criteria: The water sample is tested against National Standards for Drinking Water Quality of Pakistan.

Bacteriological Parameters	National Standards for Drinking Water Quality of Pakistan (Physical)						
E.coli	pH	Turbidity	Total Dissolved Solids	Electrical Conductivity	Colour	Odour	Taste
0/100 ml	6.5-8.5	< 5NTU	< 1000 ppm	2000 µs	Un Objectionable	Un Objectionable	Un Objectionable

S#	Sampling Point	Test Results								
		Bacteriological Parameters	Physical Parameters							
		E.coli	pH	Turbidity	Total Dissolved Solids	Electrical Conductivity	Temp.	Colour	Odour	Taste
5	Darel River before merging in Indus	0 col/100ml	8.0	<5 NTU	34.5 ppm	69.0 µs	4°C	Colourless	Odourless	Tasteless
6	Darel River 10km upstream from Indus	0 col/100ml	8.0	<5 NTU	20.9 ppm	41.2 µs	4°C	Colourless	Odourless	Tasteless
7	Giyal Darel (Spring)	0 col/100ml	7.6	<5 NTU	30.4 ppm	60.8 µs	4°C	Colourless	Odourless	Tasteless
8	Phuguch Darel (Spring)	0 col/100ml	7.8	<5 NTU	45.2 ppm	90.4 µs	4°C	Colourless	Odourless	Tasteless

Conclusion: Results show that the tested samples are within the National Standards for Drinking Water Quality of Pakistan.

Tested By	Verified By	Approved By
Name: Syed Kashif Hussain	Name: Syed Waqar Hussain	Name: Syed Jarrar Hussain Hussain
Designation: Field Monitoring Assistant	Designation: Scientific Officer (Lab/NEQS)	Designation: Assistant Director (Lab/NEQS)
Signature & Date:	Signature & Date:	Signature & Date: 19/3/24

GB-EPA

Gilgit-Baltistan Environmental Protection Agency
Drinking Water Quality Test Report
Chemical Parameters

Doc No: LAB/WQM/001-B
EffectiveDate:01/04/2010
Version No:02
page 1 of 1

Sampling Date: 7/3/2024	Location: Tangir	District: Diamer	Union council:
Methodology / Technique: Voltammetry and Photometry (Metalometer HM 2000 and Aquaculture Photometer)			

Test Criteria: The water samples are tested against National Standards for Drinking Water Quality of Pakistan.

National Standards for Drinking Water Quality of Pakistan (mg/l)											
Nitrate	Nitrite	Cu	Al	Fe	Mn	Cr6	Zn	Ni	B		
≤50	≤3	2	≤0.2	-----	≤0.5	≤0.05	5.0	≤0.02	0.3		

Sr #	Sampling point	Test Results (mg/l)									
		Nitrate	Nitrite	Cu	Al	Fe	Mn	Cr6	Zn	Ni	B
1	Tangir River before merging in Indus	33.5	1	0.08	0	0	0	0	0	0	0
2	Tangir River 10km upstream from Indus	21.3	1	0.06	0	0	0	0	0	0	0
3	Luruk Tangir (Spring)	23.5	2	0.08	0	0	0	0	0	0.1	0
4	Juglot Tangir (Spring)	18.0	2	0.08	0	0	0	0	0	0.1	0

Conclusion: Tested Results show that the concentration of Nickel exceeds National Standards for Drinking Water Quality of Pakistan in Luruk and Juglot Tangir Spring samples.

Tested By	Verified By	Approved By
Name: Syed Kashif Hussain	Name: Syed Waqar Hussain	Name: Syed Jarrar Hussain
Designation: Field Monitoring Assistant	Designation: Scientific Officer (Lab/NEQS)	Designation: Assistant Director (Lab/NEQS)
Signature & Date:	Signature & Date:	Signature & Date: 19/3/24

GB-EPA

Gilgit-Baltistan Environmental Protection Agency
Drinking Water Quality Test Report
Chemical Parameters

Doc No: LAB/WQM/001-B
EffectiveDate:01/04/2010
Version No:02
page 1 of 1

Sampling Date: 7/3/2024	Location: Darel	District: Diamer	Union council:
Methodology / Technique: Voltammetry and Photometry (Metalometer HM 2000 and Aquaculture Photometer)			

Test Criteria: The water samples are tested against National Standards for Drinking Water Quality of Pakistan.

National Standards for Drinking Water Quality of Pakistan (mg/l)											
Nitrate	Nitrite	Cu	Al	Fe	Mn	Cr6	Zn	Ni	B		
≤50	≤3	2	≤0.2	-----	≤0.5	≤0.05	5.0	≤0.02	0.3		

Sr #	Sampling point	Test Results (mg/l)									
		Nitrate	Nitrite	Cu	Al	Fe	Mn	Cr6	Zn	Ni	B
5	Darel River before merging in Indus	0	0	0	0	0	0	0	0	0.02	0
6	Darel River 10km upstream from Indus	0	0	0	0	0	0	0	0	0.02	0
7	Giyal Darel (Spring)	16.3	2	0.5	0	0	0	0.02	0	0.1	0
8	Phuguch Darel (Spring)	27.9	3	0.3	0	0	0	0.03	0	0.1	0

Conclusion: Tested Results show that the concentration of Nickel exceeds the National Standards for Drinking Water Quality of Pakistan in in Giyal and Phuguch spring water samples.

Tested By	Verified By	Approved By
Name: Syed Kashif Hussain	Name: Syed Waqar Hussain	Name: Syed Jarrar Hussain
Designation: Field Monitoring Assistant	Designation: Scientific Officer (Lab/NEQS)	Designation: Assistant Director (Lab/NEQS)
Signature & Date:	Signature & Date:	Signature & Date: 19/3/24

GB C&W

MMP
MM Pakistan (Pvt) Ltd.

Annexure III: Participants List of Public Consultation

Sr. #	Name	Father's Name	Contact No.
(Tangir Expressways- Package-I)			
1.	**Korangey**		
1.	Nasir Shah	Syed Janan	0355-4192380
2.	Amir Zar	Kaus Shah	0355-5180023
3.	Bilal Ahmed Shah	Hamd Din	0355-5254018
4.	Ibrahim Shah	Muhammad Dost	0312-9769056
5.	Shafaat Shah	Abistan	0355-6661417
6.	Shahab-ud-Din	Sher Jang	0355-4222440
7.	Khush Jehan	Pehlwan	0355-5476470
8.	Sher Jan	Abdullah	0355-5792205
9.	Akhtar Khan	Shujah	0355-51224466
10.	Shabbir Hussain	Mir Muhammad	0355-5646718
11.	Khan Sahib	Islamullah	0355-5258200
12.	Sultan Wazir	Syed Mubashir	0355-5132225
13.	Hazarat Jan	Hameed-ud-Din	0355-5447272
14.	Naimat-ud-Din	Hameed-ud-Din	0355-5558086
15.	Saddam Hussain Master	Suqab	0355-5399794
16.	Ashraf Khan	Zulfiqar	0355-6661372
2.	**Lurk**		
1.	Faizullah	Shuja Gul	0355-5777857
2.	Nadeemullah	Mohiudin	0355-5139666
3.	Aziz-ud-Din	Saeed Amir	0355-5679322
4.	ArfaNullah	Ameer Sulan	0355-4436666
5.	Sher Azaz	Ali Yar	0355-5173064
6.	M. Nourani	Muhammad Wali	0355-5204863
7.	Ali Khan	Badshah	0355-5603422
8.	Abdul Raziq	Shams	0355-5139696
9.	Qumar Khan	Saad Ameer	0355-6102970
10.	Safeer Khan	Nasrullah	0355-6103417
11.	Naeemullah	Aslam	0355-5418673
12.	Hafeez	Aziz-ud-Din	0344-1199658
3.	**Jaglot Tangir**		

Sr. #	Name	Father's Name	Contact No.
1.	Siraj Din	Sultan Hameed	0355-5118066
2.	Abdul Wali	Aaimal Khan	0355-5608132
3.	Hameed Allah	Jamroz	0355-5130702
4.	Sultan Gul	Rehmat Gul	0355-5673359
5.	Muhammad Gul	Behram	0355-5222762
6.	Sher Jan	Abdullah	0355-5792205
7.	Shafiqullah	Abdul Razzaq	0355-4543051
8.	Muhammad Hussain	Waseem Khan	0355-5129850
9.	Sher Nabi	Saad Faqir	0355-4276666
10.	Rehmat Khan	Muhammad Karam	0355-5453390
11.	Meer Azam	Gul Rehman	0355-8036417
12.	Riza Nullah	Jangi	0355-5241000
13.	Abdul Majeed	Abdul Azeem	0355-5655516
14.	Abdul Salam	Abdul Baqi	0355-5667295
15.	Gul Majeed	Abdul Mateen	0355-5274608
16.	Zakir Hussain	Saad Hussain	0355-55408518
17.	Sharat Din	Umer Din	0355-5353290
18.	Sher Muhammad	Rehmat	0355-5668851
19.	Gulia	Said Sufa	0355-5134767
20.	Abdul Rauf	Abbas	0355-5117221
21.	Rehmat Saad	Muhammad Siddiq	0355-4155941
22.	Saad Gul	Gul Sher	0355-572444
23	Muhammad Hadi	Walayat	0355-5332901
4.	**Darkile Payan**		
1.	Shah Faisal	Muhammad Ali	0311-5013577
2.	Adil Johar	Muhammad Raheem	0313-6622666
3.	Swal	Gujjar Khan	-
4.	IrfaNullah	M. Raheem	0355-4250609
5.	Muhammad Reheem	Saad Muhammad	0355-51626894
6.	Muhammad Ishaq	Saad Muhammad	0315-5635557
7.	Muhammad Ali	Lal	0355-5127046
8.	Muhammad Javer	Muhammad Ali	0355-5670384
9.	Gulab Khan	Wazir	0355-568686

Sr. #	Name	Father's Name	Contact No.
10.	Abdul Wahab	Syed Jamal	0355-5741713
5.	**Darkial Bala**		
1.	Sardar Muhammad	Muhammad Farooq	0355-5241145
2.	Abdul Raheem	Farhad	0355-5609028
3.	Tajbaz	Tehsildar	0355-5353318
4.	Luqman	Janwar Khan	0355-538152
5.	Muhammad Iqbal	Zareen Khan	0355-5204153
6.	Taj Din	Farhad	0355-5252014
7.	Sher Alam	Abdul Wadood	0317-5509100
8.	Sadam Hussain	Shiraz Gul	0355-4140297
6.	**Gabbaz Kohopat**		
1.	Fazal Muhammad	Nazar Shah	0355-6583105
2.	Bajar	Bakhtmil	0355-5204030
3.	Raz Mir	Zahid Ullah	0355-5473111
4.	Afzal	Aman	-
5.	Sher Muhammad	Raza Khan	0355-54825
6.	Sheharyar	Alamgir	0355-4155817
7.	Barkat Ali	Zahid Ullah	0355-5696086
8.	Muhammad Haleem	Raz Mir	0355-4150055
9.	Muhammad Tayyab	Raz Mir	-
10.	Muhammad Ayub	Zahidullah	0355-4245947
(Darel Express- Package-II)			
1.	**Samaigall Hayan**		
1.	Asad Ullah	Haji Mir Baz Khan	0355-5112464
2.	Sher Muhammad Khan	Haji Gul	-
3.	Abdul Hameed	Bahadar Khan	0355-8032490
4.	Shafiq Ahmed	Shafa-e-Khan	0355-5633654
5.	Fayyaz Ahmed	Saghir Ahmed	0355-5247467
6.	Haji Rehmat	Rehmat Khan	0355-5100540
7.	Muhammad Bahadar	Nosha Khan	0355-5064707
8.	Shikarat Khan	Mutmaein Khan	0355-54156710
9.	Mahfooz Ullah	Shakoor Rehmat	0355-5662815
10.	Muhammad Tamaan	Qadir Khan	0355-5444148

Sr. #	Name	Father's Name	Contact No.
11.	Altaf Hussain	Naimat Shah	0355-4267928
12.	Asif Nawaz	Alam Khan	0355-5306330
13.	Shakirullah	Asfand Yar	0355-5102717
14.	Umer Farooq	Motbar Khan	0355-5233232
15.	Muhammad Alam	Sher Wali	0355-6211762
16.	Shams-ul-Haq	Shaukat Ali	0355-4699694
17.	Ahsan-ul-Haq	Shabbir Ahmed	0355-5667992
18.	Ijaz-ur-Rehman	Alam Khan	0355-707224
19.	Akram Ullah	Abdul Azeem	0355-5361855
20.	Ijaz Alam	Suleman	0355-5007976
21.	Saleem Ullah	Muhammad Shoaib	0355-5218856
22.	Shah Mohi-ud-Din	Sher Ahmed	0355-5697777
23.	Abuzar Khan	Doost Khan	0355-5114027
24.	Shams Ullah	Gulshan Khan	0355-4111606
2.	**Phugage Village**		
1.	Shabbir Ahmed	Aseel Shah	0355-5127224
2.	Adad Ullah	Tanveer Ahmed	0355-5007481
3.	Shah Fahad	Aseel Shah	0355-8031033
4.	Masood Ahmed	Aseel Shah	0355-4828724
5.	Muhammad Jabar	Aseel Shah	0355-6116649
6.	Abdul Wali	Ghani Ullah	-
3.	**Phogage Kot**		
1.	Hafeez Ullah	Baazoor Khan	0355-5445049
2.	Muhammad Bilal	Salangheer Khan	0355-8446322
3.	Qadr Muhammad	Sami Khan	0355-4598025
4.	Naveed Alam	Muhammad Ayyaz	0355-7033351
5.	Abuzar	Raj Gul	0355-4503838
6.	Shujaat Hussain	Raja Khan	0355-5092220
4.	**Phogage**		
1.	Muhammad Abdul Rauf	Abdul Hameed	0355-6588898
2.	Muhammad Zaman	Lal Saeed	0355-5205656
3.	Abdullah	Izzat Shah	0355-5662407
4.	Abuzar	Muhammad Abdul Rauf	0355-7036510

Sr. #	Name	Father's Name	Contact No.
5.	Nazar Alam	Ali Aiman	0355-5051235
6.	Aziz Ahmed	Malook Jan	0355-4633509
7.	Gulbar Khan	Abdul Rauf	0355-4960333
8.	Nizam-ud-Din	Lal Bahadar	0355-5373799
9.	Ghulam Syed	Muhammad Abdul Rauf	0355-7033363
10.	Sabir Ullah	Muhammad Tariq	-
11.	Ikramullah	Abdul Latif	-
5.	**Ghumari Dareel**		
1.	Asbab Khan	Hukam Khan	0355-6219658
2.	Mufti Muneeb Ullah	Ghulab Khan	-
3.	Wasal Khan	Sapeen Gul	0355-5602266
4.	Zahid Hussain	Lal Shah	0355-8082899
5.	Shafiullah	Shahzad Wali	0355-8487661
6.	Hazarat Khan	Rashukaan	0355-5355048
7.	Sher Mah	Humayun Khan	0355-6296601
8.	Ghulam Hussain	Shahraiz Khan	0355-8446464
9.	Mufti Zia-ud-Din	Sikandar Ali	0355-7044448
10.	Maulvi Daulat Khan	Badaam Khan	0355-8037109
11.	Abdul Wadood	Faqir Wali	0355-5252201
12.	Sadiq Hussain	Muhammad Subaydar	0355-5261227
13.	Shafi-ur-Rehman	Fazal-ur-Rehman	0355-5314566
14.	Mahfaooz Ullah	Jaanat Gul	0355-5290230
15.	Khushhal Khan	Rasheed Khan	0355-5120795
16.	Rehmat Ullah	Khizyan Shah	0355-5438111
17.	Maulvi Farman	Hazarat Gul	0355-5211110
18.	IrfaNullah	Pakhtoon Wali	0355-5638787
19.	Abdullah	Mansoor Khan	0355-4144993
20.	Razi Ullah	Shakoor Khan	0355-5176152
21.	Abdul Wahid	Jehangir Khan	0355-4351133
22.	Sadiqullah	Yar Khan	0355-5232923
23.	Inam-ul-Haq	Badaam Khan	0355-8215323
24.	Altaf Hussain	Shabbir Khan	0355-8473345
25.	Sultan Roam	Ali Shah	0355-5876822

Sr. #	Name	Father's Name	Contact No.
26.	Sher Jehan	Wasal Khan	0355-5202232
27.	Alam Jan	Jehangir Khan	0355-5662083
28.	Ghulam Rasool	Jalal Khan	0355-5200433
29.	Numbardar Muhammad Bashir	Wasal Khan	0355-5247331
30.	Haji Abdul Shakoor	Haji Muhammad Jan	0355-5608799
31.	Haji Saifullah	Muhammad Sharif Khan	-
6.	**Kabosh**		
1.	Razi Ullah	Mir Bakhsh	0355-5145345
2.	Abuzar	Rehmat Wali	0355-5716000
3.	Maqsood Alam	Ali Aman	0355-5697159
4.	Muhammad Ismail	Hazarat Naqib	0355-5609034
5.	Sharis Khan	Gul Said	0355-5367065
6.	Sadiq Hussain	Khan Wali	-
7.	Alam Khan	Zarmas Khan	0355-5146183
8.	Khushabir Khan	Mansoor Khan	0355-6219228
9.	Abdul Ghani	Bashir Khan	0355-5114893
10.	Rehmat Hussain	Hur Khan	0355-4522467
11.	Aman Uullah	Sifat Bahadur	0355-5809595
12.	Saidullah	Azad Wali	0325-4254255
7.	**Laati Village**		
1.	Syed Jameel	Farzand Faqeer	0355-8472948
2.	Muhammad Fazal	Sujal Wali	0355-5700555
3.	Mirdad	Sher Afzal	0355-4693502
4.	Mahmood Alam	Bakhat Wali	0355-5129058
5.	Amir Yahya	Hadi	0355-5050008
6.	Abdul Bashir	Naqal Wali	0355-5662206
7.	Shams Ullah	Mir Zaman	0355-5307999
8.	Inayatullah	Syed Ghani	0353-5333505
9..	Shakir Wali	Khanoon	0355-5246800
10.	Baba Jan	Ali Afzal	0355-6696299
11.	Abrar Ahmed	Ijaz Ahmed	0355-5005271
12.	Shams-ul-Haq	Syed Alam	0355-6459155
13.	Tahseeb Ullah	Ijaz Ahmed	0355-5409360

Sr. #	Name	Father's Name	Contact No.
14.	Shermah Khan	Arman Malook	0355-5232577
15.	Sher Alam	Shakar Wali	0355-5064133
16.	Muhammad Nawaz	Skakar Wali	0355-5203364
17.	Hadayat Ullah	Farzand Wali	0355-773670
8.	**Darel Gial**		
1.	Mujeeb-ur-Rehman	Abdul Hakeem	0355-5120955
2.	Afsar Khan	Akbar Khan	0355-7030531
3.	Fida Ullah	Afsar Khan	0355-8473220
4.	Abdul Zaman	Said Khan	-
5.	Iqbal Hussain	Yaqeen Shah	0355-8339523
6.	Abdul Kafi	Amir Ali	0355-5408889
7.	Niaz Ullah	Afsar Khan	0355-8082311
8.	Saidullah	Afsar Khan	0355-5744822
9.	Maqsood Alam	Muhammad Ismail	0355-547090
10.	Israfeel Muhammad	Zalamdar Khan	0355-5655571

Annexure IV: Blasting Management Plan

(This Plan is just indicative for the guidance of contractor. It will be responsibility of the contractor to prepare a site-specific Plan for approval from the project consultant before start of construction activities)

1. INTRODUCTION

This Blasting Management Plan (Plan) identifies measures that will be implemented by the Construction Contractor(s) during construction to mitigate risks and potential impacts associated with blasting. This Plan provides Project-specific guidance to avoid, minimize, and mitigate Project-related impacts; by protecting public and worker safety; by preventing unnecessary degradation of the environment. The Construction Contractor(s) are responsible for the complete implementation of this Plan.

2. PURPOSE

The purpose of this Plan is to address safety and prevent adverse impacts on human health, property, and the environment that could result from the use of explosives during Project construction. Blasting is used where rock needs to be removed and alternative methods (such as excavation) are insufficient. Blasting will be used only in areas where traditional excavation and earthmoving equipment and practices are unable to accomplish the excavation.

This Plan provides Project-specific blasting procedures, environmental protection measures (EPMs), and other stipulations and methods to be implemented, as applicable for blasting activities. Precise locations where blasting may be required will be identified based on site-specific geotechnical investigations. The mechanism for providing site-specific blasting details will be site-specific blasting plans. The Construction Contractor(s) will prepare site-specific blasting plans for each area determined to require blasting prior to the commencement of blasting activities. Attachment A: Blasting Plan Table of Contents provides the table of contents for site-specific blasting plans. The Construction Contractor(s) will develop site-specific blasting plans.

The Construction Contractor(s) will employ qualified, experienced, and licensed blasting personnel to perform blasting using current and professionally accepted methods, products, and procedures to maximize safety during blasting operations.

3. BLASTING PLAN GUIDANCE

The Construction Contractor(s) will address safety and will design all specific blasting and blasting-related activities in each site-specific blasting plan. Each site-specific blasting plan will contain site-specific details developed by the Construction Contractor(s), which will identify: conditions and procedures prior to the occurrence of any particular blast; the details of the drilling and blasting patterns; the controls proposed to use for all blasting and blasting-related activities; requirements for prior notification of nearby residents, ranches, farms, businesses and/or the public; the specific EPMs or other stipulations to minimize environmental impacts; and locations of wells and springs. Every blast must be designed to meet existing conditions of the rock formation and overburden and to produce the desired result. A trial blast is typically performed in the field to validate theoretical blast designs or to provide additional information for final blast designs.

4. Overview of Blasting Principles

4.1 Locations

The Construction Contractor(s) will avoid blasting in potential rockslide/landslide areas to the maximum extent possible and will consult with a geologist before blasting in such areas.

4.2 Materials

The Construction Contractor(s) will determine the specific materials needed for blasting operations.

5. SAFETY PROCEDURES

Safe storage and use of explosive materials will be a top priority during construction. The safety measures discussed in this section are intended to protect against fire, and prevent personal injury and property damage. These measures are intended as general guidelines, and specific safety requirements will be identified by the Construction Contractor(s) prior to blasting. These specific safety requirements will be included in each site-specific blasting plan.

5.1 Transportation of Explosives

The Construction Contractor(s) is responsible to ensure that the transportation of explosives will comply with all applicable laws govern the packaging, labeling, materials compatibility, and safety of transported explosives, as well as driver qualifications. In general, these regulations require vehicles carrying explosive materials to be well maintained, properly marked with placards, and have a non-sparking floor.

Materials in contact with the explosives will be non-sparking, and the load will be covered with a fire- and water-resistant tarpaulin. Vehicles also must be equipped with fire extinguishers. Every effort will be made to minimize the transportation of explosives through congested or heavily populated areas.

Prior to loading an appropriate vehicle for carrying explosives, the vehicle will be fully fueled and inspected to ensure its safe operation. Refueling of vehicles carrying explosives will be avoided. Smoking and other ignition sources will be prohibited during the loading, transporting, or unloading of explosives. In addition, the following specific restrictions apply to the transport of other items in vehicles carrying explosives:

- Tools may be carried in the vehicle, but not in the explosives' cargo compartment.
- Batteries and firearms will never be carried in a vehicle with explosives.
- Vehicle drivers must comply with the specific laws and regulations related to the materials being transported.
- Vehicles carrying explosives will not be parked or left unattended except in designated parking areas. When traveling, vehicles carrying explosives will avoid congested areas to the maximum extent possible.

5.2 Storage

At a minimum, the following storage requirements will be implemented:

- Explosives must be stored in an approved structure (magazine), and storage facilities will be bullet, weather, theft, and fire resistant.
- Magazine sites will be located in remote (out-of-sight) areas with restricted access; will be kept cool, dry, and well-ventilated; and will be properly labeled and signed.
- Detonators will be stored separately from other explosive materials.
- The most stringent spacing between individual magazines will be determined according to the guidelines contained in the Explosives Act, 1884.
- Both the quantity and duration of temporary on-site explosives storage will be minimized.
- The Construction Contractor(s) will handle and dispose of explosives storage boxes in accordance with relevant laws.

5.3 Blasting Notification and Safety Procedures

The Construction Contractor(s) will identify all notification and safety measures required by regulation and will develop best practices, which will include the following:

- The Construction Contractor(s) will publish a proposed blasting schedule in the local newspaper 1 week before any blasting occurs. The notification will identify the location, dates, and times blasting will occur. No blasting will occur outside of the published schedule, except in emergency situations.
- The Construction Contractor(s) will post warning signs at all entry points for the Project at least 2 weeks prior to the scheduled blasting event. Warning signs will include information on blasting, including the general hours blasting might take place, and the audible signals to be used to warn of impending blasting and to indicate that the site is all clear.
- Residences, farms, ranches, businesses, and other utilities located 0.5 mile or closer to a proposed blasting site will be notified in writing at least 72 hours before any blasting occurs of the day and time of the blast.
- The Construction Contractor(s) will restrict access to areas where blasting will take place at least 30 minutes prior to blasting. The Construction Contractor(s) will place clearly visible temporary signs warning of an impending blast and for unauthorized personnel to keep out along access roads and trails leading to the specific blast area, at least 0.25 mile from the blast area (further if required by the size of the blast), and at least 30 minutes before the time of the blast.
- The Construction Contractor(s) will patrol the unsafe area of the blast site 5 minutes prior to blasting to ensure no unauthorized personnel are present. If unauthorized personnel are located within the unsafe area, they will be escorted to a safe distance from the blast. No blasting will occur when unauthorized personnel are located in the unsafe blasting area.
- An audible warning signal, capable of carrying for 0.5 mile, will be given at least 2 minutes prior to blasting. An “all-clear” signal will be given once it has been determined that the area is safe.
- The Construction Contractor(s) will be responsible for damages that result solely from the blasting activity.
- A determination that the blasting area is all clear of danger will be derived once the blasting area has been inspected for undetonated or misfired explosives. The blasting area will be inspected for hazards, such as falling rock and rockslides. Once the area has been inspected and these issues have been addressed, the all-clear signal, as described above, will sound and persons will be able to safely re-enter the blast zone.
- Additional safety precautions will be developed to address site-specific conditions at the time of the blast. Special attention will be given to preventing potential hazards in the blasting area resulting from flying rock, destabilized walls or structures, presence of low-flying aircraft, and dispersion of smoke and gases.

5.4 Fire Safety

The presence of explosive materials on the Project site could potentially increase the risk of fire during construction. Special precautions will be taken to minimize this risk, including the following:

- Prohibiting ignition devices within 50 feet of explosives storage areas.
- Posting clearly visible signs prohibiting ignition devices within 50 feet of explosives storage areas.
- Properly maintaining magazine sites so they are clear of fuels and combustible materials,

well- ventilated, and fire-resistant.

- Protecting magazines from wildfires that could occur in the immediate area.
- Posting Construction Contractor(s) fire suppression personnel and equipment at the blast site during high-fire danger periods.
- Prohibiting blasting during extreme fire danger periods.
- Additional fire safety measures will be identified and implemented by the Construction Contractor(s) to address site-specific conditions and will be included in each site-specific blasting plan, as applicable.

6. ENVIRONMENTAL PROTECTION MEASURES (EPM)

Blasting has the potential to cause safety concerns and environmental impacts. Implementing the EPMs listed below will mitigate these impacts. This section provides the baseline measures for inclusion in any site-specific blasting plan, to be developed by the Construction Contractor(s).

- The Construction Contractor(s) will be responsible for preparing site-specific blasting plans.
- Site-specific blasting plans will identify blasting procedures including safety, use, storage, and transportation of explosives that will be employed where blasting is needed, and will specify the locations that require blasting, and will be approved and stamped by a licensed professional engineer.
- All blasting will be performed by registered licensed blasters who will be required to secure all necessary permits and comply with regulatory requirements in connection with the transportation, storage, and use of explosives and blast vibration limits for nearby structures, utilities and wildlife.
- Appropriate flags, barricades, and warning signals will be used to ensure safety during blasting operations. Blast mats will be used when needed to prevent damage and injury from flyrock.
- Damage that results from blasting will be repaired or the owner fairly compensated.
- Proper blasting techniques, including proper cover of charges, will be followed.
- Matting will be used in rock blasting operations to minimize and control dust.
- Advanced notification of blasting activities will be provided to nearby residents within 72 hours.
- Blasting will take place during daylight hours only and will be monitored with three axis seismographs to ensure safe vibration levels are not exceeded.
- Vibration measured as peak particle velocity will not exceed 4 inches per second adjacent to an underground pipeline and 2 inches per second for any aboveground structure (including water wells).
- Identify and provide a public liaison person before, and during, construction to respond to concerns of neighboring receptors, including residents, about construction noise disturbance.
- Establish a toll-free telephone number for receiving questions or complaints during construction and develop procedures for responding to callers.
- Implement and maintain a noise complaint review process to deal with residents' or other potential queries and complaints as they arise. Such complaints will be logged and investigated on an individual basis to facilitate the resolution of the issue of concern.

Annexure V: Air Quality Management Plan

(This TMP is just indicative for the guidance of contractor. It will be responsibility of the contractor to prepare a site specific TMP for approval from the project consultant before start of construction activities)

1. Introduction

The purpose of the Air Quality Management Plan (AQMP) is to provide basic frame work to establish a comprehensive plan for the identification, mitigation, and continual monitoring of air quality impacts associated with the construction activities of the Tangir and Darel Expressways. This plan is critical to ensure compliance with the applicable legal and regulatory framework, minimizing adverse health and environmental outcomes, and promoting sustainable development practices in the fragile mountainous ecosystem of the project area.

This Air Quality Management Plan provides a comprehensive and enforceable framework designed to proactively mitigate and monitor air emissions associated with the construction of any project. Grounded in the Environmental Protection Act, 2014 (Gilgit Baltistan) and aligned with national and international standards, the plan ensures strict adherence to regulatory requirements while safeguarding public health and environmental integrity. Through systematic implementation of control measures, continuous monitoring, and responsible handling of air-impacting materials, this plan supports sustainable development and reflects the project's commitment to environmental stewardship throughout its lifecycle

This plan is prepared in accordance with the Gilgit Baltistan Environmental Protection Act, 2014, enacted under the legislative framework of the Gilgit Baltistan (Empowerment and Self-Governance) Order, 2009, Schedule IV. The 2014 Act repealed the Pakistan Environmental Protection Act, 1997 within the territory of Gilgit Baltistan and now serves as the primary legal authority governing environmental protection in the region. This AQMP aligns with provisions related to ambient air quality, hazardous emissions and air pollution controls under these statutes.

2. Objectives of Air Quality Management Plan

The key objectives of this AQMP are:

- To ensure compliance with the Gilgit Baltistan Environmental Protection Act, 2014, and all applicable standards related to ambient air quality.
- To minimize fugitive dust emissions and gaseous pollutants resulting from earthworks, vehicular movement, construction machinery, and material storage.
- To safeguard the health of workers, nearby communities, and sensitive receptors (e.g., schools, healthcare units, and ecological zones) within the project's area of influence.
- To institutionalize best practices in air pollution control and environmental performance monitoring through systematic procedures.
- To develop a mechanism for periodic monitoring, documentation, and corrective action.
- To enhance awareness and accountability among contractors, operators, and all personnel involved in the project regarding air quality management.

3. Legal and Regulatory Framework

This Air Quality Management Plan is developed in strict compliance with the following legislative instruments:

- Gilgit-Baltistan Environmental Protection Act, 2014: Enacted to provide a comprehensive framework for environmental conservation in Gilgit Baltistan, including air quality standards, monitoring, and enforcement mechanisms.
- National Environmental Quality Standards (NEQS) for Ambient Air (2010): Issued by the Pakistan Environmental Protection Agency, these standards specify limits for ambient concentrations of pollutants such as PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, and O_3, and serve as a benchmark for air quality performance under this plan.

4. Sources of Air Pollution and Material Inventory

The primary sources of air pollution expected during the construction phase of the Tangir and Darel Expressways include the following:

- Excavation, earthwork, and grading: These activities produce significant amounts of dust (particulate matter), particularly in dry and windy conditions.
- Transportation of construction materials, movement of heavy vehicles on unpaved roads in dust re-suspension.
- Emissions from equipment such as bulldozers, excavators, pavers, and generators contribute to NOx, CO, SO_2, and PM emissions.
- Asphalt batching plants and concrete mixers: These units, if not properly managed, may emit hydrocarbon vapors and fine particulates.
- Open burning of waste materials: Although prohibited under law, improper disposal practices may lead to additional air contaminants such as dioxins and furans.
- Wind erosion of stored materials: Improperly stored construction materials, including aggregates, sand, and cement, may result in fugitive dust emissions.

The inventory of material expected to be used during construction activities of the Tangir and Darel Expressways is given in the **Table-1**, below.

Table-1: Material Inventory and Air Quality Control

Material	Purpose of Use	Air Quality Hazards	Storage Protocols	Handling Guidelines	Emission/Disposal Strategy
Diesel Fuel	Powering construction vehicles and generators	VOC emissions, NOx, SO_2, $PM_{2.5}$/PM_{10} from combustion	Stored in double-walled, bunded steel tanks with vapor recovery systems	Refueling to be done with spill-prevention valves and only in ventilated zones	Emissions minimized by equipment maintenance; used fuel/oil disposed via licensed hazardous waste contractor
Bitumen (Asphalt)	Road surfacing and binding	Releases VOCs and fumes when heated	Stored in thermostatically controlled tanks away from ignition sources	Workers must use respirators and heat-resistant PPE	Residual fumes controlled by using pre-heated asphalt mixers and low-emission bitumen

Material	Purpose of Use	Air Quality Hazards	Storage Protocols	Handling Guidelines	Emission/Disposal Strategy
Paints and Solvents	Painting of structures and anti-corrosion	Contains volatile organic compounds (VOCs)	Stored in flameproof, ventilated cabinets	Application in open or ventilated areas with proper PPE	Dispose of residues through licensed hazardous waste handler; use low-VOC paints where possible
Compressed Gases (O_2, Acetylene)	Welding, cutting, metalwork	Fugitive gas leaks may increase combustion risk	Secured vertically in ventilated, clearly marked cylinder cages	Leak checks prior to use; no smoking or flames nearby	Empty or expired cylinders returned to authorized suppliers for refilling or disposal
Ammonium Nitrate Fuel Oil (ANFO)	Controlled rock blasting for excavation	Risk of explosion, release of combustion byproducts including NOx and dust	Stored in licensed, secure magazines away from populated or windy areas	Handled only by trained and certified personnel using PPE	Blasting limited to low-wind conditions; detonation emissions monitored; excess returned to supplier
Hydraulic Oils and Lubricants	Machinery operation and maintenance	Volatile fractions contribute to air contamination if spilled or overheated	Stored in sealed, labeled drums in shaded and bunded zones	Use spill trays during transfers; avoid open-air maintenance	Used oil collected in sealed drums and disposed through certified recyclers
Grease and Lubricants	Reducing friction in mechanical systems	Potential evaporation of light hydrocarbons; localized emissions when heated	Kept in cool, shaded containers with proper labels	Applied using manual tools; avoid prolonged air exposure	Spent grease stored in waste drums and collected by licensed vendor
Cement and Lime	Concrete mixing, stabilization	Generates Respirable particulate matter (PM10, PM2.5) when dry	Stored in covered silos or moisture-proof bags with dust filters	Dry mixing to be avoided in windy conditions; masks mandatory	Use pre-mixed concrete where possible; dust collectors at batching plants

5. Air Quality Monitoring Parameters

Various parameters to be monitored during construction is given in the **Table-2** along with applicable standards, monitoring frequency and party responsible for monitoring.

Table-2: Air Quality Monitoring Parameters

Parameter	Applicable Standards / Guidelines	Monitoring Frequency	Responsible Party
Particulate Matter **PM_{10}, $PM_{2.5}$**	- **NEQS**: PM_{10} ≤ 150 µg/m³ (24-hour), $PM_{2.5}$ ≤ 35 µg/m³ (24-hour) - **WHO Guidelines (2021)**:	Monthly near to active construction sites	Contractor, supervised by project Environmental and Social Management Unit (ESMU)

	$PM_{2.5}$ ≤ 5 µg/m³ (annual mean), PM_{10} ≤ 15 µg/m³ (annual mean)		
NO_x, CO, SO_2, VOCs (Gaseous Pollutants)	- **NEQS**: NO_2 ≤ 80 µg/m³ (24-hour); SO_2 ≤ 120 µg/m³ (24-hour); CO ≤ 5 mg/m³ (8-hour) - **WHO Guidelines**: NO_2 ≤ 40 µg/m³ (annual mean); CO ≤ 10 mg/m³ (8-hour); VOCs to be minimized	Monthly	Contractor / ESMU
Visual Dust Inspection	- **Qualitative Monitoring**: Observations for fugitive dust emissions from unpaved roads, excavation, and stockpiles - Conducted as per dust suppression protocols and site conditions	Daily	Site Supervisors, reporting to Contractor / ESMU
Emissions from Construction Plants and Equipment	- **NEQS for Stack Emissions**: SO_2 ≤ 1700 mg/Nm³, NO_x ≤ 600 mg/Nm³ (for diesel-based generators), smoke <40% opacity	Quarterly	Contractor, under direct supervision of Environmental Consultant and ESMU

6. Monitoring Approach

- **Instrumental Monitoring** will be conducted using portable real-time analyzers or fixed monitoring stations calibrated according to national standards.
- **Laboratory Sampling** may be carried out for validation and in case of dispute or audit.
- **Daily Inspection Logs** will be maintained by Site Supervisors for visual dust emissions, and submitted weekly to ESMU.
- **Calibration and Maintenance** of monitoring instruments will be carried out monthly, with service logs reviewed by the Consultant.

7. Training and Capacity Building

Training is an integral component of effective air quality management. Personnel involved in construction activities must be adequately trained to understand air quality issues and their role in mitigating emissions.

The contractor, under the guidance of the Supervision Consultant and ESMU, shall conduct regular training sessions for all site personnel, including machinery operators, drivers, and supervisors. These sessions shall cover:

- The sources and health impacts of air pollution.

- Standard operating procedures for dust suppression.
- Best practices for equipment maintenance and fuel efficiency.
- Use of personal protective equipment (PPE), particularly masks and respirators in high dust zones.

Toolbox talks on air quality issues will be held weekly, and refresher trainings will be conducted every three months or upon the induction of new staff. Awareness materials such as posters and signage related to air quality control shall be displayed at key locations across the construction site.

Annexure VI: Executed Material Dumping Plan

(This Plan is just indicative for the guidance of contractor. It will be responsibility of the contractor to prepare a site-specific Plan for approval from the project consultant before start of construction activities)

1. Introduction

The construction of the Tangir and Darel Expressways involves extensive excavation, earthworks, and rock cutting in rugged, mountainous terrain. These operations will generate a significant volume of surplus excavated materials, including soil, boulders, fractured rock, and fines. Without a strategic plan, the unregulated dumping of such materials can lead to adverse environmental and social impacts including slope instability, sedimentation of water bodies, degradation of adjoining agricultural land, blockage of local pathways, and air quality deterioration due to windblown dust. This "Excavated Material Dumping Plan" outlines best practices to ensure that all materials are disposed of in a safe, environmentally responsible, and legally compliant manner.

2. Objectives

- To establish clear and effective procedures for the handling, transportation, and disposal of excavated materials generated during construction of Expressways project, ensuring compliance with environmental standards and minimizing adverse impacts on the surrounding ecosystem.
- To minimize environmental degradation through the responsible management of excavated materials, particularly by controlling dust emissions, preventing soil erosion, and avoiding contamination of nearby water sources.
- To ensure compliance with applicable national and local regulations (e.g., the Gilgit Baltistan Environmental Protection Act, 2014; Gilgit Baltistan Empowerment and Self-Governance Order, 2009), as well as relevant international environmental standards and guidelines.
- To protect public health and safety by ensuring that all material disposal practices, including dumping site management and transportation, are carried out in a manner that minimizes risks to local communities and construction workers.
- To implement effective dust and erosion control measures on dump sites, including the use of water sprinkling, slope stabilization techniques, and vegetative cover to mitigate air pollution, soil erosion, and surface runoff.
- To facilitate the rehabilitation and restoration of dump sites after use, promoting the sustainable management of land and preventing the long-term degradation of the surrounding environment.
- To provide workers, contractors, and community stakeholders with continuous training and awareness programs regarding the safe handling, transportation, and disposal of excavated materials, as well as the potential environmental and health risks associated with improper management.
- To maintain comprehensive monitoring and reporting systems for all phases of the excavation and dumping process, ensuring transparency, accountability, and adherence to the project's environmental and social objectives.

3. Material Classification

Material characterization is crucial for determining the reuse or disposal of excavated materials based on factors like grain size, stability, and contamination potential. For the Tangir and Darel Expressways project, this classification helps optimize material reuse, reduce environmental impact, and ensure compliance with regulations by categorizing materials into groups based on their suitability for construction and environmental safety.

- **Category A – Reusable Structural Material**

  Includes hardstone, large-sized rocks, and coarse gravel suitable for use in road embankments, slope protection (rip-rap), sub-base layers and retaining walls.

- **Category B – General Fill**

  Comprises granular soil and weathered rock that can be repurposed for backfilling, landscaping, berms, and road shoulders.

- **Category C – Unusable Material**

  Consist of organic-rich soils, expansive clays, silt, and contaminated or mixed debris that do not meet engineering standards. These materials must be transported to designated disposal sites approved by environmental authorities.

- **Category D – Fine Particulate Spoil**

  Composed of fines, dust, and powdered rock from cutting or blasting operations. Due to their high erosion and air pollution potential, they require specific dust suppression measures and controlled disposal practices.

4. Excavated Material Reuse plan

Category	Material Type	Potential Use / Action
Category A	Reusable Structural Material	Large-sized rocks, gravel, and hard-stone suitable for embankments, sub-base, slope protection (rip-rap), and retaining walls
Category B	General Fill	Granular soil and weathered rock that can be reused for non-structural filling such as road shoulders, berms, and landscaping.
Category C	Unusable Material	Organic-rich soils, expansive clay, silt, or mixed debris unsuitable for engineering applications; must be disposed of in approved dumping sites.
Category D	Fine Particulate Spoil	Rock dust and fines generated from blasting and cutting activities; these require controlled disposal with dust suppression to prevent erosion and air pollution.

5. Dumping Procedures at Disposal Sites

The following procedures shall be implemented at spoil disposal areas:

- Controlled Dumping: Material will be dumped in layers not exceeding 1.5 meters in thickness and compacted using rollers to ensure stability.
- Slope Stabilization: If the dumping is done on slopes, terraces will be created and stone pitching or vegetation will be used to stabilize the site.
- Perimeter Drainage: Surface runoff shall be diverted around the site using interceptor drains to prevent erosion and sedimentation.

- Dust Suppression: Water spraying will be conducted regularly to suppress dust at active dumping sites.
- Buffer Zone: A green buffer or visual screen will be maintained between the dump site and adjacent land uses, where required.

6. Dump Site Selection Criteria

All dumping sites will be selected based on the following environmental and social safeguards:

- Located at least 500 meters from rivers, streams, wetlands, and agricultural land.
- Away from human settlements and other sensitive receptors like schools, hospitals and protected areas.
- Preferably on naturally depressed land to prevent slope failure and not to block the natural drainage of the area.
- Geologically stable with low landslide susceptibility.
- Accessibility by existing haul routes to minimize new access road construction.

A list of approved dumping sites will be maintained by the Environmental and Social Management Unit (ESMU) in collaboration with the Contractor and Project Supervising Consultant.

7. Dumping Site Preparation and Operation

Before material is transported and dumped:

- Each dump site will be surveyed and marked with boundary fencing and clear signage ("Designated Spoil Disposal Area – Authorized Access Only").
- Containment measures (e.g., embankments or trenches) will be constructed to prevent material runoff.
- Surface water diversion drains will be built around dump sites to prevent erosion.
- Material will be dumped in layers not exceeding 1.5 meters in height and compacted to reduce wind erosion and settlement.
- Where possible and feasible, topsoil from excavation sites will be preserved and used to cover spoil piles to facilitate re-vegetation.

8. Excavated Material Reuse Plan

Category	Material Type	Potential Use / Action
Category A	Reusable Structural Material	Large-sized rocks, gravel, and hard-stone suitable for crushing to prepare aggregate, embankments, sub-base, slope protection (rip-rap), and retaining walls.
Category B	General Fill	Granular soil and weathered rock that can be reused for non-structural filling such as road shoulders, berms, and landscaping.
Category C	Unusable Material	Organic-rich soils, expansive clay, silt, or mixed debris unsuitable for engineering applications; must be disposed of in approved dumping sites.
Category D	Fine Particulate Spoil	Rock dust and fines generated from blasting and cutting activities; these require controlled disposal with dust suppression to prevent erosion and air pollution.

9. Air Quality and Dust Control Measures

To prevent degradation of ambient air quality due to dust emissions:

- Water will be regularly sprayed on haul routes and dumping surfaces, especially during dry and windy conditions.
- Speed limits will be enforced (max 20 km/h) for vehicles hauling spoil.
- Tarpaulin covers will be used on dump trucks transporting fines and loose materials.
- Spoil heaps will be compacted and, where necessary, covered with geotextile or biodegradable mats until natural vegetation reestablishes.
- Windbreaks or vegetative barriers will be established along the perimeter of major dumping areas.

10. Monitoring and Compliance

Parameter	Methodology	Frequency	Responsible Party
Airborne Dust (PM_{10}, $PM_{2.5}$)	Air quality sampling and visual inspection	Monthly	Contractor / ESMU
Dump Site Integrity	Visual inspection of slope, drainage, runoff	Biweekly	Site Engineer / ESMU
Reuse vs. Disposal Ratio	Material inventory audit	Monthly	Contractor / Supervision Team
Community Complaints	Grievance Redressal Monitoring	Ongoing	ESMU / Community Liaison Team

11. Post-Dumping Restoration

- All dumping sites will be regarded and contoured to blend with the natural landscape.
- Topsoil will be reapplied and native vegetation or grass will be planted to stabilize the site and prevent erosion.
- A minimum 12-month post-dumping monitoring period will be maintained to assess site stabilization and vegetation growth.
- Unauthorized dumping will be strictly prohibited and penalized under contract clauses and environmental regulations.

12. Training of Workers

- Project Induction: Overview of EMDP objectives, site rules, environmental responsibilities, and reporting lines.
- Equipment & Handling: Safe operation of haul trucks, compactors, and water-spraying units, including load securing and spill prevention.
- Dust & Erosion Control: Techniques for water-spraying, windbreak setup, and rapid dust suppression.
- Emergency Response: Drills for slope failure, spill containment, and uncontrolled dust events with clear communication protocols.
- Monitoring & Reporting: Use of inspection checklists, accurate data logging, and immediate non-conformance reporting.

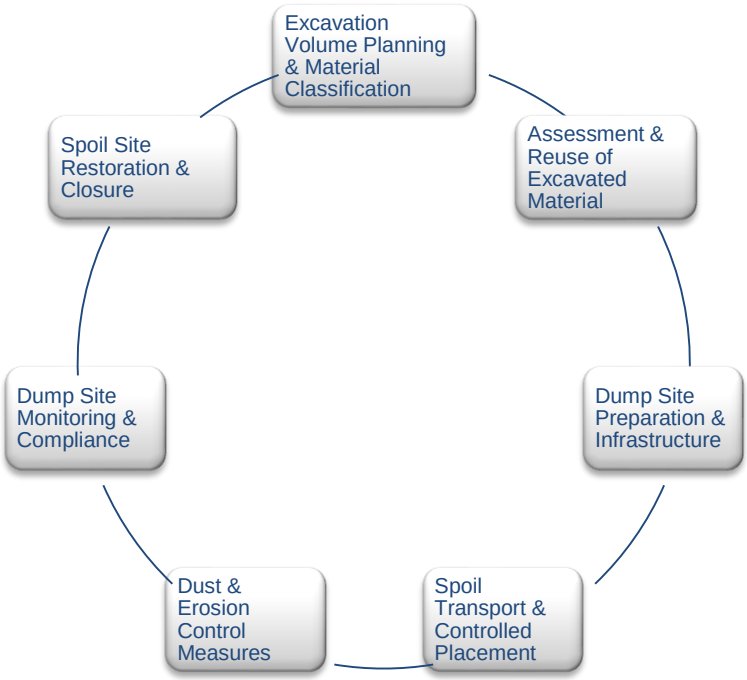
- PPE Usage: Correct selection, fitting, and maintenance of respirators, masks, gloves, boots, and high-visibility wear.

13. Emergency Measures

In the event of slope failure, excessive dust dispersion, or water pollution due to dumping activities, the following actions shall be immediately taken:

- Cease dumping at the affected site.
- Mobilize erosion control measures such as gabion baskets, mulch, or silt fences.
- Conduct emergency air quality monitoring.
- Notify the ESMU and implement remediation under the supervision of the Supervising Consultant.

14. Excavated Material Management Approach



This Excavated Material Dumping Plan is a vital component of the EIA framework for the Tangir and Darel Expressways. It ensures that surplus materials generated during construction are managed in a safe, efficient, and environmentally responsible manner. Strict implementation of management plan will prevent environmental degradation, uphold public safety, and ensure full compliance with the relevant laws and standards of Gilgit Baltistan and Pakistan.

Annexure-VII: Traffic Management Plan

(This TMP is just indicative for the guidance of contractor. It will be responsibility of the contractor to prepare a site specific TMP for approval from the project consultant before start of construction activities)

12 TMP objectives

The TMP during construction phase shall be to ensure that:

- Road users are accommodated through and around the construction zones safely with minimum of delays;
- Traffic control and the construction activities are coordinated to provide for safe and efficient flow of traffic together with efficient, safe and rapid progress of the construction activity.
- When construction activities are taking place at multiple sites along the same or on parallel routes, construction activity and the movement of road users is coordinated to ensure that the total delay along the route or on signed alternative routes is within acceptable limits.
- Driver behavior is effectively influenced so that the speeds are reduced to the desired levels on the approaches to and within the construction zones;
- The works requiring partial road closures on various points should be phased, where possible, so that they are not undertaken at the same time.
- The arrangement of traffic diversion during construction will be accordance with

13 Traffic safety and control

- The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the highway under improvement.
- The barricades erected on either side of the carriageway / portion of the carriageway closed to traffic, shall be of strong design to resist violation, and painted with alternate black and white stripes. Red lanterns of warning lights of similar type shall be mounted on the barricades at night and kept lit throughout from sunset to sunrise.
- At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the carriageway) the channel for traffic shall be clearly marked with the aid of pavement markings, painted drums or similar devices as per the directions of the Engineer. At night, the passage shall be delineated with lanterns or other suitable light source.
- Signs, lights, barriers and other traffic control devices, as well as the riding surface of diversions shall be maintained in a satisfactory condition till such time they are required as directed by the Engineer. The temporary diversion road shall be kept free of dust by frequent applications of water, if necessary.

14 Safety in active construction zones

The construction zone creates an environment where the road user is faced with a series of unusual hazards in the form of unfamiliar routes, substandard horizontal and vertical alignment, adverse cambers, construction equipment etc. The road user also has to watch for traffic control devices apart from performing normal driving functions of vehicle control and responding to other traffic and hazards. These factors increase the strain on driver performance and lead to accidents. The safety practices in construction zones should, therefore, be orientated towards reducing conditions which lead to such hazards and consequent stress whereby risk of accidents is increased. The guiding principles for safety in road construction zones are:

Warn the road user clearly and sufficiently in advance;

- Provide safe and clearly marked lanes for guiding road users;
- Provide safe and clearly marked buffer and work zones;
- Provide adequate measures that control driver behavior through construction zones.

15 Traffic control devices

Traffic control devices are the equipment and installations over and, on the road, which individually and collectively perform the following tasks:

1) Warn the road user;
2) Inform the road user;
3) Guide the road user;
4) Modify road user behavior;
5) Protect the road user and the vehicle;
6) Ensure safe passage to the road user; and
7) Provide a safe working area.

16 Signs

The road construction and maintenance signs fall into the same three major categories as do other traffic signs, that is Regulatory Signs, Warning Signs and Direction (or Guidance) Signs. Where possible, the size, colors and placement of sign shall conform international standard. Each sign should be well located so that its message is seen and is clear, which will be assisted if the surroundings are devoid of “unnecessary” signs and other clutter. These signs should be of retro reflective sheeting’s of engineering grade depending upon the importance of the road. On kerbed roads, the extreme edge of the sign adjacent to the road shall not be less than 600 mm away from the edge of the kerb. On un-kerbed roads, the extreme edge of the sign adjacent to the road shall be at a distance of two to three meter away from the edge of the carriageway depending on local conditions but in no case, shall any part of sign come in the way of vehicular traffic. Where signs are in position for some time and pedestrians are expected, the lower edge of the lowest sign (plate) should not be less than two meter above the surface on which it stands. Most common types of signs are:

Regulatory signs: Regulatory signs impose legal restriction on all traffic. It is essential, therefore, that they are used only after consulting the local police and traffic authorities. The most likely type of regulatory signs to be used in traffic control zones are: STOP, Give Way, Do Not Enter. Various other signs that are needed to regulate traffic may be required which have not been standardized. They should confirm with the general requirements of shape and colour, and their message should be brief, legible and clearly understandable.

Warning Signs: Warning signs in the traffic control zone are utilized to warn the drivers of specific hazards that may be encountered. Drivers should be alerted to potential hazards in sufficient time to adjust their movement and speed. The most common type of warning signs for the use in the traffic control zone are: Men at Work, Road Narrows Traffic Signal Ahead, Two Way Traffic, Rough Road, Slippery Road, Loose Chippings, Divided Road and Divided Road Ends.

Direction signs
Direction or Guide signs are required at traffic control zones to provide the necessary information and guidance for the alternative route and work being done. These signs shall have black letters, arrows on yellow background. The commonly used guide signs are: Diversion, Detour, and Diverted Traffic.

17 Delineators

These channelizing devices such as cones, traffic cylinders, tapes, drums are placed in or adjacent to the roadway to control the flow of traffic. Few of the important practical types of delineators are traffic cones and cylinders, drums, Barricades

18 Flagmen

Flags used for signaling should be minimum 600 mm by 600 mm in size, made of a good red cloth and securely fastened to a staff or approximately 1 m in length. Sign paddles should be at least 600 mm wide and provided with a rigid handle. The background color of STOP should be red and its shape shall be octagonal conforming to IRC:67. The word STOP should be in white, in the middle of the sign. The background of SLOW should be yellow with black letters and borders.

19 Traffic Management

Introduction

The traffic management strategies to be used at traffic control zones must include the following fundamental principles:

- Make traffic safety an integral and high priority element of project,
- Avoid inhibiting traffic as much as possible,
- Guide drivers in a clear and positive way,
- Perform routine inspection of traffic control elements and traffic operations,
- Give care and attention to road safety.

Speed Control

The co-operation of the local police should be sought to the introduction of a temporary but mandatory speed limit, lower than the existing speed limit on the approaches and through the working zone. This may be as low as 50 km/h even for high-speed road, where only one lane is available for traffic.

General precautions

The following defined precautions shall apply to all the work sites:

- All the signs and delineators shall be maintained in a clean and brightly painted condition at all times;
- Adequate lighting arrangements shall be made for proper visibility during the negotiation of the work area; and
- Adequate arrangements like frequent sprinkling of water shall be made to keep the area dust free.
- For high traffic density roads, the following further precautions must be taken:

For Safety of Workmen

Workmen must be trained in use of tools and plant;
Gum boots, tarring outfits, spectacles etc., must be given to persons handling bitumen. Their use should be mandatory;
First aid training be provided to all workmen and enough safety kits should be available at site;
Workers required on site during night hours must be provided with fluorescent yellow jackets with reflective tapes;
Safety helmet must be given to all workmen at site; and
First aid posts should also be set up at important sites.

For Safety of Road User

As far as possible, the material, equipment and machinery should be installed/parked in places sufficiently away from the berms in the available road land. Only in unavoidable cases, the same shall be allowed to be collected/installed/parked near the edge berms. In any case, no material should be collected nor any equipment/machinery installed/parked near and on curves;
Machinery should be parked at appropriate places with red flags and red lights on; and
Minimum quantity of material required for one operation should be collected.

Annexure VIII: Barrow Area Development and Restoration Plan

(This Plan is just indicative for the guidance of contractor. It will be responsibility of the contractor to prepare a site-specific Plan for approval from the project consultant before start of construction activities)

1. Introduction

In the course of expressways construction, substantial quantities of raw materials such as soil, gravel, sand, and crushed rock are required for various engineering interventions. These materials are essential for forming embankments, filling excavated areas, stabilizing slopes, and constructing the subbase and base layers of the roadway. To meet these demands, construction contractors typically identify and develop barrow areas in designated zones where natural material are excavated for project use. While these areas play a critical role in ensuring timely progress of construction, unsupervised or unregulated extraction from barrow sites can result in serious environmental consequences, including:

- Land degradation and loss of agricultural productivity;
- Soil erosion and sedimentation of nearby water bodies;
- Dust pollution, which affects air quality and public health;
- Destruction of natural habitats and biodiversity loss; and
- Alteration of natural drainage, leading to flooding.

In ecologically sensitive and mountainous regions like this project, these impacts can be even more severe due to fragile terrain and limited natural regeneration capacity.

Objectives of This Barrow Area Development and Restoration Plan aims to mitigate such risks by providing a structured approach to:

- Site selection and assessment.
- Environmentally responsible excavation practices.
- Rehabilitation and restoration of disturbed areas post-extraction.

2. Objectives Barrow Area Development and Restoration Plan

The main objectives of the “Barrow Area Development and Restoration Plan” centered on balancing construction needs with environmental protection and regulatory compliance. Each objective serves to minimize the negative impact of material extraction and promote responsible land use.

- Extraction will follow technical guidelines such as controlled depth, slope angle, and moisture control to prevent accidents or over-excavation.
- Selection of barrow sites will be based on environmental assessments of the area and avoid sensitive zones such as wetlands, forests, and cultural heritage sites.
- The aim is to ensure that material sourcing does not compromise surrounding ecosystems or community resources.

- Uncontrolled excavation can expose soil to wind and water erosion, leading to gullies, landslides, and sedimentation in rivers.
- Barrow pits, if left unrestored, can become visual scars on the landscape and breeding grounds for pests or stagnant water.
- Proper planning and gradual excavation help preserve natural contours and biodiversity, avoiding displacement of native flora and fauna.
- Once extraction is complete, the disturbed site will be restored to safe slopes, covered with topsoil and vegetated to promote ecology of the area
- Restoration helps return the area to its original or near to original land use (e.g., grazing, agriculture, or natural cover) or make it safe for alternative uses.

3. Criteria for Site Selection

To avoid disruption in baseline conditions and to the natural environment and local communities the following guidelines are proposed:

- **Avoidance Areas**

  Barrow area must not be located in or nearby:

  - Agricultural land – to prevent loss of productive soil and community livelihoods.
  - Forested areas – to protect biodiversity, wildlife habitats, and ecosystem services.
  - Wetlands or marshy lands – to avoid disturbing fragile aquatic ecosystems and natural drainage.

- **Minimum Distance Requirements**

  To minimize adverse impacts, barrow sites will maintain:

  - At least 500 meters from water bodies (rivers, lakes, streams) to prevent sedimentation and water contamination.
  - At least 300 meters from settlements (villages, houses, schools) to reduce noise, dust, and vibration disturbances.
  - A safe buffer zone from protected or ecologically sensitive areas, such as wildlife reserves, archaeological sites, and cultural landmarks.

Baseline Environmental Survey

Before excavation begins, a detailed baseline survey will be carried out by environmental experts or engineers to gather essential information about the proposed site. This includes:

- Assess the slope, elevation, and general terrain features to determine excavation feasibility and drainage patterns.
- Avoid steep or unstable slopes that will lead to erosion or landslides post-extraction.
- Identify soil composition (sandy, clayey, loamy) to ensure the material is suitable for the purpose.
- Avoid sites prone to degradation and erosion from wind and rainfall.
- Document all plant species and tree cover in the area as it will help in compensatory plantation (5 trees against one tree cut).
- Evaluate the ecological value of the vegetation — whether it's natural grassland, invasive weeds, or home to important species.
- Check if the site is near streams, rivers, drainage channels, or seasonal nullahs.
- Ensure that excavation does not obstruct water flow, cause sediment buildup, or increase flood risk during the rainy season.

4. Environmental Controls During Use

While the barrow area is active, it is crucial to implement environmental protection measures to reduce negative impacts on the surroundings. The following controls measures are proposed for implementation:

- **Dust Control**

  Dust from excavation, vehicle movement, and stockpiles can reduce air quality and affect nearby communities and workers.

  Control Measures:

  - Regular water spraying on roads, bare ground, and material piles.
  - Use of dust screens or shade nets during transportation.
  - Maintain low driving speeds for construction vehicles.
  - Cover trucks transporting materials to prevent dust spill during transport.

- **Noise and Vibration Control**

  Machinery generates noise and vibrations that can disturb local residents and wildlife.

  Control Measures:

  - Restrict operations to daylight working hours only (typically 7 a.m. to 6 p.m.).
  - Fit machinery with mufflers or silencers to reduce noise.
  - No unnecessary idling of engines.

- Monitor noise levels regularly using decibel meters, especially near sensitive receptors and communities.

- **Safety Measures**

Excavation areas pose risks of accidents, especially for workers and trespassers.

Control Measures:

- Install temporary fencing or barricades around open pits and hazardous zones.
- Place warning signs in local languages and with visuals (e.g., "Danger – Deep Excavation").
- Ensure workers use personal protective equipment (PPE): helmets, high-vis vests, boots, and gloves, dust masks, etc.
- Maintain emergency contact numbers and first aid kits at all active zones.

5. Restoration Plan

Once material extraction is complete, the site will be rehabilitated to avoid long-term damage and restore it to a natural or usable state.

- **Grading and Slope Stabilization**

Goal:

- Return the terrain to a stable and safe form.

Actions:

- Use earthmoving equipment to smooth and level the site following its original contours, or as per design.
- Create gentle slopes (preferably not steeper than 1:2) to reduce erosion risk.
- Establish drainage channels or contour bunds to direct rainwater safely without causing gullies.

Vegetation and Replanting

Goal:

- Stabilize the land, prevent erosion, and restore ecological balance.

Actions:

- Use native plant species (grasses, shrubs, trees) that are suited to local climate and soil.
- Apply hydroseeding or manual sowing where machinery cannot reach.
- For steep or erosion-prone slopes, use bioengineering materials like:
  - Jute netting, coir rolls, or geotextiles for stabilization.
  - Live staking of fast-growing vegetation (e.g., willow).

- Protect planted areas with fencing if livestock or wildlife disturb them.

- **Monitoring**

  Goal:

  - Ensure the restoration efforts are successful and sustainable over time.

  Actions:

  - Inspect the site regularly after reasonable interval.
  - **Monitor for:**
    - Plant growth (density, survival rate)
    - Soil condition (erosion signs, compaction)
    - Drainage (check for standing water, blocked channels)
  - If vegetation fails to establish or erosion continues reseed as necessary.
  - Keep documentation of all monitoring results, corrective actions taken, and photographs of site condition.

Annexure IX: *Contingency, Safety and Environmental Protection Plans*

(This Plan is just indicative for the guidance of contractor. It will be responsibility of the contractor to prepare a site-specific Plan for approval from the project consultant before start of construction activities)

A. Emergency Preparedness Plan

A.1 Introduction

Emergency planning is very important during construction activities of any project. The purpose of such plans is to provide awareness to all concerned with a planned response to emergency situations that can arise during construction phase. The plan ensures to protect lives, infrastructure, environment and properties. Emergencies can arise from natural disasters or from project activities which have the potential for creating devastating destruction. The following is an indicative list of the types of emergencies that can occur during construction phase of the Motorway project.

- Fire
- Earthquake
- Flood
- Severe weather
- Land sliding
- Hazards

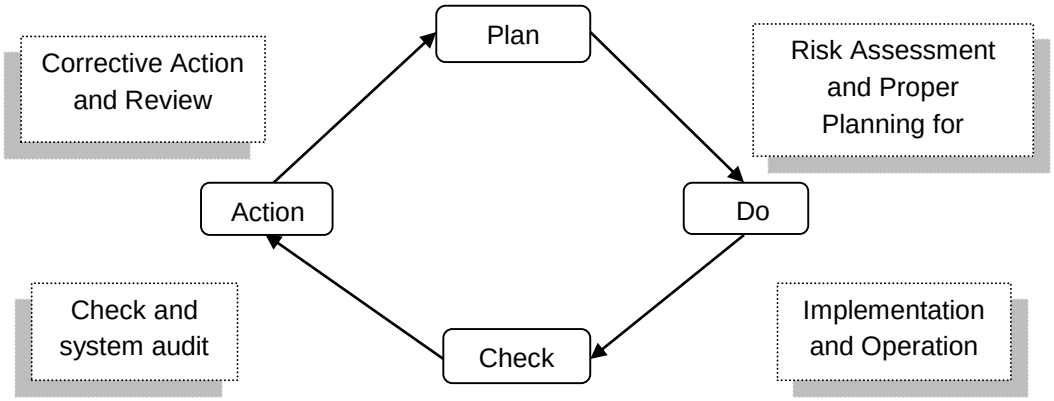
The concerned contractor(s) will be responsible to prepare project specific “Emergency Plans” before start of construction. These plans will be approved by the Supervision Consultant. The contractor will issue these plans to all concerned in the form of Standard Operating Procedures (SOP) for implementation, indicative EPP for some of emergency situations is given below for guidance of the contractor(s).

A.2 The Plan

To avoid losses from natural hazards following mechanism is proposed to be followed by the contractor(s).

- Obtain an early warning of the emergency conditions such as flood, storms and cyclones from the metrology department and other concerned agencies.
- Formulation of local emergency teams for different working sites/packages.
- Safeguard personnel to prevent injuries or loss of life, ESMU and Contractor with the assistance of Supervision Consultant should assess in advance the possibility of the occurrence of emergency situations, and establish procedures for preventing workers from being injured.
- Proper Management and handling of harmful substances; Organic solvents, Dust, Specified chemical substances, Radiation substances etc.
- Management of working environment and proper safety measures must be adopted.

- In emergency preparedness, procedure of risk management must be adopted for continual improvement and risk reduction. PDCA Cycle (Plan, Do, Check, Action) leads to continual improvement while preparing for emergencies as is illustrated below.



A.3 Risk Management

Apply risk assessment and management procedures at all construction sites as under:

- Identify, characterize and assess all risks that can impact on health, safety and environment.
- Mitigate risks with controls in engineering, administration and other protective measures.
- Monitor risks and take timely action to offset the emergence. Regularly review performance to improve procedures, further reduce risk, detect weaknesses and trigger corrective measures.
- Document, report relevant data and maintain records in compliance with regulatory requirements.

Following measures are suggested to deal with different types of emergency situations.

Fire

- Broad outline of firefighting procedure will be as under;
- Establish well equipped firefighting section separately for each package ,
- Fire extinguishers must be of proper capacity and to be provided at all work places.
- Periodically check the function of fire alarm system.
- The construction in charge to report the fire, giving location and other necessary details to Fire Fighting Section.

Earthquake

- Issue SOP to impart necessary periodic training to all working staff.
- Quickly run for an open area.
- If inside camp site then seek shelter immediately under a heavy desk/table, or brace yourself inside a door frame or against an inside wall.
- After earthquake help others.
- Report to the Project Emergency Coordinator.

Flood

Flood waters can destroy human life, infrastructure, labor camps and machinery. An early *Alert* or *Warning* of flood should be issued. The mitigation measures for flood can be classified into following phases;

i. The Emergency Phase: distinguished by the action implemented to rescue the lives of workers and other project staff. This phase involves rescue efforts, first aid, medical assistance, and the rehabilitation of the communication and transportation network.

ii. The Transitional Phase: consists of efforts executed to accelerate the rehabilitation of the workers and situation back to the previous state of life such as reconstructing damaged buildings and curing of certain diseases.

iii. The Reconstruction Phase: this phase occurs when there are reconstruction and rehabilitation efforts.

Severe Weather

Severe weather includes very high and very low temperature, dense fog and suspended dust. In severe weather, working hours should be terminated, reduced or adjusted accordingly.

Landslides

Land sliding may occur in the project area due to high steepness and due to natural seismic activities. The project activities, especially during blasting of rocks, the formation may become loose and the risk of landslides will increase in the immediate vicinity of the construction sites. Therefore, blasting of formations must be minimized and if unavoidable, then use low intensity explosive. Continuous watch of active land sliding areas will be responsibility of ESMU, Contractor and Consultant.

Hazards

Various types of hazards expected during construction are:

- Mechanical Hazards: Hazard of machinery and other project activities may include collisions, fall from height, struck by objects etc.
- Chemical Hazards: includes explosive substances, combustible substances and leakage;
- Physical Hazards includes noise, lighting, vibration and hypothermia
- Biological Hazards includes, bacteria, viruses, communicable diseases, snake and other animals biting

Against these hazardous factors safe design, safeguarding and additional safety measures must be adopted. The measures include safe usage of machines, protection from accident, warning systems, new workers education, management of working environment, investigations of causes of accidents and preventive measures for hazardous substances.

A detailed and comprehensive site map of different activities of construction phase must be developed with emergency management applications and routes of evacuation/exit points etc. and must be delivered to all levels of working crew, so that each and every working person is familiar with it.

Health & Safety Plan

B.1 Introduction

Health and safety plan is devised to maintain a safe and healthy workplace during construction activities of the proposed Motorway.

B.2 Objectives of Health and Safety Plan

Health and safety plan is devised to achieve the following specific objectives;

- To move continuously toward zero injuries and occupational illnesses.
- To manage and integrate safety and occupational health into all decisions, plans and operations.
- To respond immediately, directly and openly to the concerns of workers.
- Provisions of Instructions and training as appropriate in the handling storage and dispatch of waste.
- Demonstrate commitment to, and accountability for safety and occupational health.
- Working safely is integral part of the employment and workers are accountable for their own safety and the safety of those around them.
- Assess and manage the risks associated with construction activities.
- Verify that all employees, contractor and other associated with working place are trained to perform their jobs safely.
- Maintain regularly test emergency preparedness systems and carry out emergency drills.
- Promote safe activities to extend and reinforce safety and health consciousness.
- Systematically auditing behavior-based safety, work processes, management systems and equipment and promptly correcting the deficiencies.
- Encouraging the workers to report incidents and investigate all incidents to determine contributing factors and improve ongoing prevention efforts.

B.3 Project actions that may adversely impact health of workers and local people include;

- Selection of campsite, type of machinery and equipment yards.
- Type and disposal arrangements of solid waste from campsite, workshops, batching plants and other working sites.
- Surface and groundwater contamination due to project activities.
- Air emissions from vehicles and other machinery/equipment and drilling activities. Air emissions may be of following categories;
  - Dust and potential pollutants from construction machinery, excavation, crushing and drilling processes.
  - Gaseous emissions from vehicles / transport machinery.
- Noise pollution due to machinery, blasting, drilling activities and crushing of stones.
- Water borne, vector diseases due to stagnant water and open dumping of solid waste.

- Communicable diseases due to large number of workers of variable cultural backgrounds in the project vicinity.
- Potential health hazards due to various operational activities and natural disasters. Natural disasters include floods, fires, earthquakes, lightning strike, windstorm or cyclone.

B.4 Accident Occurrence

Reasons that may lead to accident occurrence and pose threat for safety during project operations can be divided into two categories;

2. Unsafe status
3. Unsafe actions

Unsafe status

This may include;

- Fault of Object: Design, materials, decrepitude, maintenance, repair and machine failure.
- Fault of Safety Device: Absence of safety device, insufficient protection/shield, while crushing of aggregates etc.
- Work place, Layout: Narrow & Confined space, improper layout and exit and live wiring.
- Protective gears, Clothing: Unsafe clothing, improper use of protective gears (Helmet, Dust/Gas mask, Dust respirator, Goggle, Safety shoes etc.)
- Noncompliance with work instructions (Standard): unsuitable for specific task machine, device, tool, improper working equipment, and improper co-operation.

Unsafe actions

This may include;

- Outdated safety devices/ Expire validation of Safety Devices.
- Leaving from the place without switching off machines and devices
- Making unsafe condition for other workers
- Improper usage of machine, device, tools
- Approach to sensitive spot without protective measures
- No use of protective gear, Unsuitable/ improper clothing
- Improper usage of machine or tool
- Error of action
- Maintenance of machines while being operated
- Neglecting safety instructions.

B.5 Mitigation Measures

These health and safety hazards can be reduced or mitigated by adopting following measures during construction activities of the proposed Motorway Project.

- The Project Environmental and social Management Unit (ESMU) will be required to take care of occupational health and safety requirements of the project. Contractor will employ a part time qualified occupational safety officer during the construction phase. The contractor will need to carry out risk assessments and then follow site and project specific Health and Safety Management Plans to prevent accidents, injuries and work-related diseases.
- Proper management at campsite through providing pre-treatment and proper sanitation facilities like septic tanks for effluents at campsites.
- Proper management and disposal of rubbish and wastes from campsites, offices, residential areas and other places. Various options for the treatment and disposal of solid waste are incineration, composting, sanitary land filling and pulverization etc.
- Air emissions are controlled by use of incineration (stack flares), adsorption, gas scrubbing, and other absorption processes.
- Dust and potential pollutants from construction places are avoidable using water spraying during operation.
- Gaseous emissions can be avoided by maintenance and tuning of vehicles and construction machinery being used for construction/operation.
- Prohibition on burning of waste material.
- Provision of personal protective equipment including masks and wearing of helmets, gloves etc. to workers in all project areas.
- Apply safeguarding technology e.g. installing fences, gates, escape ladders, safety rings, safety signs, warning sirens, strobe lights and other physical protective measures
- For reducing noise other mitigation measures include:
  - Use of low sound rated equipment
  - Control timing of noise and vibration to least disruptive periods
  - Install noise barriers
  - Particularly noisy operations should be enclosed
  - Design noise monitoring program identifying location of monitoring sites
- Good design of drainage to avoid stagnant water for prevention of water borne, vector diseases. Run-off control measures such as storm water detention basins with treatment prior to discharge are normally necessary to avoid such adverse water impact.
- As a safety measure against communicable diseases, workers must not be provided congested campsites. Proper partition as a living place must be given to each worker.
- Ensure that periodic awareness campaign for HIV/AIDS is undertaken for the project staff/ medical checkup should also be conducted for the workers on regular basis.
- Awareness of potential health hazards should be developed. For each category of natural disaster, potential hazards should be identified, and the significance of their consequences should be assessed in order to develop associated contingency scenarios.
- For chemical storage with a risk of fire, explosion, or release of chemical substances a preliminary hazard analysis (PHA) should be considered. The important elements of a PHA include:

- Identifying hazard scenarios associated with use or storage of chemical substances and calculating the probability of potentially hazardous incident occurring.
- Conducting a quantitative risk assessment of the most relevant hazards; this assessment should be based on public safety considerations as well as impact on the environment if an operational hazard or natural hazard takes place.
- Identifying risk mitigation measures; this should include an assessment of the adequacy of operational and emergency procedures involving dangerous and hazardous goods and their effectiveness in reducing risk and environmental impacts.
- Assessing cumulative risk levels expected from the proposed development (i.e. the safety implication for surrounding land uses).
- Regular safety audits should be conducted, which includes the equipment and machines as well as for the on job activities for the storage of material on the project site.
- Conduct tool box talk on daily basis, so as to enhance the awareness of safety among workers.
- Protective gears like dust mask for dust emitted from construction activities, gloves for hand protection and safety goggles for eye protection.

The adequacy of proposed safeguards should be evaluated against risk levels.

- Careful planning and control of service areas.
- Medical facilities in the project area.

Medical facilities in the project area may lessen the occupational health hazards. Occupational health hazards may mean;

- Conditions that cause legally compensable illnesses

Any condition in the workplace that impairs the health of employees is enough to restrain them from work or to cause significant discomfort. Both are undesirable and preventable. For prevention of health hazards, Physicians play a vital role.

B. Solid Waste Management Plan

C.1 Introduction

Solid waste management plan is designed to describe the procedures, methods and techniques to be adopted for disposal of solid waste during construction activities. It is illustrated to;

- Identify the quantity of each type of waste expected to be produced.
- Estimate the quantity of each type of waste.
- Identify and plan waste management actions proposed for each type of waste generated.

Proper management of solid waste is important at project site because the danger of improper solid waste handling and disposal to human health and the environment cannot be ignored. Problems that can be created due to unsound solid waste management include:

- Careless and indiscriminate open dumping of wastes can create visual pollution as well as conditions;
- Delay in delivery of solid wastes to landfills, disposal/dump sites; result in nuisance and unpleasant odors, which attract flies and other vectors. Such dumps also lead to pollution of land/soils, ground and surface water through leachate as well as air through emission of noxious and offensive gases;
- Open solid waste dumps can also be a public health risk. Direct contact with them can be dangerous to the workers and local public, as infectious diseases such as cholera and dysentery can spread through contact with these wastes. Open solid waste dumps also provide suitable breeding places for vermin and flies and other disease vectors, and can also contain pathogenic microorganisms;
- Some categories of solid waste block permeability of soils and drainage systems, including water courses, open drains and sewers, thus posing difficulties in the functioning and maintenance of such facilities.

C.2 Types of Waste

The expected types of wastes generated from construction activities will be;

- Campsite waste or Domestic waste
- Workshop waste (vehicles and machinery)
- Fuel, oil and chemical waste
- Medical waste
- Packing waste
- Debris from construction and excavation sites

The wastes mention above can also be generalized into following categories:

Biodegradable waste: Mainly organic wastes such as foodstuffs, fruit and vegetables, wood, grass, bones, textile and other biodegradable items.

Non-biodegradable waste: It includes polythene bags, excavated material, glass, stone/brick, Shopping bags, plastic products, pesticides residues, process wastes, highly flammable and volatile substances, used vehicles tyre and batteries including metal scrap and medical wastes such as used needles, plastic, glass bottles and syringes etc.

C.3 The Plan

The solid waste management plan for proposed motorway Project is developed to ensure that waste should be dealt with an efficient and environmentally sound manner, starting from waste collection and ending on disposal. Human and other activities shall be centered at camp site, crushers and batching plants.

Construction of landfill sites

Construction of landfill site will be required separately for campsite area where all biodegradable waste from camp site will be dumped.

Waste Collection Receptacles

Waste collection receptacles will have the following characteristics;

- Separate receptacles for bio-degradable and non-biodegradable wastes.
- Containment (no littering or leakage), convenient to handle, environmentally sound (safe from winds and scavenging by dogs, rats and cats etc.), economical and accepted by Environmentalist of Supervision Consultant.
- The receptacles design must be suitable for all kinds of wastes.
- Distribution of the bins must be based on the number of workers using it or the solid waste generation rate in the project area. A 140-litre bin is sufficient for around 30-36 people.
- The standard waste generation rate of a person is 0.5 kg/ day and for estimated 2500 or 3000 workers it would be 1250 to 1500 kg/day.

Sorting of the Waste

It is necessary to sort the waste into various categories as mentioned under section 1. The waste should be sorted manually or mechanically before applying necessary treatment and disposal arrangement.

Waste Transportation

The waste must be transported from collection points to disposal points in well maintained, designated and covered vehicles. Every transportation vehicle must have fixed routes, which should be established by the Project Environmental and social Management Unit (ESMU). Hazardous material must not be allowed to mix with domestic waste. Waste must be collected every day; however, collection schedule can be adjusted depending on the labor strength and actual requirement.

Treatment and Disposal

Various options for treatment and disposal of solid waste are waste minimization, recycling, composting, incineration and sanitary land filling. Different kinds of wastes generated during project activities can be treated and disposed of according to the methods given below.

Type of waste	Description	Disposal method
Campsite (domestic waste)	Biodegradable: Foodstuffs, fruits and vegetables, wood, bones, grass, tree branches and leaves etc. Non-Biodegradable: Paper, metals, glass, plastic bottles, scrap metal,	Biodegradables: Composting Non-Biodegradable:

Type of waste	Description	Disposal method
	textile and shoes, bottles and jars, fluorescent tubes.	Most of the garbage plastic, glass, combustible/non-combustible and recyclable waste will be segregated and supplied to vendors for recycling or Incineration. Non-recyclable or non-combustible waste should be buried in designated sanitary landfill to be built by Contractor as per design approved by the Project Consultants and ESMU.
Workshop waste	Used oil, plastic containers, ferrous / nonferrous materials, batteries, vehicles, tyre tubes etc	Anything mechanically reusable should be provided to certify recycling Contractor for reuse or recycling. Anything potentially dangerous such as batteries and aerosols will be placed in a separate container, appropriately marked, and disposed of through the vendor.
Medical waste	Syringes, glass bottles, bandages, blood sampling tubes, expired drugs, dressing etc.	Hazardous medical waste will be bagged and binned in a separate, appropriately labelled container and to be incinerated at nearby hospital incinerator, if any, or an equivalent facility.
Packing waste material	Paper, plastic, textiles, cardboard, rubber, wood, glass, tin, cans, Aluminum cans etc.	Recyclable waste to be handed over to recycling contractors. Combustible waste to be burned in burn pit or incinerator.
Excavated and Demolition waste	Rocks, sand, silt/clay, concrete, bricks and other building materials	Almost all excavated, construction and demolition waste is capable of being recycled, providing the waste is segregated and separated. The recycled materials can then go on to be used for aggregate formation, landscaping and in road construction.
Excess construction material	Sand, aggregate, cement, bricks, reinforcement steel bars, paints and other construction materials	To be sold back or given to the supplier or other users.

Annexure X: Hazardous and Explosive Material Management Plan

(This Plan is just indicative for the guidance of contractor. It will be responsibility of the contractor to prepare a site-specific Plan for approval from the project consultant before start of construction activities)

1. Introduction

Construction of the expressways involves extensive excavation, rock cutting, and the use of light and heavy machinery. This requires the use of various hazardous materials (such as fuels, batteries, chemicals, bitumen) and explosives for blasting activities to break the hard rock. Due to the remote terrain, fragile ecosystems, and proximity to local communities, a robust management plan is essential to ensure safety, regulatory compliance, and environmental protection.

2. Objectives of Hazardous and Explosive Material Management Plan

- To establish guidelines for contractor(s), a procedure that ensure proper handling of hazardous and explosive materials are handled, used, stored, and transported safely throughout the project construction phase.
- To minimize the risk of accidents, injuries, health hazards, and environmental contamination arising from the use or mishandling of dangerous substances.
- To comply with all applicable national laws (e.g., Explosives Act 1884, GB-Environmental Protection Act 2014), local regulations in Gilgit-Baltistan, and relevant international standards such as IFC and World Bank EHS Guidelines.
- To manage and dispose of hazardous wastes safely and legally, preventing contamination of soil, water, and air.
- To provide workers and contractors with regular training and awareness programs on material safety, hazard communication, use of personal protective equipment (PPE), and emergency response.
- To maintain secure storage facilities for explosives, chemicals, and fuels with proper labeling, bunding, and security systems, and to keep accurate inventory records to prevent theft, loss, or overstocking.

3. Legal and Institutional Framework

The project will comply with:

- The Explosives Act, 1884.
- The Factories Act, 1934 (Occupational Health & Safety).
- Motor Vehicle Ordinance (for transport of hazardous substances).
- National Disaster Management Authority (NDMA) Guidelines.
- GB-EPA Regulations.

4. identification of Hazardous and Explosive Materials

- **Hazardous Materials**

- Fuels: Diesel, Petrol, Gasoline
- Lubricants: Grease, engine oils, transmission oils
- Hydraulic fluids and brake fluids
- Solvents: Paint thinners, acetone, methylated spirit
- Paints, adhesives, resins
- Batteries
- Acids: Hydrochloric acid, sulfuric acid (for cleaning)
- Cleaning agents with corrosive or reactive properties

- **Explosive Materials**
  - Ammonium nitrate (used where permitted for non-blasting rock work)
  - Caps, fuses, and minimal detonators (strictly controlled use)
  - Material Safety Data Sheets (MSDS)
  - MSDS must be available and accessible at all locations where hazardous materials are stored, used, or transported. It must include health risks, chemical properties, fire-fighting measures, spill procedures, and disposal instructions.

5. Inventory of Hazardous and Explosive Materials

The inventory outlines the hazardous and explosive materials that will be used, stored, or transported during the expressway construction project. This inventory includes detailed information regarding each material's purpose, physical state, associated hazards, and safe storage methods, handling precautions, and recommended disposal procedures. The aim is to ensure effective safety management, regulatory compliance, and environmental protection throughout the project lifecycle. A format for preparation of inventory along with other useful information of such material is given in the **Table-1** below.

Table-1: List of Hazardous Material Generally Used on Roads Project in Hilly Terrain

Material Name	Purpose of Use	Physical State	Hazards	Storage Method	Handling Precautions	Disposal Method
Ammonium Nitrate Fuel Oil (ANFO)	Rock blasting for excavation	Solid (mixed at site)	Highly explosive, risk of detonation by impact or fire	Licensed explosive magazine with secure fencing and warning signage	Handled only by licensed blasters with PPE; No smoking or open flames nearby	Return unused materials to licensed supplier; Never burn or bury
Diesel Fuel	Fuel for construction machinery and vehicles	Liquid	Flammable, fire hazard, inhalation risk	Bunded steel tanks with fire extinguishers nearby	Wear gloves and avoid inhalation; Refuel in ventilated areas	Use licensed contractor for used oil disposal
Bitumen	Road surfacing and binding	Semi-solid (heated during use)	Flammable when hot, emits toxic fumes	Heated insulated tank away from ignition sources	Use heat-resistant gloves and masks; Avoid skin contact	Let cool, solidify, and dispose through licensed facility
Hydraulic Oil	Lubrication of heavy equipment	Liquid	Flammable, harmful to aquatic life	Store in original sealed containers in shaded, bunded areas	Use gloves, avoid spills near drains or soil	Collect and hand over to licensed recycling contractor
Paints and Solvents	Equipment painting, corrosion protection	Liquid	Flammable, causes respiratory irritation	Flameproof cabinets or ventilated rooms	Wear respirator, gloves; Do not inhale fumes	Dispose of through hazardous waste handler
Compressed Oxygen Gas	Welding and cutting operations	Gas (high pressure cylinder)	Supports combustion, explosion risk with flammable materials	Stored upright, chained, away from combustibles	Avoid oil contact; Use pressure regulators; Store separately from fuels	Return to supplier or authorized cylinder recycler
Acetylene	Used in gas welding	Gas (high pressure cylinder)	Highly flammable, explosive in air	Store upright in well-ventilated cylinder cages	No smoking nearby; Check for leaks before use	Return empty cylinders to supplier
Grease and Lubricants	Machine maintenance and bearing protection	Semi-solid	Fire risk, soil and water pollution	Closed containers in cool, dry, shaded area	Use tools, gloves; Avoid open flames	Used grease to be stored in waste drums and collected by approved vendor
Battery Acid (Sulfuric Acid)	Power supply backup and heavy equipment	Liquid	Highly corrosive, severe burns on contact	Leak-proof, acid-resistant cabinets with secondary containment	Face shield, gloves, chemical apron; Keep away from metals	Neutralize and dispose as per hazardous waste SOP

6. Safe Storage and Handling Guidelines

It is important to frame specific storage and handling practices for both explosives and hazardous substances used during the construction of the expressway. Proper implementation of following guidelines is critical for ensuring safety, minimizing risk, and complying with applicable laws and standards.

- **Explosives**
  - Explosives will be stored in licensed explosive magazines in accordance with the Explosives Rules, 2010.
  - The storage facility will be guarded 24/7 and located at a minimum distance of 500 meters from populated areas, public roads, water bodies, and other sensitive receptors.
  - The magazine will be fire-resistant, well-ventilated, and have non-sparking tools only.
  - Proper warning signs such as "DANGER - EXPLOSIVES", "NO SMOKING", and "RESTRICTED AREA" will be prominently displayed.
  - Only certified blasters and authorized personnel will handle or access explosive materials.
  - A register will be maintained to log all persons entering the storage area.
  - Blasting should be carried out only during daylight hours and under favorable weather conditions.
  - Advance notice will be given to local authorities, nearby residents, and workers.
  - Safety sirens and barricades will be deployed before and during blasting.
  - After blasting, a thorough inspection will be conducted to check for misfires.
  - Use non-electric initiation systems (e.g., shock tube or safety fuse) in areas prone to lightning, heavy rainfall, or static electricity to avoid unintentional detonation.
  - Explosives will be transported in dedicated vehicles with proper locking mechanisms and warning signage.
  - Transport will comply with Motor Vehicle Ordinance and Pakistan Explosives Transport Guidelines.
- **Hazardous Substances**
  - **All** hazardous **materials will be stored in containers that are clearly labeled with:**
    - **Chemical name**
    - Hazard classification (flammable, corrosive, toxic, etc.)
    - Pictograms and signal words in accordance with the Globally Harmonized System (GHS).
  - Incompatible materials (e.g., acids and bases, fuels and oxidizers) will be stored separately to avoid chemical reactions.
  - Flammable substances should be kept away from ignition sources and stored in flameproof cabinets.
  - All liquid chemicals will be stored with secondary containment systems (e.g., bund walls or trays) capable of holding 110% of the largest container's volume.

- Absorbent materials, spill kits, and neutralizing agents will be available near storage areas.
- Store chemicals in well-ventilated areas with protection from direct sunlight, heat, and moisture.
- Temperature-sensitive materials should be monitored and stored within specified ranges.

- **Fire Protection:**
  - Appropriate types of fire extinguishers (foam, CO_2, dry chemical) will be placed within 15 meters of storage areas.
  - Conduct regular fire drills and inspections to check readiness.
  - Personnel will wear appropriate PPE based on the material's hazard (e.g., gloves, goggles, respirators, aprons).
  - PPE will be readily accessible, inspected regularly, and used as per training.
  - Use mechanical aids or safety-approved pumps to transfer hazardous liquids — avoid manual pouring.
  - Ensure all drums and containers are properly grounded and bonded to prevent static discharge.
  - Unused or expired chemicals will never be poured into drains or thrown into open land.
  - Disposal will follow Material Safety Data Sheet (MSDS) instructions and be conducted by licensed hazardous waste handlers.

7. Risk Assessment and Control Measures

This section outlines potential hazard scenarios related to the handling of hazardous and explosive materials and the control measures required to minimize risk to workers, the community, and the environment.

- **Risk Scenarios**
  - Risk of diesel or petrol leaking from storage tanks or machinery, leading to fire outbreaks or contamination of groundwater or nearby water sources.
  - Bitumen, if disposed of on bare ground or into open land, will cause long-term soil pollution, harming vegetation and microbial life.
  - Unsafe handling, unsecured transport, or miscommunication during blasting will result in accidental explosions, posing danger to workers and nearby populations.
  - Vapors from paints, solvents, or acids can cause respiratory distress, headaches, or long-term illness. Direct skin contact will result in chemical burns or allergic reactions.

- **Control Measures**
  - Use heavy-duty blast mats during rock blasting to suppress flying debris and reduce shockwave effects.
  - Install fixed and portable gas detectors in fuel storage areas to provide early warning of vapors or leaks.
  - Prevent environmental contamination in case of chemical leaks or spills.

- Develop and enforce SOPs for fuel transfer, chemical mixing, blasting, and hazardous waste handling.
- Mandatory for high-risk activities such as hot work (welding, cutting), blasting, or confined space entry.
- Display Material Safety Data Sheets (MSDS) and safety signage near storage and work zones.
- Workers will use task-specific PPE including:
  - Flame-resistant suits for handling flammable substances or during hot work.
  - Gas masks or respirators for working around solvent vapors or dust.
  - Chemical-resistant gloves and safety goggles for direct contact tasks.
- Only trained and authorized personnel should be allowed inside hazardous material and explosive storage areas.
- "Danger – No Unauthorized Entry" signs to be installed at all entry points of high-risk zones.

8. Emergency Preparedness and Response (Expanded)

This section outlines the actions and resources required to respond effectively to emergencies such as fires, chemical spills, or explosions on-site.

- **Emergency Planning**
  - Develop tailored ERP documents for each site section (e.g., fuel depot, explosive magazine, chemical store).
  - Include evacuation routes, willer points, emergency contacts, and incident reporting flowcharts.
  - Establish formal contact and response protocols with:
    - Local hospitals for burn treatment and chemical exposure.
    - Fire brigades for fire suppression support.
    - Police and civil defense for evacuation and traffic control during major incidents.
- **Emergency Equipment**

  Equip work areas with:
  - First Aid Kits with supplies for burns, cuts, and trauma.
  - Chemical Burn Kits (including neutralizers and cold packs).
  - Eye Wash Stations near fuel and chemical handling areas.
  - Fire Extinguishers (foam, dry powder, CO_2) tested and accessible.
- **Training and Drills**
  - All site workers should undergo basic firefighting, CPR, and first aid training.
  - Specific teams should be designated as emergency response personnel.
  - Staff will be trained on how to safely respond to chemical spills, inhalation exposure, and skin contact scenarios.
  - Conduct emergency simulations (mock drills) every 2 months, including:

- Fire outbreak at a fuel station.
- Chemical spill or leak in a storage shed.
- Explosion or misfire during blasting operations.

- Drills should be evaluated, and corrective actions documented.

ROLES AND RESPONSIBILITIES OF DIFFERENT STAKEHOLDER

Role	Responsibilities
Project Proponent	Overall responsibility for compliance and resource allocation.
Consultant and Contractor	Execution of daily activities and supervision of hazardous material operations.
HSE Officer	Daily inspections, hazard identification, reporting, training facilitation.
Storekeeper	Safe labeling, storage, stock keeping, and reporting of hazardous materials.
Security Personnel	Prevent unauthorized access to hazardous material stores.
Local Authorities	Provide licenses, enforce regulations, and conduct external audits.

Annexure XI: Mechanism for supply of drinking water for workers

(This Mechanism is just indicative for the guidance of contractor. It will be responsibility of the contractor to prepare a site-specific mechanism for approval from the project consultant before start of construction activities)

1. Introduction

The provision of safe drinking water is a fundamental requirement at any construction site, particularly in large-scale infrastructure projects. Workers, including skilled and unskilled laborers, machine operators, engineers, and support staff, are exposed to intense physical activity under varying environmental conditions. The availability of clean drinking water plays a critical role in maintaining their health, strength, hydration, and ability to perform tasks efficiently.

In areas of rugged terrain and high altitudes, where access to water sources is already limited and topographically challenging, ensuring a reliable supply of potable water becomes even more crucial. Safe drinking water helps prevent the outbreak of waterborne diseases such as diarrhea, cholera, and typhoid, and contributes to the overall well-being and morale of the workforce. Moreover, water access is directly tied to workers' productivity and the overall pace and quality of construction progress.

The importance of clean drinking water is also reflected in global policy frameworks, particularly the United Nations Sustainable Development Goal (SDG) 6.1, which calls for universal and equitable access to safe and affordable drinking water by 2030. This plan is aligned with those goals as well as national and Gilgit-Baltistan regional environmental policies.

2. Contractor's Obligation

It is the responsibility of the contractor to ensure the continuous provision of safe, potable water to all workers engaged at the construction sites and labor camps. The obligations stems not only from humanitarian and occupational health perspectives, but also rooted in legal compliance frameworks. The Gilgit-Baltistan Environmental Protection Agency (GB-EPA), under the Environmental Protection Act, 2014, mandates that all construction and development activities provide safe and environmentally sustainable working conditions. The supply of safe drinking water forms a key component of this requirement. Furthermore, compliance with the Pakistan National Environmental Quality Standards (NEQS) for drinking water is essential. The contractor must take proactive steps to provide, test, and ensure the safety of drinking water from source to consumption point. Failure to do so may result in legal penalties, worker grievances, or project delays due to health-related absenteeism.

Proper planning, equipment procurement, and water monitoring are part of the contractor's environmental management responsibilities and should be documented as part of the project's Health, Safety, and Environment (HSE) management system.

3. Existing Water Quality in the Project Area

To evaluate the suitability of local water sources, samples were collected from eight different locations across Tangir and Darel Rivers, including river water and natural spring sources. The testing was conducted by the Gilgit-Baltistan Environmental Protection Agency Water Testing Laboratory, and results were benchmarked against the NEQS for Drinking Water **(Table-1)**.

Summary of Water Quality Observations

- The physical parameters including color, odor, and taste were all within acceptable standards, indicating no unpleasant characteristics.
- Turbidity levels were consistently below the maximum threshold of 5 NTU.
- The pH values were stable, ranging between 7.6 and 8.1, which falls well within the permissible range of 6.5 to 8.5.
- Total Dissolved Solids (TDS) values ranged from 10.9 ppm to 45.2 ppm, which are significantly below the NEQS maximum limit of 1000 ppm.
- Microbiological quality was excellent, with no E. coli contamination detected in any of the water samples, meeting the strict NEQS requirement of 0 CFU/100 ml.
- The chemical composition was well within permissible limits for most substances. Nitrate and nitrite levels were below danger thresholds. Nickel was slightly above the NEQS limit (≤ 0.02 mg/l) in some samples (0.1 mg/l), but given the overall context and location-specific geological factors, this is considered non-critical for short-term consumption by construction workers.

Table-1: Water Quality Comparison – Project Area vs. NEQS

Parameter	NEQS Standard	Observed Range in Samples	Compliance Status
Color	Acceptable	Colorless	Compliant
Odor	Acceptable	Odorless	Compliant
Taste	Acceptable	Tasteless	Compliant
pH	6.5 – 8.5	7.6 – 8.1	Compliant
TDS	< 1000 ppm	10.9 – 45.2 ppm	Compliant
Turbidity	< 5 NTU	< 5 NTU	Compliant
Temperature	No standard	4°C	Not Regulated
Electrical Conductivity	< 2000 µs	21.8 – 90.4 µs	Compliant
Nitrate	≤ 50 mg/l	0 – 33.5 mg/l	Compliant
Nitrite	≤ 3 mg/l	0 – 3 mg/l	Borderline Compliant (Monitor)
Nickel	≤ 0.02 mg/l	0 – 0.1 mg/l	Slight Exceed (Manageable Risk)
E. coli	0 CFU/100 ml	0 CFU/100 ml	Compliant

Given the findings, the natural water sources in the project area are considered suitable for drinking after basic preliminary treatment.

4. Proposed Water Supply Mechanism

Based on the usable quality of water available from rivers and springs in the project area, a preliminary treatment and safe distribution system is deemed sufficient to meet the drinking water requirements of the construction workforce.

Water Source Identification and Access

- The water will be sourced from the nearest spring-fed tributaries and high-altitude River segments where contamination risk is minimal and flow is consistent.
- Points of intake will be identified in consultation with local communities verified by the contractor from any reputable laboratory.
- Preference will be given to gravity-fed systems, reducing dependency on electrical pumps and minimizing operational costs.

Preliminary Treatment Infrastructure

- Intake structures equipped with mesh filters to prevent entry of large debris.
- Multi-stage gravel and sand filtration systems to eliminate suspended solids.
- Activated carbon filters may be added where there is evidence of organic contamination.
- Basic chlorination units will be employed at tank level to provide residual disinfection (target: 1–2 mg/L chlorine).
- Filtration units will be placed as close as possible to the labor camps to reduce risk of recontamination during transport.

Water Storage and Distribution

- High-density polyethylene (HDPE) storage tanks, ranging from 1000 to 2000 liters in capacity, will be installed at each working site and camp area.
- Tanks will be installed under shade or covered to avoid algae growth and microbial activity due to sunlight.
- Water will be distributed via non-corrosive tap stands with hand washing facilities nearby to promote hygiene.
- Camp kitchens will have additional water reservoirs with either boiling units or UV sterilization units for food preparation and sensitive use.

Quantity Provision

- Water demand will be calculated based on an average of 20–25 liters per worker per day, including drinking, cooking, and minor hygiene needs.
- For a workforce of 200, this equates to a minimum of 4,000 to 5,000 liters per day, requiring logistics planning for refill, transportation, or automated refilling from the source.

Health and Hygiene Awareness

- Workers will be provided with basic training on safe water handling, including hygiene practices such as:
- Using designated drinking containers.
- Not contaminating tap sources with used vessels.
- Reporting discoloration or unusual taste/odor.

5. Monitoring, Operation, and Maintenance

Regular monitoring will be carried out to ensure sustained water quality and operational functionality of the supply system.

Activity	Frequency	Responsibility
Visual inspection of filters	Weekly	Camp Utility Supervisor
Cleaning of tanks and pipelines	Bi-weekly	Labor Camp Maintenance Crew
Microbiological testing (E. coli)	Weekly	Contractor's Health and Safety Officer
Chemical parameter testing	Monthly	External Laboratory (Certified)
Chlorine residual level check	Weekly	HSE Officer / Store In-charge

Contingency arrangements including bottled water supply will be activated if test results show deviation from NEQS or in the event of system malfunction.

6. Institutional Responsibilities

To ensure effective implementation of this water supply plan, the following stakeholders will have defined roles:

Entity	Role and Responsibilities
Contractor	Installation of intake, treatment, and storage infrastructure; periodic monitoring; reporting
Construction Supervision Consultant	Verification of compliance with EIA and HSE standards; recordkeeping and reporting
Project Proponent (Executing Agency)	Budget approval, grievance redress, enforcement of obligations under contract

7. Conclusion

The natural water resources of the Tangir and Darel valleys present a reliable and high-quality source of drinking water for the construction workforce. Through the adoption of basic filtration, routine monitoring, proper storage, and compliance with regional environmental regulations, the constructor can meet its legal and ethical obligations while contributing to the health and efficiency of workers. This plan ensures that the provision of drinking water is environmentally sustainable, operationally feasible, and fully aligned with the NEQS, GB-EPA guidelines, and SDG 6.1 targets for safe and equitable water access.

Annexure XII: *Chance Find Procedures*

(This Chance Find Procedure is just indicative for the guidance of contractor. It will be responsibility of the contractor to prepare a site-specific procedure for approval from the project consultant before start of construction activities)

Chance finds procedures which will be used during this Project are as follows:

- Stop the construction activities in the area of the chance find;
- Delineate the discovered site or area;
- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be present until the responsible local authorities and the Ministry in charge of Department of Archaeology take over;
- Notify the supervisory Engineer who in turn will notify the responsible local authorities and the Ministry immediately (within 24 hours or less);
- Responsible local authorities and the Ministry in charge of Department of Archaeology would oversee protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists of the Department of Archaeology and Museums (within 72 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;
- Decisions on how to handle the finding shall be taken by the responsible authorities and the Ministry in charge of Department of Archaeology. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;
- Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the Ministry in charge of Department of Archaeology; and
- Construction work could resume only after permission is given from the responsible local authorities and the Ministry in charge of Department of Archaeology concerning safeguard of the heritage.

These procedures will be referred to as standard provisions in construction contracts, when applicable. During project supervision, the Site Engineer will monitor the above regulations relating to the treatment of any chance find encountered are observed.