RAVI URBAN DEVELOPMENT AUTHORITY
(RUDA), GOVERNMENT OF THE PUNJAB

TRUMPET/INTERCHANGE FOR CHAHARBAGH, RUDA

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

AUGUST, 2023

Volume 01 of 02

Client

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rumpet/Interchange for Chaharbagh, RUDA

Environmental Impact Assessment Report (EIA)

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AoI	Area of Influence
AQI	Air Quality Index
BOD	Biochemical Oxygen Demand
BRBD	Bambawali Ravi Bedian Depalpur canal
COD	Chemical Oxygen Demand
CoI	Corridor of Impact
DCRs	District Census Reports
DMCs	Developing Member Countries
EC	Environmental Committee
EIA	Environmental Impact Assessment
EE	Environmental Expert
EMP	Environmental Management Plan
EMMM	Environmental Mitigation and Management Matrix
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
ESEs	Environmental and Social Experts
GBV	Gender Based Violence
GoPb	Government of Punjab
HVAC	Heating, Ventilation, Air Conditioning
HSE	Health, Safety and Environment
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ILO	International Labour Organization
LAA	Land Acquisition Act
L-20	Loop 20 Ring Road
MBT	Main Boundary Thrust
MSL	Mean Sea Level
NCS	National Conservation Strategy
NEQS	National Environmental Quality Standards
NESPAK	National Engineering Services Pakistan
NDMA	National Disaster Management Authority
NOC	No Objection Certificate
NPZs	Noise Perimeter Zones
OHSAS	Occupation Health and Safety Assessment Series
OHS	Occupational Health and Safety
O&M	Operation and Maintenance
OIC	Organization of the Islamic Conference
PEPA	Pakistan Environmental Protection Act
PEQS	Punjab Environmental Quality Standards
PHA	Punjab Horticulture Authority
PPE	Personnel Protective Equipment
PGA	Peak Ground Acceleration
RE	Resident Engineer
RRUDP	River Ravi Urban Development Project
RUDA	Ravi Urban Development Authority

RoW	Right of Way
SC	Supervisory Consultant
SDGs	Sustainable Development Goals
SSEMP	Site Specific Environmental and Management Plan
STDs	Sexually-Transmitted Diseases
SOPs	Standard Operating Procedures
TC	Tehsil Council
UC	Union Council
UCC	Upper Chenab Canal
UNO	United Nations Organization
VOC	Vehicle Operating Cost
VPD	Vehicle Per Day
WASA	Water and Sanitation Agency

EXECUTIVE SUMMARY

ES-1 INTRODUCTION

Government of Punjab (GoPb) has planned Ravi River Front Urban Development on both banks of the river 46 KM long stretch that is contiguous to Lahore district's Northern and Western boundaries. An authority "Ravi Urban Development Authority (RUDA)" was established to meet the objectives of infrastructure development under River Ravi Urban Development Project (RRUDP). RUDA initiated the Chaharbagh Housing Scheme to provide location for regional-serving retail, office, taller buildings and residential uses that provide a vibrant mixed-use setting that fosters positive day and night time activity. The site is surrounded by residential areas on the Eastern side whereas Lahore Ring Road is located on the Western side.

A comprehensive road network has also been proposed for the accessibility of the projects under Ravi Urban Development Authority (RUDA). Therefore, to cater the future traffic influx from Chaharbagh, to counter occurrence of accidents and maintain congestion free corridor to minimize environmental pollution, an Interchange/Trumpet has been proposed on main Ring Road (L-20) to ease the traffic flow and provide the interconnectivity with the Ring Road. This document presents the findings of Environmental Impact Assessment (EIA) Study of Chaharbagh Interchange/Trumpet.

ES-2 REGULATORY AND POLICY REVIEW

The following major relevant strategies, policies, Acts and legislation, from environmental perspective, considered in the proposed project; Punjab Environmental Protection Act, 1997 (Amended, 2012 & 2017), Pakistan Environmental Protection Agency, Punjab Environmental Protection (Review of IEE and EIA) Regulations, 2022, Punjab Environmental Quality Standards (PEQS), 2016, Guidelines for the Preparation and Review of Environmental Reports, 1997, Guidelines for Environmental Assessment, Land Acquisition Act (LAA), 1894 Including Later Amendments, Punjab Environmental Protection (Motor Vehicles) Rules, 2013, The Punjab Occupational Safety And Health Act, 2019 and Building Code of Pakistan.

ES-3 DESCRIPTION OF PROJECT

The proposed Project falls in District Lahore of Punjab Province. The proposed project is located on main Ring Road (L-20) before Sharif Pura Alpha Toll Plaza near Lakhodair and Sharif Pura. Tentative cost of the proposed Project is about Rs. 3.162 Billion.

Salient features of the proposed Project are provided in Table ES-1 as follows:

Table ES-1: Design Details of the Proposed Project

Trumpet Road Inventory		
Trumpet/Interchange Width	62	ft
Total Legth	2293	ft

Lane Width	12	ft
No of Lanes	4	-
Main Carriageway width	48	ft
Center N.J Barrier	2.78	ft
Edge N.J Barrier	1.39	ft
Median	NJB	
Walkway	Nil	
Service Road	15	ft
Total Carriageway	200	ft
At Grade Widening/Improvement (Towards DHA Side)		
No. of Lanes (Two Lane Extension of Service Road	2	
Carriageway width	22	ft
At Grade Widening/Improvement (Towards Niazi Interchange Side)		
No. of Lanes (Relocation of Svc Road)	2	
Carriageway width	30	ft
Tentative Pavement Structure		
Asphaltic Wearing Course	2	in
Asphaltic Base Course	6	in
Water Bound Macadam	12	in
Sub base	12	in
CBR	8%	

ES-4 DESCRIPTION OF THE ENVIRONMENT

Considering the potential impacts of the proposed Project, existing baseline environmental conditions of the proposed project's Area of Influence (AoI) has to be used as a benchmark for comparison of the physical, ecological and socio-economic conditions before and after construction phases of the Project. This baseline will also provide the datum for assessing the impacts and suggesting the mitigation measures, which will be implemented effectively at various phases of the project activities.

Physical Environment:

The topography of the district Lahore is flat. The general height varies from 150 to 200 meters above the Mean Sea Level (MSL). The project area is located in the upper part of Punjab plain near to the River Ravi. The area is underlain by thick alluvial deposits consisting of clay, silts and sand deposited by the River Ravi.

According to Building code of Pakistan, 2007 issued by Government of Pakistan, the project area falls in Seismic Zone 2A of Pakistan (low to moderate damage), and Peak Ground Acceleration (PGA) from 0.08 to 0.16 g.

The Project area has moderate to extreme climate conditions, with hot summers and cold winters. The summer starts from April and lasts till September, with mean minimum and maximum temperature ranges from 27^{o}C to 47^{o}C. The winter seasons lasts from November to March, with mean minimum and mean maximum temperature ranges from 2^{o}C to 18^{o}C.

Water and Sanitation Agency (WASA) is the competent authority for the planning, designing, development and maintenance of water supply, sewerage and drainage system in the study area. The groundwater resources are in abundance. The drainage system of the District consists of natural drains. The main surface water resources in the Lahore city are Ravi River, Lahore Branch Canal, Khaira Distributary and the Bambawali Ravi Bedian Depalpur (BRBD) canal

The land use of the study area is mainly agriculture. There is no notified and major sensitive receptor identified within CoI.

Ecological Environment:

The tract, in which the project site exists, was once covered with native vegetation consisting, of trees like Kikar (Acacia) Karir (*Capparis deciduas*), Wan (*Salvadora oleoides*) and Jhand (Prosopiss picigera). With the onslaught of civilization, this vegetation was cleared for agricultural and commercial purposes. These trees are mostly of medium size with a girth between 2' to 4'. Some of the broad leaved trees exist in the area and these few species still survive the on-slaught of urbanization. House sparrow (*Passer domesticus*), House crow (*Corvuss plendens*) and Mynah (*Acredotheres tristis*) are the most common in the area. No endangered flora and fauna was found in the tract.

Socio-Economic Environment:

The project area falls in District Lahore. Total two (02) main settlements named lakhodair and Sharifpura fall near the Project Area. Based on the District Census Report, 2017, Lahore has a population of 11,126,285 while it was 6,318,745 as per 1998 census. Simple Random Sampling Technique was adopted and fifty-eight (58) respondents were interviewed on the basis of simple random sampling technique.

The household surveys, indicated that household size is 7.1 persons. Based on the social survey, the maximum population falls in the age group between 20 and 39 years and it is the group which is responsible for most of daily life routine activities. The major caste/ethnic groups are Gujjar, Jutt, Arian, Sheikh, Malik, Rehmani, Muslim Sheikh, Mochi, and Rajpoot. Educational distribution of the respondents shows that twelve (12%) of the respondents were illiterate. 17% were educated up to primary level. However, 25% and 17% were educated up to middle and matric level respectively. Moreover, 14% respondents were educated up to intermediate and 15% respondents described their education level up to graduation and above. The population of the settlements in AoI is predominantly Muslim followed by Christians. Educational facilities in Lahore are mainly being provided by the Government of Punjab, the city government. During the field visit, it was noted that few institutions (private sector) provide education at matric or secondary level.

ES-5 STAKEHOLDER CONSULTATION

A series of public consultations were conducted to get the feedback/concerns of the different category of stakeholders including provincial departments i.e., Environment Department, Forest, Agriculture, Wildlife Department, Punjab Horticulture Authority (PHA) etc.), potential PAPs, local community, Ring Road Authority and other general public residing in the Study Area. Consultation process included Focus Group Discussions, semi-structured interviews, one to one meeting and interviews with the government and private institutions. Basic concerns of the stakeholders were related to land acquisition, construction phase impacts and implementation of mitigation measures.

ES-6 ANTICIPATED PROJECT IMPACTS AND MITIGATION MEASURES

Significant efforts were made to identify the main environmental (physical, ecological, social, and cultural) issues related to the design, construction and operation of the proposed project. The significant adverse impacts and their mitigations during the design, construction and operation phases are here under:

- The land associated with the proposed Project is about 54 kanals.
- The noise and vibration will be produced due to the operation of construction machinery and equipment. Noise and vibration are perceived as one of the most undesirable consequences of construction activities. There are a variety of ways by which construction equipment and worksite noise can be controlled that includes use of Quieter Equipment, Modification of Existing Old Equipment, Barrier Protection, change in Work Activity Schedule and Maintenance of vehicle/equipment.
- Wastewater will be generated at the construction camps and from construction activities. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as water channels. The wastewater generation is estimated to be 3200 liters/day[1] for 100 construction workers; and sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit. Wastewater will be generated in the form of sewage from washrooms and other sources of the residential and commercial buildings of Chahar Bagh. Install a sewerage treatment plant (STP) will be installed to treat the waste water.
- A total of about 50 kg/day of solid waste will be generated from construction camps on daily basis. All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper Solid Waste Management System;
- Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles. Emissions from batching / asphalt plants can be controlled efficiently by the installation of cyclone / scrubbers. In addition to that, regular maintenance activities comprising changing of lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators;
- The project will involve clearing of vegetation cover on construction areas particularly along proposed road construction. It is initially examined that approximately 175 trees / saplings may be affected. A tree plantation program has been formulated with the

[1] Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/day)

recommendations of compensatory planting of 1750 trees against fallen trees of similar floral function at the available spaces in/around the project area;

- Due to the construction camps, number of impacts may arise temporary in nature that include waste, soil pollution, groundwater pollution, dust, etc. The construction activities and vehicular movement at construction sites may result in road side accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Institutions along the route may also suffer during construction period due to air, noise and road accidents. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Contractor will ensure the proper control on construction activities. Contractor will also take due care of the local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions.

ES-7 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The EMP of the proposed project mainly comprises institutional requirements; environmental mitigation and management; environmental monitoring plan; planning for EMP implementation; and EMP cost. RUDA through Supervision Consultants will be responsible for implementation of EMP of the proposed project during construction and operational phase. The total cost required to effectively implement the mitigation measures is approximately Rs. 17.9 Million, which includes cost of environmental monitoring, tree plantation and Health and Safety and environmental management, etc. during construction and operational phases. The EMP will be part of the contract document with the Contractor(s).

ES-8 CONCLUSION AND RECOMMENDATIONS

Results of the EIA Study have shown that the impacts of the project activities on the physical environment will be low to moderate significant. These impacts could be reduced by proper and judicious compensation to the affectees and well-planned meticulous design and by EMP, implementing an appropriate tree plantation Plan.

The EIA Study concludes that there are no critical environmental impacts associated with the project. An Environmental Management Plan (EMP) for all the phases (pre-construction, construction and operation) has been developed as part of the report that covers impacts, mitigation measures roles and responsibilities and timings to avoid, minimize or mitigate the adverse impacts of the project. The EMP, its mitigation and monitoring programs, contained herewith will be included within the Bidding documents for project works for all Project components.

1 INTRODUCTION

1.1 Project Background

The Government of the Punjab (GoPb) under its Ravi Urban Development Authority (RUDA) intends to develop urban areas of the province Punjab into sustainable, livable and well managed engines of economic growth. Urban development and its management are critically linked with sound, comprehensive and strategic metropolitan level long-term planning. Over the years, rapid urbanization has changed the socio-economic and physical characteristics of the cities. The physical growth of the cities has emerged in a very different way from the land uses proposed in master plans and other planning documents.

Lahore, the capital of the Punjab province is rapidly urbanizing being a regional urban center of key commercial, financial, industrial and socio-cultural significance. The population of Lahore in 2017 census is estimated at around 11 million. In view of City"s projected population and issues related to the water in the River Ravi, Government of Punjab (GoPb) has planned Ravi River Front Urban Development (RRUDP) on both banks of the river (46 KM long stretch) that is contiguous to Lahore District Northern and Western boundaries.

RUDA has initiated the Chaharbagh project to provide location for regional-serving retail, office, taller buildings and residential uses that provide a vibrant mixed-use setting that fosters positive day and night time activity. The site is surrounded by residential areas on the eastern side whereas Lahore Ring Road is located on the western side.

A comprehensive road network has also been proposed for the accessibility of the projects under Ravi Urban Development Authority (RUDA). Therefore, to cater the future traffic influx from Chahar Bagh, an Interchange/Trumpet has been proposed on main Ring Road (L-20) to ease the traffic flow and provide the interconnectivity with the Ring Road. As the capacity of existing roads of Lahore is getting insufficient day by day to accommodate the rapid growth in number of vehicles, it is becoming essential to improve existing road network in order to avoid traffic delays.

This document presents the findings of Environmental Impact Assessment (EIA) Study of Chahar Bagh Interchange/Trumpet.

1.2 Need for Environmental Assessment Study of the Proposed Project

As per Punjab Environmental Protection Act (Amendment) 2017, under Section 12 (1) IEE/EIA is mandatory which states that:

"No proponent of a project of public and private sector shall commence construction or operation unless he has filed an Initial Environmental Examination / Environmental Impact Assessment with the Punjab Environmental Protection Agency, as the case may be, or, where the project is likely to cause adverse environmental effects; an Environmental Impact Assessment, and has obtained from the Provincial Agency approval in respect thereof".

According to the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations 2022, the proposed project may fall under category D (Transport) of Schedule II, which requires EIA before commencement of construction.

1.3 Nature, Size and Location of the Project

The proposed Project involves the construction of an Interchange/Trumpet to provide interconnectivity with the Ring Road, Lahore for the Chaharbagh Society.

The proposed Project falls in District Lahore of Punjab Province. The proposed project is located on main Ring Road (L-20) before Sharif Pura Alpha Toll Plaza near Lakhodair and Sharif Pura. **Figure 1.2** shows the location map of the proposed project.

1.4 Accessibility

The proposed Project falls in District Lahore of Punjab Province. The proposed project can be accessible from main Ring Road (L-20) before Sharif Pura Alpha Toll Plaza near Lakhodair and Sharif Pura. **Figure 1.1** shows the accessibility map of the proposed project.

1.5 Scope of Study

The scope of this EIA Study aims at collection and scrutinization of data related to physical, biological and socio-economic environment of the project area and to prepare the baseline environmental profile. It also aims the identification, prediction and evaluation of the possible environmental impacts of the proposed project on its immediate surroundings on both short and long-term bases. Based on the nature and scale of those impacts, appropriate mitigation measures are proposed in this EIA Report.

1.6 Purpose of EIA Report

The purpose of this EIA Report is to identify and preliminary assessment of significant adverse environmental and social impacts and to suggest mitigation and remedial measures to make the proposed project environment friendly and sustainable during the construction and operational stages. Also, to propose institutional arrangement and to develop cost estimate to implement those mitigation measures.

1.7 The Proponent and Consultant

a) Proponent Contact/Address

Chief Executive Officer (CEO)
River Ravi Urban Development Project (RRUDP)
Ravi Urban Development Authority (RUDA)
Government of the Punjab
151 Abu Bakar Block, Garden Town facing Canal Road Lahore, Punjab
Tel: +92 42 99263541

b) Consultant Contact/Address

National Engineering Services Pakistan Private Limited (NESPAK)
GT&GE Division, NESPAK House
1-C, Block – N, Model Town Extension, Lahore.
Tel: 042-99090000 Ext. 233

1.8 EIA Team Composition

Based on the requirements of ToRs and objectives of the study, NESPAK formed a team of experts comprising Environmental Engineer, Environmental Scientists, Sociologist and Ecologist. The professional staff was involved in analyzing the data, impact assessment and mitigation measures and report compilation. Director Environment RUDA also accompanied the team. In addition, the EIA team worked in close coordination with the design team and several inputs were provided by the design specialists to the EIA team. Detail of EIA team is given in **Table 1.1** below:

Table 1-1: Team Composition for the EIA Study

Sr. No.	Name of Expert	Designation
1.	Mr. Jamshed Janjua	Project Manager
2.	Muhammad Shariq Ahmed	Head ERSD Section
3.	Mr. Saqib Rehman	Senior Environmental Scientist
4.	Mr. Muhammad Sajjad	Senior Sociologist
5.	Mr. Muhammad Farooq	Ecologist/Biodiversity Expert
6.	Mr. Musa Dar	Highway Design Expert

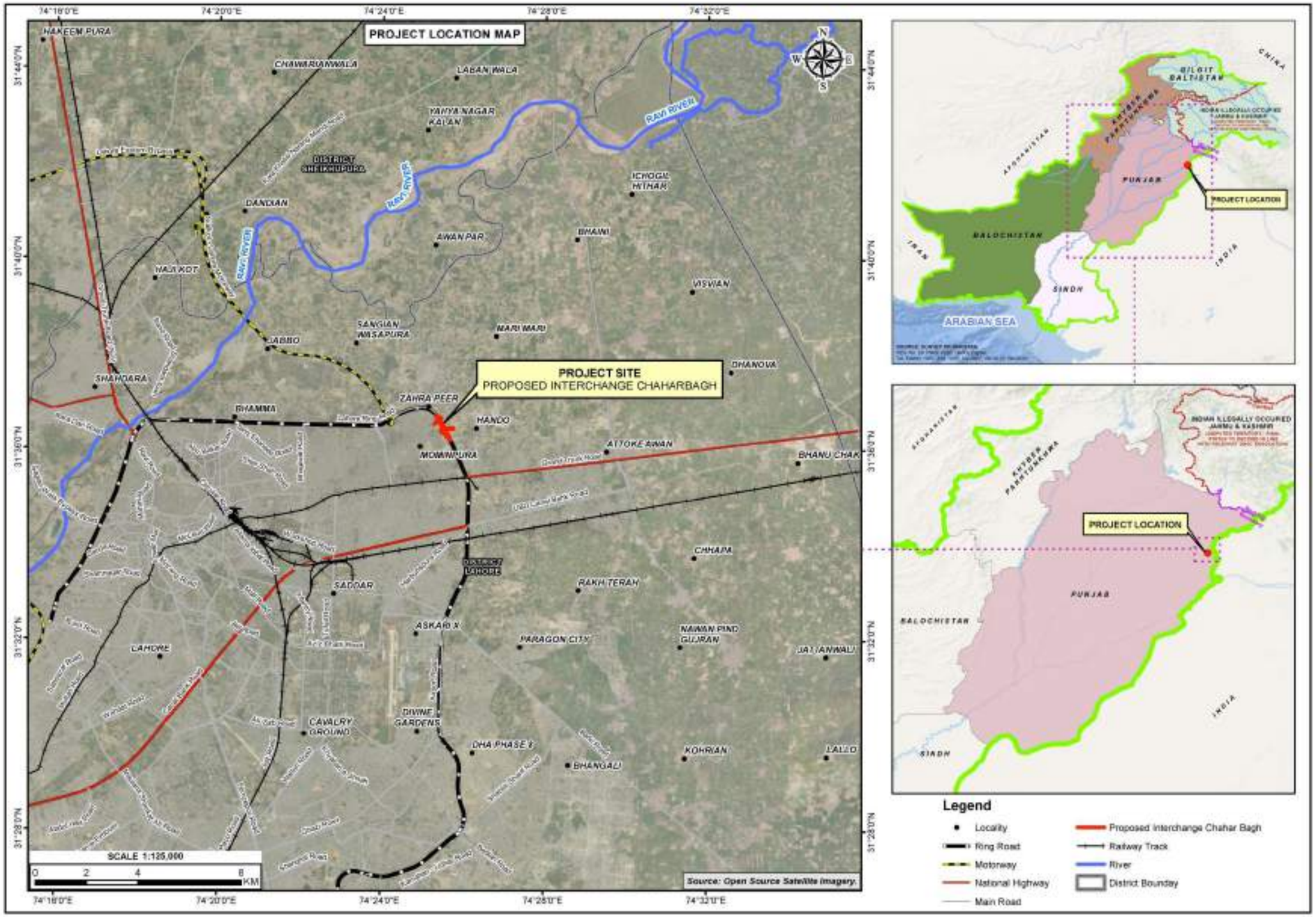


Figure 1-1: Accessibility Map of the Proposed Project

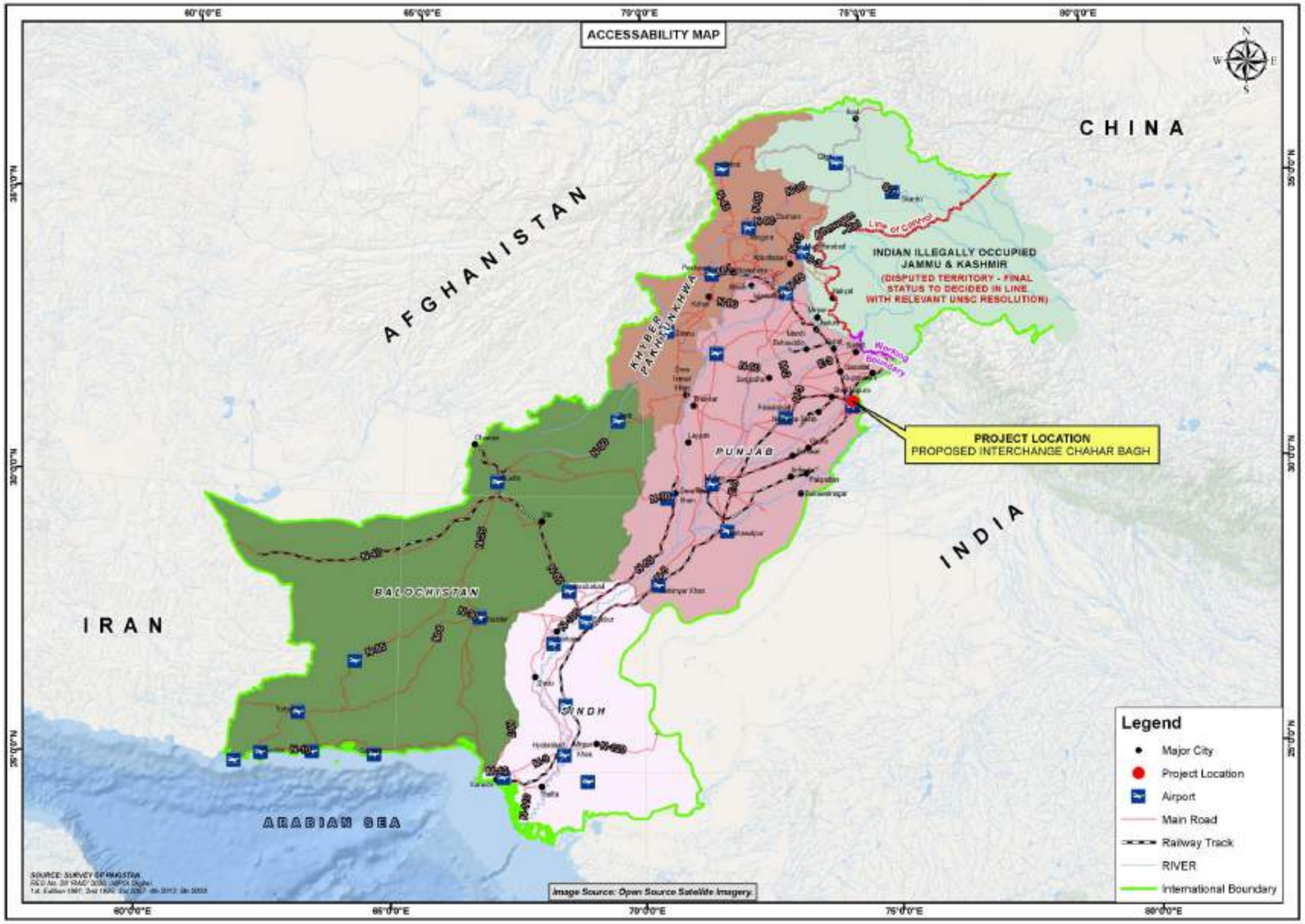


Figure 1-2: Location Map of the Proposed Project

1.9 Methodology

The following methodology was adopted for carrying out the EIA study of the proposed project:

1.9.1 Orientation

Meetings and discussions were held among the members of the EIA Consulting Team. This activity was aimed at achieving a common ground of understanding of various issues of the study. Subsequent to the concept clarification and understanding, a detailed data acquisition plan was developed for the internal use of the EIA consulting team. The plan identified specific data requirements and their sources; determined time schedules and responsibilities for their collection; and indicated the logistics and facilitation needs for the execution of the data acquisition plan.

1.9.2 Data Collection

In this step, primary and secondary data was gathered through field observations, concerned departments and published materials to establish baseline of physical, biological and socio-economic environmental conditions.

- Literature Review;
- Site Reconnaissance;
- Analysis of Maps and Plans;
- Public Consultations; and
- Environmental Sampling, Testing and Analysis.

1.9.3 Review of Environmental Laws and Institutional Requirements

All applicable national and international laws, legislations, guidelines and treaties were reviewed relevant to the proposed project components.

1.9.4 Delineation of Study Area

Study area includes the area in the surroundings of the proposed alignment receiving direct impacts of project activities. The study area delineated for the proposed project is 25 m each side from the outer boundary of the proposed project. Study area map is shown as **Figure 1.3.**

1.9.5 Survey of the Study Area

A team of Environmental Scientists, Ecologist and Sociologist carried out the environmental and social survey of the Study Area in January, 2023 to familiarize themselves with the local conditions and the environmental settings. During the survey, the information regarding the topography, soils, surface water, groundwater, flora & fauna, affected infrastructure, social settings and villages/towns along the RoW was observed.

1.9.6 Environmental Baseline Survey of the Project

Detailed environmental and social survey was carried out as mentioned above. For data collection, formal meetings were held and data collected through visual observations, interviews with the local residents and officials. In order to collect the relevant published information, government offices were also visited. Prior to the start of field activities, comprehensive checklists, proformas and maps were developed to collect the information related to the following parameters:

Physical Environment

The information acquired for the establishment of physical environment baseline included the following main parameters:

- Land resources (including landuse pattern, soil composition, contamination of soil and soil erosion etc.);
- Water resources (including available surface and groundwater resources and natural streams, hydrology, spring water, water supply, water contamination etc.);
- Climate data (including temperature, rainfall, humidity, wind speed and direction etc.);
- Ambient air quality and noise level monitoring data;
- Existing solid waste management and effluents disposal practices and storm water drainage;
- Buildings and infrastructure details, including residential, commercial and animal shed for complete/partial relocation;
- Religious, cultural and heritage information (mosques, shrines, graveyards);
- Archaeological monuments; and
- Other private/public infrastructures such as roads, telephone poles, hand pumps, tube wells etc.

Ecological Environment

The status of the flora and fauna of the study area were determined by a review of literature of the area, and an assessment of both terrestrial and aquatic environments.

a) Flora

The vegetative communities were identified and classified into community types. Identification was carried out of dominant tree species, assessment of stage of growth (mature or sapling), etc.

b) Fauna

Information on fauna was gathered from existing literature on reported species as well as observations in the field.

Socio-Cultural Environment

The consultants utilized a combination of literature, field investigations, census report, meetings through public consultation and interviews to describe the existing social environment and assessment of the potential impacts of the construction of the proposed project. Data was gathered on the following aspects of the social environment:

- Land use and Municipal Status;
- Demographics;
- Livelihoods;
- Community Facilities;
- Solid Waste Management;
- Proposed Developments;
- Archaeological and Cultural Heritage; and
- Identification and Evaluation of Environmental Impacts.

1.9.7 Stakeholder Consultations

The Consultant identified Project stakeholders and held meetings with them during the surveys to receive feedback on the expected environmental issues related to the Project impacts and suggested mitigation measures. Meetings were carried out with the Project affectees, relevant departments including Environment Department, Agriculture Department, Forest & Wildlife Department, Ring Road Authority etc. to discuss the issues/constraints and got their views and feedback to mitigate the potential environmental as well as social impacts associated with the implementation and operation of the Project.

1.9.8 Screening of Potential Environmental Impacts and Mitigation Measures

Based on the generally established baseline conditions in the adjacent as well as in the Project Area, potential physical, ecological and social impacts of the proposed Project were identified, evaluated and quantified, wherever possible. A logical and systematic approach was adopted for impact identification and assessment by utilizing a combination of the secondary data, satellite imagery, environmental checklists, socioeconomic survey proformas, field observations and discussion with the local residents of the Project Area. Adequate mitigation measures and implementation framework were proposed so that the proponent could incorporate them beforehand in the design phase.

1.9.9 Environmental Monitoring Program and Institutional Requirements

An Environmental Monitoring Program and Institutional Requirements has been prepared to ensure the adequacy and effectiveness of the suggested mitigation measures by clearly identifying the roles and responsibilities of the agencies, monitoring mechanism, monitoring plan for environmental and social parameters to be monitored with their frequency, existing and suggested framework, necessary approvals and the required further studies. Similarly, costs for environmental monitoring and social component/social mitigation measures were also estimated.

Figure 1-1: Study Area for the Proposed Project

1.10 Structure of the Report

Section **1 "Introduction"** briefly presents the project background, objectives, methodology and need of the EIA study.

Section **2 "Policy, Legal and Administrative Framework"** comprises policy guidelines, statutory obligations and roles of institutions concerning EIA study of the proposed Project.

Section **3 "Description of Project"** furnishes information about the studied alternatives, location of the proposed project, cost and size of the project, its major components and alternatives considered for the proposed project.

Section **4 "Environmental Baseline"** describes physical, biological and socio-economic conditions prevalent in the project area.

Section **5 "Public Consultation"** identifies the main stakeholders and their concerns raised through scoping sessions, and deals with the measures to mitigate the social impacts.

Section **6 "Anticipated Environmental Impacts and Mitigation Measures"** identifies and evaluates impacts of the project activities during the construction and operation stages and recommends with the measures proposed to mitigate potential environmental impacts of the road project.

Section **7 "Environmental Management Plan"** outlines environmental mitigation plan, institutional arrangements for the implementation of the proposed mitigation measures, monitoring requirements, monitoring cost etc.

Section **8 "Conclusions and Recommendations"** elaborates the conclusion of subject environmental study and suggests the recommendations to address the issues raised from proposed construction activities.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORKS

2.1 General

This section provides an overview of the policy framework and legislation that applies to control the environmental consequences as a result of proposed project implementation and operation. The project needs to comply with all the applicable environmental policies, laws, guidelines, acts and legislations of Government of Pakistan and Provincial Government.

2.2 Summary of Relevant Strategies, Policies, Acts and Legislation

The summary of major relevant strategies, policies, acts and legislation from environmental perspective are briefly described in Tables 2.1 & 2.2 below:

Table 2-1: Main Strategies/Policies Related to Environment and their Relevance to the Project

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
1	National Conservation Strategy, 1992	Pakistan National Conservation Strategy (NCS), which was approved by the federal cabinet in March 1992, is the principal policy document on environmental issues in the Country. The NCS outlines the Country's primary approach towards encouraging sustainable development, conserving natural resources and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment.	The core areas that are relevant in the context of the proposed project are pollution prevention during construction, conserving biodiversity and supporting forestry and plantation.
2	National Environmental Policy, 2005	In March 2005, GoP launched its National Environmental Policy, which provides a framework for addressing the environmental issues. Section 5 of the policy commits for integration of environment into development planning as instrument for achieving the objectives of National Environmental Policy. It also provides broad guidelines to the Federal Government, Provincial Governments, Federally Administered Territories and	Clause (b) of sub-section 5.1 states that Environmental Assessment related provisions in Environmental Protection Act, 1997, will be diligently enforced for all developmental projects.

		Local Governments to address their environmental concerns and to ensure effective management of their environmental resources.	
3	National Climate Change Policy, 2012	The National Climate Change Policy provides a framework for addressing the issues that Pakistan faces or will face in future due to the changing climate. In view of Pakistan's high vulnerability to the adverse impacts of climate change, in particular extreme events, adaptation effort is the focus of this policy document. The vulnerabilities of various sectors to climate change have been highlighted and appropriate adaptation measures spelled out. The policy covers measures to address issues in various sectors such as water, agriculture, forestry, coastal areas, biodiversity and other vulnerable ecosystems. Notwithstanding the fact that Pakistan's contribution to global Greenhouse Gas (GHG) emissions is very small, its role as a responsible member of the global community in combating climate change has been highlighted by giving due importance to mitigation efforts in sectors such as energy, forestry, agriculture and livestock. Furthermore, appropriate measures relating to disaster preparedness, capacity building, institutional strengthening; technology transfer; introduction of the climate change issue in higher education curricula; ensuring environmental compliance through Initial IEE and EIA in the development process; addressing the issue of deforestation and illegal trade in timber; promoting Clean Development Mechanisms (CDM); and raising Pakistan's stance regarding climate change at various international forums, have also been incorporated as important components of the policy.	This policy document is a 'living' document and will be reviewed and updated regularly to address emerging concepts and issues in the ever-evolving science of climate change. This policy will accelerate due to the emissions from the construction machinery and equipment.

		The policy thus provides a comprehensive framework for the development of Action Plans for national efforts on adaptation and mitigation.	
4	National Drinking Water Policy, 2009	The National Drinking Water Policy provides a framework for addressing the key issues and challenges facing Pakistan in the provision of safe drinking water to the people. Drinking water is the constitutional responsibility of the provincial governments and the specific provision function has been devolved to specially created agencies in cities and Town and Tehsil Municipal Administrations under the Local Government Ordinance 2001.	This policy is applicable for the proposed project during construction phase in terms of regular water quality monitoring.
5	National Water Policy, 2018	The National Water Policy aims at efficient management and conservation of existing water resources, optimal development of potential water resources, steps to minimize time and cost overruns in completion of water sector projects, improving urban water management by increasing system efficiency and reducing non-revenue water through adequate investments to address drinking water demand, sewage disposal, handling of wastewater and industrial effluents; equitable water distribution in various areas and canal commands, measures to reverse rapidly declining groundwater levels in low-recharge areas, increased groundwater exploitation in high-recharge areas, effective drainage interventions to maximize crop production, improved flood control and protective measures, steps to ensure acceptable and safe quality of water, minimization of salt build-up and other environmental hazards in irrigated areas, institutional reforms to make the managing organizations more dynamic and responsive.	The core areas that are relevant in the context of the proposed project are drinking water demand, sewage disposal, handling of wastewater.

6	National Forest Policy, 2015	The goal of this policy is to expansion, protection and sustainable use of national forests, protected areas, natural habitats and watersheds for restoring ecological functions, improving livelihoods and human health in line with the national priorities and international agreements. In line with the Federal functions of national policy, planning and implementation of international agreements, specific objectives of the National Forest Policy include: a) Promoting ecological, social and cultural functions of forests through sustainable management and use of forest produce including wood and non-wood forest products; b) Implementing a national level mass afforestation programme to expand and maintain optimum forest cover; c) Maximizing forest areas by investing in available communal lands/ shamlat, and Guzara forests and urban forestry; d) Enhancing role and contribution of forests in reducing carbon emissions and enhancing forest carbon pools; e) Facilitating implementation of international conventions and agreements related to Forestry, Wetlands, Biodiversity and Climate Change; and f) Promoting standardized and harmonized scientific forest planning, research and education including for community-based management.	The proposed Project dose not involves any national forests, protected areas, natural habitats and watersheds, so this policy is not applicable.
7	Pakistan Labour Policy, 2010	The main objective of the Labour Policy, 2010 is the social and economic well-being of the labour of Pakistan. The Labour Policy, 2010 has following 4 parts: • Legal Framework; • Advocacy: rights of workers and employers; • Skill development and employment; and • Manpower export.	The labour force will be employed for construction of the proposed Project. The provision of policy will apply to all the employed labourers.
8	National	In March, 2002 Pakistan Environmental	This policy will be triggered if

	Resettlement Policy, 2002	Protection Agency (Pak-EPA), GOP has issued its National Resettlement Policy, which explains the basis for compensation, rehabilitation and relocation of the affectees. It also explains the requirements and implementation of Resettlement Action Plan (RAP).	resettlement issues will arise for the construction of proposed road alignment.
9	National Disaster Risk Reduction Policy, 2013	NDMA, being the lead focal agency for disaster preparedness and management, has therefore, embarked upon formulation of a comprehensive National Disaster Risk Reduction Policy through wider consultations with all stakeholders including all provinces, state of AJ&K and regions. This policy covers disasters risk reduction in a more holistic way and introduces a proactive and anticipatory approach by laying special emphasis on risk assessment and prevention.	This policy will be elicit if any unforeseen natural and man-made disaster occurs during construction and operation phase.
10	National Action Plan for COVID-19 Pakistan	Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at https://www.nih.org.pk/wp-content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf. The Government of Pakistan has launched the real-time data portal for COVID-19 http://covid.gov.pk/. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf.	This Action Plan for COVID-19 is applicable to the proposed project as it is being launched during this pandemic. building. Besides this COVID-19 daily situation report is also available at https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf

Table 2-2: Main Legislation/Acts Related to Environment and their Relevance to the Project

Sr. No.	Act	Brief Coverage	Relevance to Project

Sr. No.	Act	Brief Coverage	Relevance to Project
1	Punjab Environmental Protection Act, 1997 (Amended, 2012 & 2017)	The Punjab Environmental Protection Act, 1997 (Amended, 2012 & 2017) is comprehensive legislation and provides the legislative framework for protection, conservation, rehabilitation and improvement of the environment. The 'environment' has been defined in the Act as: (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the interrelationships between any of the factors specified in sub-clauses 'a' to 'f'. The notable points of the law are: • No proponent of a project shall commence construction or operation unless he has filed an IEE/EIA with the Provincial Agency designated by the Provincial EPAs an EIA, and has obtained an approval; • Establishment and formation of the Punjab Environmental Protection Council(PEPC); • Prohibition of certain discharges or emissions; • Punjab Environmental Quality Standards (PEQS) for wastewater, air emissions and noise; and • Provincial Government can issue notices and enforce them to protect the environment. In the recent amendment of 2012, legislatives powers related to environment and ecology are given to provincial governments from the Federal government. The provinces are required to enact their own legislation for environmental protection. Other amendments include increasing the penalties for violations.	The provision of the Act is applicable to proposed Project for conducting an EIA according to Section 12 and to obtain environmental approval from the EPA. The Section 11 of the Act is applicable in terms of compliance with Punjab Environmental Quality Standards (PEQS). Similarly, Section 13 of the Act prohibits the import of hazardous waste. The provisions of Section 16 are also applicable to comply with the discharge or emission of any effluent, waste, air pollutant or noise or disposal of waste or handling of hazardous substance. Under Section 17, penalties will apply if anyone fails to comply with the provisions of Section 11, 12, 13 and 16.

Sr. No.	Act	Brief Coverage	Relevance to Project
		For the proposed Project, Environmental Protection Department (EPD)/Environmental Protection Agency (EPA), Government of Punjab (GoPb) is the concerned authority. The capability of regulatory institutions for environmental management is ultimately responsible for the success of environmental assessments and that development projects are environmentally sound and sustainable.	
2	Punjab Environmental Protection (Review of IEE and EIA) Regulations, 2022	These regulations set out: • Key policy and procedural requirements for filing an EIA; • The purpose of environmental assessment; • The goals of sustainable development; • The requirement that environmental assessment be integrated with feasibility studies; • The jurisdiction of the Federal and Provincial EPA's and Planning & Development (P&D) Departments; • The responsibilities of proponents; • Duties of responsible authorities; • Provides schedules of proposals that the project requires either IEE or an EIA; • The environmental screening process of the projects under schedule I, II and III; and • The procedure for the environmental approval for filing the case with the concerned EPA for the granting of the NOC.	The provisions of these regulations are applicable for environmental screening of the project. The process described in the regulations will be useful for RUDA to follow the procedure to file an EIA with Punjab EPA and to understand its review process along with timelines to be followed.
3	Punjab Environmental Quality Standards (PEQS), 2016	PEQS promulgated recently in 2016. Specified standards under PEQS are for: • Drinking Water; • Ambient Air; • Noise; • Industrial Gaseous Emissions; • Municipal and Liquid Industrial Effluents; • Motor vehicle exhaust and noise; and • Treatment of Liquid and Bio-Medical Waste.	All projects to be implemented in Punjab must conform to PEQS during all the phases i.e., construction and operation.

Sr. No.	Act	Brief Coverage	Relevance to Project
1.	Guidelines for the Preparation and Review of Environmental Reports, 1997	These guidelines describe the format and content of IEE/EIA reports to be submitted to PEPA for obtaining NOC/approval. The guidelines present: • The environmental assessment report format; • Assessing impacts; • Mitigation and impact management and preparing an environmental management plan; • Reporting; • Review and decision making; • Monitoring and auditing; and • Project Management.	The guidelines are applicable for the preparation of the EIA.
2.	Guidelines for Environmental Assessment	Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development Projects. The guidelines that are relevant to the proposed Project are listed below. • Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997; • Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May, 1997; and • Sectoral Guidelines: Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997.	The guidelines are applicable for the preparation of the EIA.
3.	Ravi Urban Development Authority Act 2020	The Ravi Urban Development Authority Act 2020 (the "Act 2020") was promulgated to establish Ravi Urban Development Authority (the "Authority") for carrying out the purposes of the Act ibid. The Act 2020 focuses on the administrative, procedural and operational activities of the Authority with certain prohibitions attached to its functions. The preamble of the Act 2020 is exhaustive in nature pointing out the entire actions in public interest for the purpose of comprehensive system of planning and development in the area specified in Master Plan of the Project so as	This Act is directly related to the establishment of proposed Access Road as it falls under jurisdiction of RUDA.

Sr. No.	Act	Brief Coverage	Relevance to Project
		to improve the quality of life as per legislative objectives and further to establish an integrated modern and regional development approach and a continuing process of planning and development to achieve the highest environmental standards, quality of life and modern standard facilities so as to make a healthy and prosperous community in the designated area duly determined by the Government to rehabilitate water aquifer and the dying Ravi River into fresh perennial water body with a state-of-the-art water front and urban development on reclaimed and adjoining lands. The objectives of the Act 2020 are to provide quality life along with developed infrastructure and modern standard facilities.	
4.	Pakistan Climate Change Act, 2017	This Act aims to meet obligations under international conventions relating to climate change and to provide for adoption of comprehensive adaptation and mitigation policies, plans, programmes, projects and other measures required to address the effects of climate change and for matters connected herewith and ancillary thereto.	This Act will accelerate due to the emissions from the construction machinery.
5.	National Clean Air Act, 2000	The Act aims to control vehicular emissions, pollution from industry, and indoor air pollution in rural and urban areas.	This Act will trigger if vehicles and machinery used for construction activities emanate air pollutants above the permissible limit.
6.	Punjab Parks and Horticulture Authority Act, 2012	This act entails regulation, development, and maintenance of public parks, green belts and green areas in the Punjab; regulation of billboards, sky signs and outdoor advertisements; to promote open and unrestricted views of the Punjab.	This Act will trigger if any green belts along the proposed project route will be affected during construction phase.
7.	Punjab Wildlife Act, 1974	The Punjab Wildlife Act (1974) is developed for the regulation of activities relating to protection, conservation and management of wildlife in Punjab.	The proposed project involves the cutting of trees which may result in loss of habitat, therefore, the provisions of this law are applicable.

Sr. No.	Act	Brief Coverage	Relevance to Project
8.	Punjab Plantation and Maintenance of Trees Act, 1974	The Punjab Plantation and Maintenance of Trees Act, (1974) regulates tree plantations and enforces measures for their protection.	The requirements of this Act are applicable in terms of planting new trees and their maintenance by the occupier of the existing land who would have the physical possession.
9.	Pakistan Antiquities Act 1975 & Punjab Antiquities Amendment Act 2012	The Punjab Antiquities Amendment Act, 2012 is adopted from the Pakistan Antiquities Act of 1975 with a few minor changes. The Antiquities Act, 1975 (amended in 1990) states the following: • "Ancient" is any object that is at least 75 years old; • All accidental discoveries of artefacts must be reported to the Federal Department of Archaeology; • The Government is the owner of all buried antiquities discovered on any site, whether protected or otherwise; • All new construction within a distance of 200 feet from protected antiquities is forbidden; • No changes or repairs can be made to a protected monument, even if it is owned privately, without approval of the responsible authorities; and • The cultural heritage laws of Pakistan are uniformly applicable to all categories of sites regardless of their state of preservation and classification as monuments of national or world heritage.	The law will be applicable to the project mainly due to its two provisions: ▪ According to the law, any construction activity within 61 m or 200 ft. of protected antiquities, are prohibited. The provisions of this Act would also be applicable, if any accidental archaeological discoveries may occur during the excavation works for the construction of proposed Project.
10.	The Punjab Special Premises (Preservation), Ordinance, 1985	The Punjab Special Premises (Preservation), Ordinance (1985) provides the legal framework for preservation of premises of historical, cultural, archaeological, and architectural value in the Punjab province. This legislation empowers the provincial government to notify heritage sites and sites of cultural and archaeological importance and to prohibit implementation of developmental schemes or new constructions within the notified areas around the special premises. So far 246 sites stand notified under the Punjab Ordinance.	The provision of the ordinance is applicable for protection and conservation of special premises declared by department of Youth Affairs, Sports, Archeology & Tourism, Punjab. The ordinance is applicable in terms of land acquisition, entrance, exploitation and destruction of special premises near site.

Sr. No.	Act	Brief Coverage	Relevance to Project
11.	Pakistan Penal Code, 1860	The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents.	The provisions of the Penal Code, 1860 are applicable to the project in terms of penalties for effecting human lives and public property. It also addresses the control of noise, air emissions and effluent disposal.
12.	Labour Laws as part of Constitution of Pakistan 1973,	The Constitution of Pakistan contains a range of provisions with regards to labour rights, in particular: • Article 11 of the Constitution prohibits all forms of slavery, forced labour and child labour; • Article 17 provides a fundamental right to exercise the freedom of association and the right to form unions; • Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and • Article 37(e) makes provision for securing just and human conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment. Labour law is controlled at both provincial and national levels with compulsory employment agreements containing the terms set out by the labour laws.The labour laws are a comprehensive set of laws in Pakistan dealing with the following aspects: • Contract of Employment; • Termination of Contract; • Working Time and Rest Time; • Working hours; • Paid Leave; • Maternity Leave and Maternity Protection; • Other Leave Entitlements; • Minimum Age and Protection of Young Workers; • Equality • Pay Issues; • Workers' Representation in the Enterprise;	The labour laws will be relevant as it would deal with employment of labour for the construction of propose project. Following are the major labour laws which are applicable to the project: • Bonded Labour System (Abolition) Act, 1992 • Employment of Child Act, 1991 • Minimum Wages Ordinance, 1961 • Industrial Relations Act, 2010 • West Pakistan Minimum Wages for Unskilled Workers' Ordinance, 1969

Sr. No.	Act	Brief Coverage	Relevance to Project
		• Trade Union and Employers Association Regulation; and • Other Laws.	
13.	Punjab Municipal Water Act, 2014	The basic aim of the Act is to recognize, regulate and manage present and future municipal water supply and sanitation services and to establish rights of access to basic water supply and basic sanitation, and to ensure conservation of water resources in the Province. This Act is in draft stage.	This Act will elicit if there is misappropriation of water supply during construction activities.
14.	Hazardous Substance Rules, 2003	The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. Inter alia, general safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are described in these rules. Requirements for project waste management plans are also defined.	This rule is applicable to the proposed project due to involvement of hazardous waste handling, use and disposal during the construction stage.
15.	Punjab Environmental Protection (Motor Vehicles) Rules, 2013	Subject to the provisions of this act, and the rules and regulations, no person shall operate a motor vehicle from which air pollutants and noise are being emitted in an amount, concentration or level which is in excess of the Punjab Environmental Quality Standards, or where applicable the standards established under clause (g) of subsection (1) of section 6 of the act.	This Act will be elicited during construction and operational phase due to use of motor vehicles that produces air pollutants and noise.
16.	ISO 18001 Occupation Health and Safety Assessment Series (OHSAS)	OHSAS 18001 is an Occupation Health and Safety Assessment Series for health and safety management systems to help organizations to control occupational health and safety risks. The OHSAS specifications are applicable to any institute that desires to establish an OH&S management system to eradicate or reduce risk to employees and other interested parties who may be exposed to the risks allied with the project activities. The construction of the proposed project may involve various health and safety issues to construction labour, therefore these ISO 18001 guidelines will be applicable and pertinent.	This series will be elicit during construction and operational phase to ensure health and safety of workers associated with the project activities.

Sr. No.	Act	Brief Coverage	Relevance to Project
17.	The Punjab Occupational Safety and Health Act, 2019	This Act entails provision of occupational safety and health of the workers at workplace and to protect them against risks arising out of the occupational hazards; to promote safe and healthy working environment catering to the physiological and psychological needs of the employees at workplace.	The Act will trigger during construction and operational phase to ensure health and safety of workers at workplace associated with the project activities.
18.	Punjab Restriction on Employment of Children Act, 2016	According to the sub-section 11(a) of this Act, an occupier who employs or permits a child (person under the age of 15 years) to work in an establishment shall be liable to punishment with imprisonment for a term which may extend to six months, but which shall not be less than seven days, and a mandatory fine between 10,000 and 50,000 rupees.	This Act will trigger if contract hire skilled and unskilled labour under age 15.
19.	Punjab Protection of Women against Violence Act, 2016	The act is administered by federal government which provides guidelines for the provision of disaster management plans, offer necessary technical assistance to the Provincial Governments and Provincial Authorities as well for preparing their disaster management plans in case of any mishap.	This Act is valid to the subject project in case of any unseen situation.
20.	Electricity Act, 1910	The Act provides a legal basis for distribution of Power. It enables a licensee to conduct operations for supply of electricity and binds the license to payment of compensation in respect of any damages caused during the construction, Operation and Maintenance (O&M) of Power distribution facilities.	This Act will be applicable if any damages occur during construction of the power facilities.
21.	Cutting of Trees (Prohibition) Act, 1975	The Act was enforced in 1975 to place restrictions on cutting of trees in order to restrain unchecked trend of tree felling without replacement plantations.	This Act will be applicable to the subject project where the cutting of tree will be involved.
22.	Punjab Forest Act (Amended), 2010	The act empowers the provincial forest departments to declare any forest area as reserved or protected. It empowers the provincial forest departments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce, quarrying and felling, lopping and topping of trees,	The proposed project is urban in nature and no protected forest is situated in the Project area.

Sr. No.	Act	Brief Coverage	Relevance to Project
		branches in reserved and protected forests.	
23.	The Punjab Protected Areas Act, 2020	The Act provides provisions for the protection, preservation, conservation and management of ecologically important areas such as National parks, Nature reserves, Wildlife sanctuaries, Wilderness areas, Buffer zone, Wetlands, etc.	This Act will not be triggered as there is no protected area in and around the study area.
24.	The Punjab Heritage Foundation Act, 2005	This act entails preservation, conservation, maintenance and rehabilitation of the Punjab Heritage through various means, including technical or financial assistance and to create awareness among the people for preservation of the Punjab Heritage.	This Act will not be triggered as no heritage sites are present in and around the proposed project route.
25.	The Punjab Emergency Services Act, 2006	It deals with the establishment of emergency service for a purpose of maintaining a state of preparedness to deal with emergencies, to provide timely response, rescue and emergency medical treatment to the affected persons and recommending measures to be taken by related organizations to avoid any emergency situation.	This Act is applicable to the proposed project to provide timely response, rescue and emergency medical treatment to the affected persons during construction and operation phase of project.
26.	National Disaster Management Act, 2010	National Disaster Management Act, 2010 was passed by Parliament of Pakistan in 2010. The Act applies to whole Pakistan. The Act was passed in backdrop of 2010 Floods in Pakistan and strengthens Disaster Management system.	This Act is applicable to the proposed project. The proposed project will require special consideration to disasters and risk management strategies as per the Act.
27.	Building Code of Pakistan, Seismic Provisions 2007	This code stipulates the minimum requirements for seismic safety of building and structures and the provisions of the Building Code of Pakistan (Seismic Provisions-2007) shall apply for engineering design of buildings, like structures and related components. Construction of buildings shall be considered as violation of professional engineering work specified under clause (XXV) of section 2 of the Act.	This Code is applicable to the proposed project as it includes the formation of structures.

2.3 International Protocol / Conventions

As Pakistan is member of a number of international organizations such as United Nations Organization (UNO), Organization of the Islamic Conference (OIC), South Asian Association for Regional Cooperation (SAARC), Economic Cooperation Organization (ECO) etc., so it has to follow the international protocols and obligations related to the environment. The major protocols, ratification dates by Pakistan and obligations related to the proposed project are provided in the Table 2.3 below:

Table 2-3: International Agreements/Conventions Relevant to the Project

Sr. No	Agreement/Convention	Ratification	Description/Relevance
1.	UNESCO Convention on the Protection of the World's Cultural and Natural Heritage, 1972 Web Link: http://whc.unesco.org/en/%20convention%20text/	Pakistan ratified this convention on 23 July 1976.	Convention concerning the Protection of the World Cultural and Natural Heritage - requires parties to adopt a general policy on the protection of the natural and cultural heritage, to set up services for such protection, to develop scientific and technical studies, to take appropriate legal, technical, scientific and administrative measures and to foster training and education for such protection.
2.	The Rio Declaration, 1992 Web Link: http://www.unesco.org/education/pdf/RIO_E.PDF	Pakistan signed the treaty on 13 Jun, 1992 and ratified on 1 June, 1994	The Rio Declaration comprises 27 principles which address important issues such as; sustainable development to integrate environmental protection into the development process; common but differentiated responsibilities to conserve, protect and restore the earth's ecosystems; public participation and information access at the national level, reduce and eliminate unsustainable patterns of production and consumption.
3.	Kyoto Protocol, 1992 Web Link: https://unfccc.int/kyoto_protocol	Pakistan has ratified Kyoto Protocol in 2005	The Kyoto Protocol is a protocol to reduce Greenhouse gasses that cause climate change. It was agreed on 11th December, 1997 at the 3rd Conference of the countries to the treaty when they met in Kyoto, and entered into force on 16th February, 2005. As of November 2007, 175 countries have ratified the protocol. One hundred and thirty-seven (137) developing countries have ratified the protocol, including Brazil, China, India and Pakistan but have no obligation beyond

Sr. No	Agreement/Convention	Ratification	Description/Relevance
			monitoring and reporting emissions.
4.	Convention on Biological Diversity, 1994 Web Link: https://www.cbd.int/	Pakistan signed this treaty in 1992 and it was ratified by cabinet in 1994.	The Convention on the Biological Diversity (CBD) has three main goals: Conservation of biological diversity (or biodiversity); sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources.
5.	Stockholm Convention on Persistent Organic Pollutants (POPs), 2004 Web Link: https://www.un.org/press/en/2004/unep204.doc.htm	The Stockholm Convention on Persistent Organic Pollutants (POPs) was signed on 22 May 2001 and entered in to force on 17 May, 2004. Pakistan signed the convention on December 6, 2001	Convention seeks to protect human health and the environment from POPs as set out in Article-1, which are chemicals that remain intact in the environment for long periods, become widely distributed geographically and accumulate in the fatty tissues of humans and wildlife.
6.	Paris Agreement, 2015	The Paris Agreement's central goal is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below two degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to one and half degrees Celsius. Additionally, the agreement aims to increase the ability of countries to deal with the impacts of climate change, and at making finance flows consistent with a low GHG emissions and climate-resilient pathway.	The implementation of the proposed project will reduce the emission of Greenhouse Gases (GHGs) due to the construction of the proposed project.
7.	Sustainable Development Goals (SDGs)	At the Sustainable Development Summit on 25th September 2015, UN Member States adopted	The SDGs that will prevail for the proposed project are as follows: • Promote Gender Equality and

Sr. No	Agreement/Convention	Ratification	Description/Relevance
		the 2030 Agenda for Sustainable Development, which includes a set of 17 Sustainable Development Goals (SDGs) to end poverty, fight inequality and injustice, and tackle climate change by 2030. Pakistan has displayed commendable commitment to the 2030 Agenda for Sustainable Development as it was one of the first countries to endorse it globally in 2015. On 16th February 2016, the Parliament unanimously approved the Sustainable Development Goals (SDGs) as the national development agenda.	Empower Women: The contractor during construction phase will be responsible to hire women for construction activities to elude gender discrimination and to promote women empowerment, a procedure will be devised. • Combat HIV/AIDS Malaria and Other Diseases: Contractor will be responsible to conduct medical surveillance of the workers before hiring to combat HIV/AIDS, Malaria, COVID and other diseases. • Ensure Environmental Sustainability: Contractor will be responsible to ensure environmental sustainability of the proposed Project Areas by ensuring implementation of EMP to mitigate adverse environmental impacts from construction activities during construction phase.

2.4 ADMINISTRATIVE FRAMEWORK

2.4.1 RUDA

The Implementing Agency (IA) of the proposed Project is RUDA. The management of RUDA will ensure that all the proposed mitigation measures are effectively implemented at the design, construction, and operational stages of the proposed Project.

2.4.2 EPA, Punjab

Pakistan Environmental Protection Agency is meant for the enforcement of environmental laws in Pakistan. They have delegated powers to provincial environmental protection agencies for review, approval and monitoring of environmental examination/assessment projects. As the proposed Project also falls in Lahore District of Punjab Province, therefore, Punjab-EPA will be responsible for reviewing the report, issuing environmental approval and overall/broad based monitoring of the proposed project activities.

3 DESCRIPTION OF THE PROJECT

This section describes the rationale and objectives of the project. The project components and its details are discussed as under:

3.1 OBJECTIVES OF THE PROPOSED PROJECT

The objective of the proposed project is to help in reducing future traffic jams/congestion at the main ring road due to the development of Chaharbagh. This will result in saving time and fuel. The development will also reduce Vehicle Operating Cost (VOC) and reduce vehicular emissions and noise in the project area. It will also help reduce conflicts and accidents on road due to traffic congestion and blocks.

3.2 Project Implementation Schedule

The total duration for the completion of the project is approximately 12 months.

3.3 Cost of the Project

The total cost of the proposed project is estimated to be Rs. 3.162 Billion.

3.4 Components of the Project

The proposed project involves construction of Trumpet on main Ring Road (L-20).

3.5 Geometric Design of the Proposed Project

The Geometric Design of the project is governed by prevalent standard codes for highways design. The Geometric design parameters are given Table 3.1.

Table 3-1: Design Details of the Proposed Project

Trumpet Road Inventory		
Trumpet/Interchange Width	62	ft
Total Legth	2293	ft
Lane Width	12	ft
No of Lanes	4	-
Main Carriageway width	48	ft
Center N.J Barrier	2.78	ft
Edge N.J Barrier	1.39	ft
Median	NJB	
Walkway	Nil	
Service Road	15	ft
Total Carriageway	200	ft
At Grade Widening/Improvement		

(Towards DHA Side)		
No of Lanes (Two Lane Extension of Svc Road	2	
Carriageway width	22	ft
At Grade Widening/Improvement (Towards Niazi Interchange Side)		
No of Lanes (Relocation of Svc Road)	2	
Carriageway width	30	ft
Tentative Pavement Structure		
Asphaltic Wearing Course	2	in
Asphaltic Base Course	6	in
Water Bound Macadam	12	in
Sub base	12	in
CBR	8%	

Figure 3.1 shows the Layout plan showing the land required for the proposed project which is approximately 54 kanals.

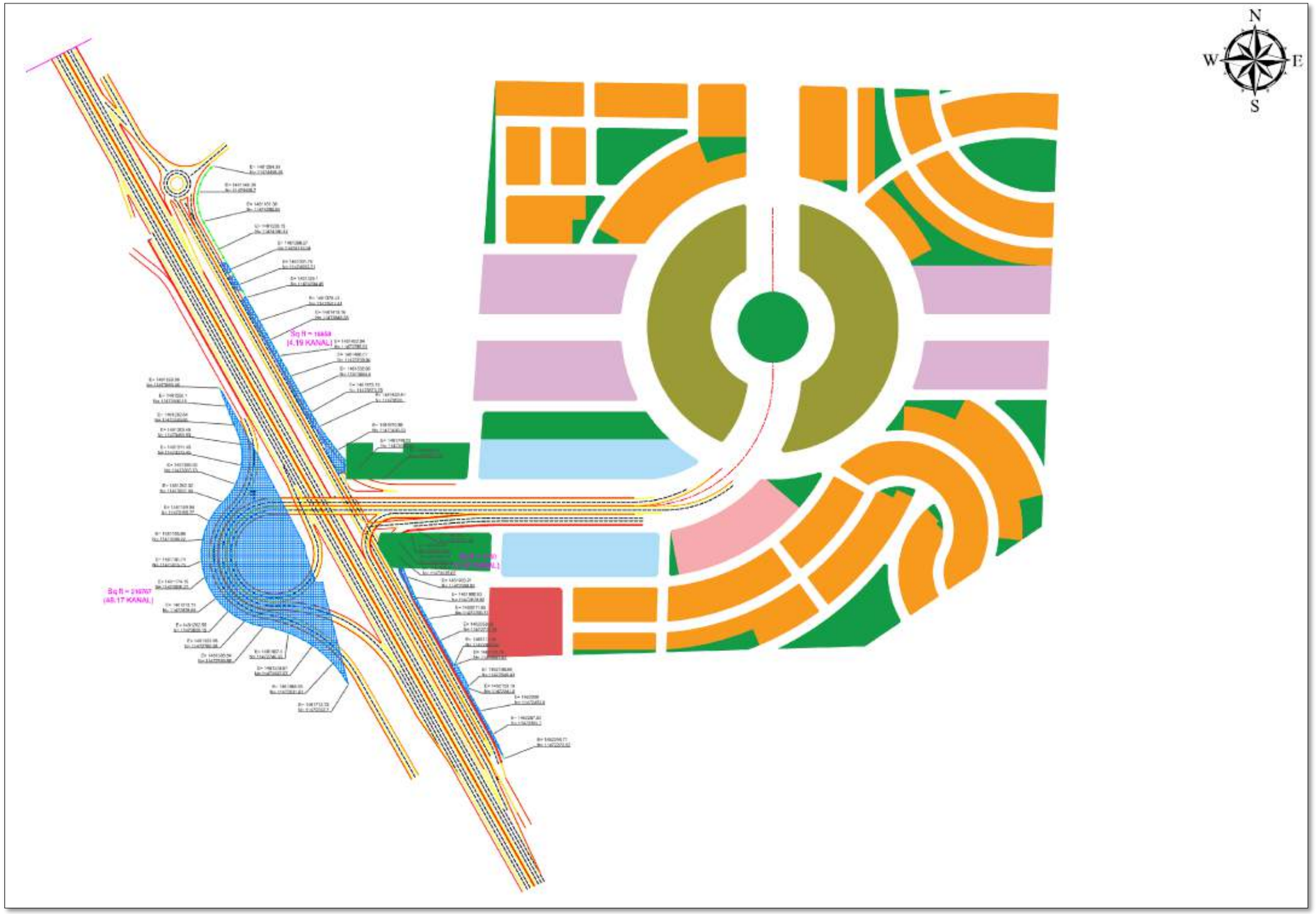


Figure 3-1: Layout plan showing the Land Requirements

3.6 Construction Materials

Construction materials are chosen in consideration of adaptability, feasibility and ease of maintenance. Construction material specifying the requirements of technical specifications will be used preferably which is as follows:

- Crush : Margalla
- Sand : Qibla Bandi/Lawrencepur
- Steel : Industrial Area near Lahore
- Cement : Bestway, Askari, FECTO, Cherat, etc.

3.7 Construction Equipment

The list of the machinery and the equipment required for the proposed project is provided in **Table 3.2**.

Table 3-2: Machinery and Equipment Requirement for the Proposed Project

Sr. No.	Type of Machinery and Equipment	Sr. No.	Type of Machinery and Equipment
1	Dump Truck	12	Self-Propelled Pneumatic Roller
2	Front End Loader	13	Asphalt Distributor
3	Dozer	14	Batching Plant
4	Grader	15	Concrete Transit Truck
5	Vibratory Roller	16	Concrete Pump
6	Water Tankers	17	Excavator
7	Agg. Spreader	18	Water Pumps
8	Three Wheel Rollers	19	Cranes
9	Tandem Roller	20	Vibrators
10	Asphalt Plant	21	Generators
11	Paver		

3.8 Construction Camps

Construction camps for the construction of proposed Project components will be located within the premises of proposed Project.

However, if construction camp is to be located outside the project boundary, following criteria shall be adopted by the Contractor to identify and for the establishment of the construction camp sites before start of the construction:

- There should be no or minimum resettlement issues for the location of the camps;

- Camp site should be away from the residential areas and sensitive receptors;
- Selection of sites for construction camps shall be near the project area having proper access to the nearby main/link road;
- The camps must be located in a place where the drainage from and through the camps will not threaten any domestic or public water supply;
- Camp site must be adequate in size to prevent overcrowding of necessary structures;
- The camp site should consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems;
- The camp site must not be subject to periodic flooding; and
- There should not be any ecological sensitive areas e.g. wildlife sanctuaries, game reserves, national parks, forest areas, etc. near to the construction camp site.

3.9 Workforce Requirements

Manpower demand estimation is an essential component to facilitate deployment of manpower. Tentative workforce required for proposed Project during construction phase will be about 100 workers/employees. Unskilled labor should be hired locally.

3.10 Source of Water

Contractor will be responsible to arrange water for construction works. However, it is supposed that water bowsers will be used by the contractor on the site for construction activities. The source of water during the operation phase for the proposed Project will be the tube wells installed inside the project boundary.

3.11 Water Requirement

The source of water during the construction phase will be from water bowser tanks and groundwater (if available) from local sources will be used. The water consumption is estimated to be 4,000 liters /day[2] for 100 construction workers labor (approx.) for the proposed Project.

3.12 Wastewater Generation and Treatment Mechanism

The wastewater generation is estimated to be 3,200 liters/day for 100 labor (approx.) for the proposed Project.

2. Tentative Work Force Requirements Including Client and Contractor Staff"
   = (100) x (40) = 4,000 liters/day
   = (100) x (80% of wastewater) =3,200 liters/day

3.13 Solid Waste

Due to construction activities, waste will be generated at construction site and contractor's camp. The contractor will provide the estimated quantity of excavation material during the construction phase. These wastes will be generated due to the construction activities and up to the extent possible the excavated materials will be reused, where applicable, for construction purposes. Solid waste generated during construction and camp sites shall be safely disposed at demarcated waste disposal sites.

The solid waste generation is estimated to be 50 kg/day (as per 0.5 kg/capita/day waste generation)[3] for 100 construction workers for the proposed Project.

3.14 Power Requirement / Power Source

The main source of electricity/electric power during construction phase will be diesel generators for construction camps. While the source of power for operation phase will be Lahore Electric Supply Company (LESCO). Approximately 35kW will be required for construction phase and 15Kw will be required during the operational phase of the project.

3.15 Traffic Projections

Traffic forecasts have been made for 26 years (2022-2047) period of the subject project by the design team.

The above tables clearly show the substantial increase in the traffic volume. The proposed project will not only allow free flow of traffic towards Chaharbagh, but also evenly dispersed vehicular traffic and better transport efficiency such that the air and noise pollution will be reduced. Similarly, the vehicle operating cost per kilometer will also get reduced. It is anticipated that less traffic noise impact will occur on the sensitive receivers which are mainly due to the excessive honking of heavy traffic during the traffic congestions. The project will also save time of the passengers due to improved operating speeds.

Table 3-3 indicates the projected Vehicle Per Day (VPD) near Bhaini Interchange to Dera Gujran (Main Road) and **Table 3-4** indicates the projected VPD on main road from Dera Gujran to Bhaini Interchange.

3. Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day

Table 3-3: Traffic Projections from Bhaini Interchange To Dera Gujran(Main Road)

Years	Number of Years (n)	VEHICLES													
											TRUCKS				
		Motor Cycle	Rickshaw	Car /Jeep	Pajero Suzuki Puckup	Hiace Wagon	Mini Bus	Bus	Loader pick-ups	TRACTOR TROLLY	2-AXLE	3-AXLE	4-AXLE	TRAILER / 5-AXLE &Above	Total Traffic
Vehicle Percentage distribution															
2022	1	0	0	6079	682	320	78	54	267	8	548	454	28	70	8588
2023	2	0	0	6346	712	334	81	56	279	8	565	469	29	73	8952
2024	3	0	0	6614	742	349	83	58	291	8	583	484	29	75	9316
2025	4	0	0	6881	772	363	86	60	303	8	601	499	30	77	9681
2026	5	0	0	7148	802	378	89	62	315	9	619	514	31	80	10046
2027	6	0	0	7415	832	392	91	64	327	9	638	529	32	82	10411
2028	7	0	0	7682	862	407	94	65	339	9	656	544	33	84	10777
2029	8	0	0	7949	892	422	97	67	352	9	674	560	34	87	11143
2030	9	0	0	8216	922	437	99	69	364	10	693	575	35	89	11510
2031	10	0	0	8483	952	453	102	71	377	10	712	590	36	92	11877
2032	11	0	0	8750	981	468	105	73	390	10	731	606	37	94	12244
2033	12	0	0	9016	1011	483	107	75	403	10	750	622	38	96	12612
2034	13	0	0	9283	1041	499	110	77	416	11	769	638	39	99	12981
2035	14	0	0	9550	1071	515	113	78	429	11	788	653	40	101	13349
2036	15	0	0	9817	1101	531	115	80	442	11	807	670	41	104	13719
2037	16	0	0	10084	1131	547	118	82	456	11	826	686	42	106	14089
2038	17	0	0	10350	1161	563	121	84	469	12	846	702	43	109	14459
2039	18	0	0	10617	1191	579	123	86	483	12	866	718	44	111	14830

2040	19	0	0	10884	1221	595	126	88	496	12	885	735	45	114	15201
2041	20	0	0	11150	1251	612	129	89	510	13	905	751	46	117	15572
2042	21	0	0	11417	1281	629	131	91	524	13	925	768	47	119	15945
2043	22	0	0	11684	1311	645	134	93	538	13	946	784	48	122	16317
2044	23	0	0	11950	1341	662	137	95	552	13	966	801	49	124	16690
2045	24	0	0	12217	1370	680	139	97	566	14	986	818	50	127	17064
2046	25	0	0	12484	1400	697	142	99	581	14	1007	835	51	130	17438
2047	26	0	0	12750	1430	714	144	100	595	14	1027	852	52	132	17813

Table 3-4: Traffic Projections from Dera Gujran(Main Road) to Bhaini Interchange

VEHICLES															
Years	Number of Years (n)										TRUCKS				Total Traffic
		Motor Cycle	Rickshaw	Car/ Jeep	Pajero Suzuki Puckup	Hiace Wagon	Mini Bus	Bus	Loader pick-ups	Tractor Trolly	2-AXLE	3-AXLE	4-AXLE	TRAILER / 5-AXLE &Above	
Vehicle Percentage distribution															
2022	1	0	0	7248	1258	863	535	388	501	519	530	547	451	426	13266
2023	2	0	0	7642	1327	910	564	409	528	547	559	576	476	449	13988
2024	3	0	0	8037	1395	957	593	430	555	576	588	606	501	472	14710
2025	4	0	0	8430	1463	1004	623	451	583	604	617	636	525	495	15430
2026	5	0	0	8824	1532	1050	652	472	610	632	646	666	550	518	16150
2027	6	0	0	9217	1600	1097	681	493	637	660	675	695	574	541	16870
2028	7	0	0	9609	1668	1144	710	514	664	688	703	725	599	564	17588
2029	8	0	0	10002	1736	1191	739	535	691	716	732	754	623	587	18307

2030	9	0	0	10394	1804	1237	768	556	718	744	761	784	647	611	19024
2031	10	0	0	10786	1872	1284	797	577	746	772	789	814	672	634	19742
2032	11	0	0	11178	1940	1331	825	598	773	800	818	843	696	657	20459
2033	12	0	0	11569	2008	1377	854	619	800	829	847	873	721	680	21176
2034	13	0	0	11961	2076	1424	883	640	827	857	875	902	745	703	21892
2035	14	0	0	12352	2144	1471	912	661	854	885	904	932	769	726	22608
2036	15	0	0	12743	2212	1517	941	682	881	913	933	961	794	749	23324
2037	16	0	0	13134	2280	1564	970	702	908	941	961	991	818	771	24040
2038	17	0	0	13525	2348	1610	999	723	935	969	990	1020	842	794	24755
2039	18	0	0	13916	2416	1657	1028	744	962	997	1019	1050	867	817	25471
2040	19	0	0	14306	2483	1703	1057	765	989	1025	1047	1079	891	840	26186
2041	20	0	0	14697	2551	1750	1085	786	1016	1053	1076	1109	915	863	26901
2042	21	0	0	15088	2619	1796	1114	807	1043	1081	1104	1138	940	886	27616
2043	22	0	0	15478	2687	1843	1143	828	1070	1108	1133	1167	964	909	28330
2044	23	0	0	15869	2755	1889	1172	849	1097	1136	1161	1197	988	932	29045
2045	24	0	0	16259	2822	1936	1201	870	1124	1164	1190	1226	1013	955	29760
2046	25	0	0	16649	2890	1982	1230	890	1151	1192	1219	1256	1037	978	30474
2047	26	0	0	17039	2958	2029	1258	911	1178	1220	1247	1285	1061	1001	31188

4 ENVIRONMENTAL BASELINE

4.1 GENERAL

For any development project, the prevailing environmental conditions need to be assessed prior to the stages of planning, designing and execution of the project. Identification of physical, ecological and social aspects of environment and collection of relevant data is essentially important for the evaluation of impacts as well as for the suggestion of adequate mitigation measures, which forms the basis for the implementation of the proposed project in terms of prevailing environmental and social conditions in the study area.

The existing environmental conditions of the proposed project have been considered within the AOI as shown in **Figure 1.2** with respect to physical, biological and socio-economic aspects. The Study Area is selected on the basis of the Project's potential environmental and social impacts on the local resources. Information has been collected from variety of sources, including published literature, DCRs, field observations and surveys, conducted specifically for this Project have been analyzed for this study. Consultations were also held with the general public and stakeholders of the project area in order to seek the public opinion on the implementation of the proposed Project. Survey tool used for public consultation for baseline data collection during field visit is attached as **Annex-I**.

4.2 PHYSICAL RESOURCES

The following section provides an overview of the information on physical environment of the proposed Project study area collected from primary as well as secondary sources. The major parameters covered include Physiographic and Topography, Geology, Soil, Seismicity, Climate and Meteorology, Ambient Air & Noise, Water Resources, Solid Waste, and Land Use.

4.2.1 Topography

Lahore is generally flat and slopes towards south and south-west at an average gradient of 1:3000. The general height varies from 150 to 200 meters above the mean sea level (MSL). It is divided into two parts i.e. the low-lying area along River Ravi and the comparatively upland area in the east, away from Ravi. The low lands are generally inundated by the river water during intense rainfall events.

The project site is located within an alluvial plain, naturally flat and level having no hills and valleys. **Figure 4.1** represents the topography of the study area of the proposed Project.

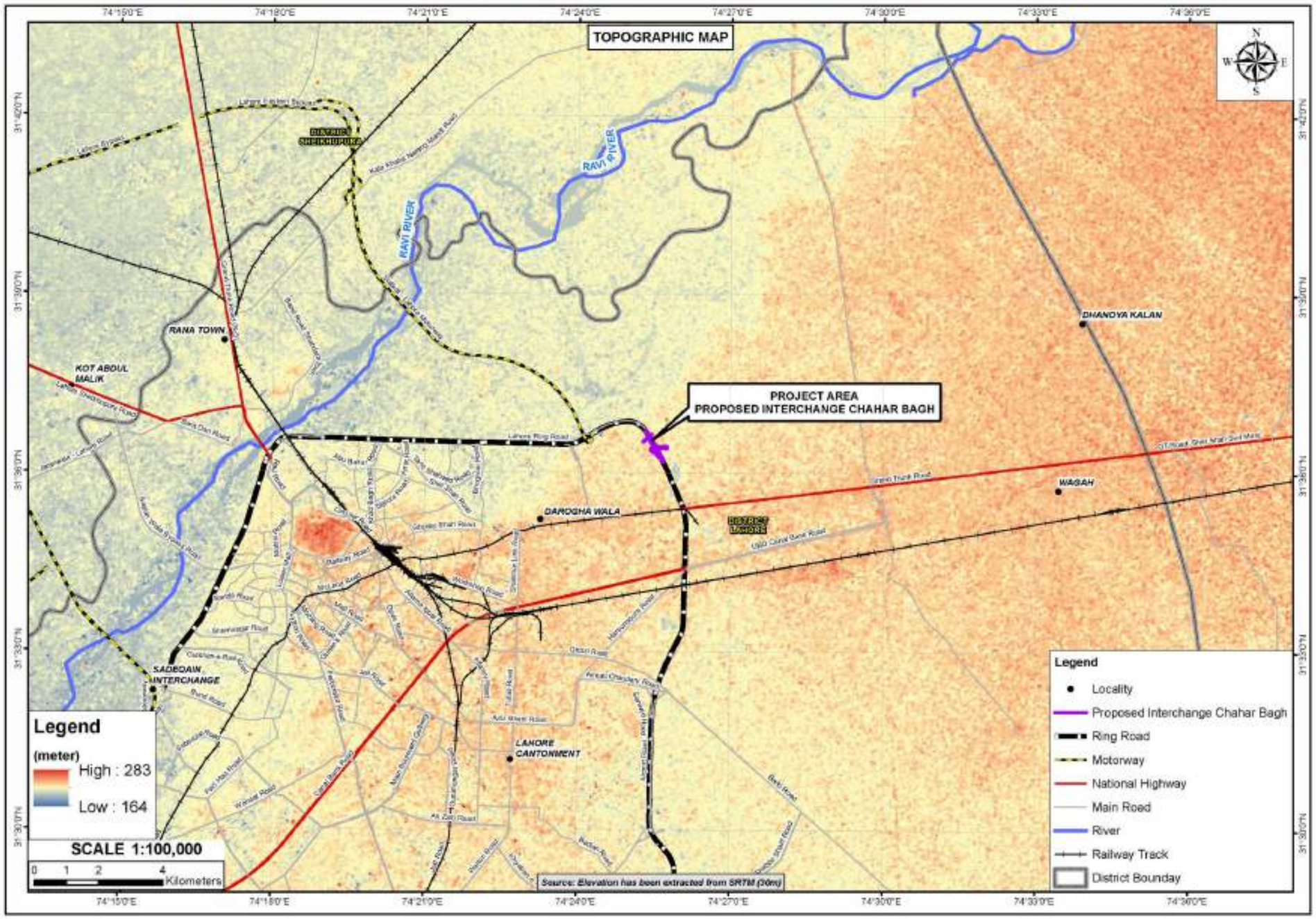


Figure 4.1: Topography Map of the Study Area

4.2.2 Geology

Lahore city lies on the alluvial plain called Bari Doab. Doab is a local word for area between two rivers. Bari Doab is a part of the Indo-Gangatic alluvial plain formed by the Indus River and its tributaries. It is bounded by Ravi and Chenab rivers in the northwest and west, and Sutlej River in the Southeast. A northeastern boundary of Doab lies near the foothills of the Himalayan Ranges. The Bari Doab is covered by quaternary alluvium which overlies semi-consolidated tertiary rocks or metamorphic and igneous rocks of Precambrian age. Except for a small area in the northeastern art of Doab where basement rock was encountered no information is available at present regarding the distribution of tertiary and Precambrian rocks in the Doab.[4]

The thickness of alluvial deposits in Lahore is reported to be more than 300 meter. The alluvial subsoil's are of late Pleistocene and were formed by the flood plains of river Ravi. These consist of clay, silt and sand. The thickness of clay increases with distance from the river bed.[4] **Figure 4.2** shows the regional geological map of the study area.

The only minerals worth to value are kallar and kankar in the district Lahore. Kallar is the grey powdery substance collected and taken out from the old village sites and other deserted abodes in the district. It is used for the manufacture of crude saltpeter and also as manure for the top dressing of young cotton and tobacco plants (no longer in the line of extensive cultivation). With the passage of time the demand for Kallar diminished and its use as a trading commodity is on the decline. Kankar is used for metaling Roads and its smaller particulars are burnt for lime. It is a kind of limestone gravel and is found, after being dug out at a depth varying from one to eight feet, in many parts of the district particularly the uplands.

The project area does not have any valuable minerals. Although, scientific in depth, investigations haven't been carried out, yet the surveys conducted have failed to discover any minerals worth the name till to-date.

4.2.3 Soil

The soil in the project area is cohesion less and is of alluvial type deposited by Ravi River. The types of soil layers that are present below the ground level includes: silt, silty clay, silty sand, poorly graded sand with silt and lean clay. The soil map of the study area is shown in **Figure 4.3.**

4.2.4 Seismology

The project site falls in the Punjab plain, which has low to moderate level of seismicity. The project region has been subjected to severe shaking in the past due to earthquakes in the Himalayas. The known main active fault of the Himalayas is the Main Boundary Thrust (MBT). The epicenters of low to moderate magnitude earthquakes, recorded in the Punjab

[4] Kadwai, S.U. and Siraj, A. (1964), "The Geology of Bari Doab, West Pakistan", WAPDA Water and Soil Investigation Division (Bulletin No. 8)

plain are associated with the subsurface fractures in the basement rocks, which are concealed by thick alluvial deposits.

According to Building code of Pakistan 2007, the project area falls in Seismic Zone 2A of Pakistan (low to moderate damage) with peak ground acceleration (PGA) from 0.08 to 0.16 g. **Figure 4.4** shows the seismic zoning map of the study area.

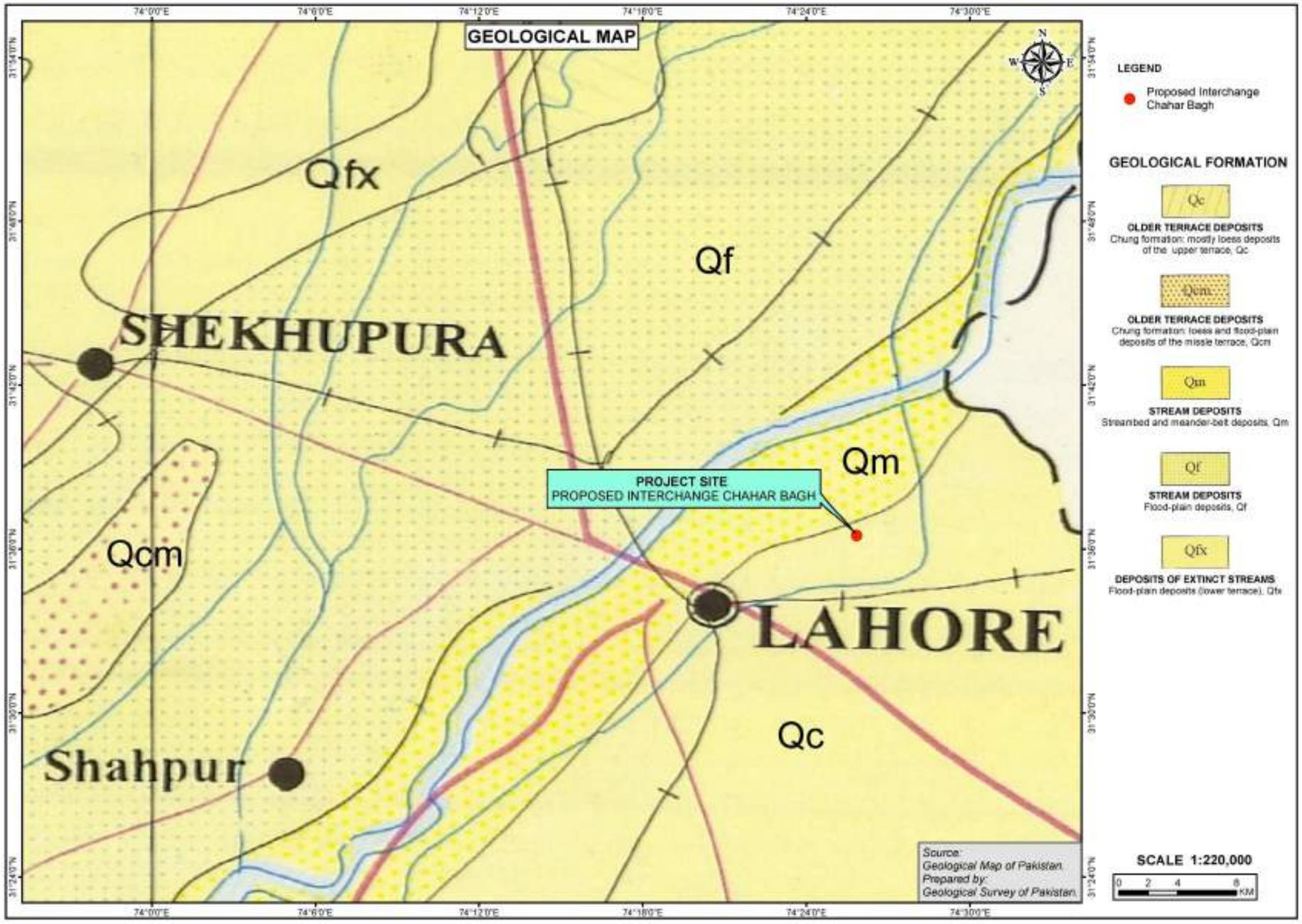


Figure 4.2: Regional Geological Map of the Study Area

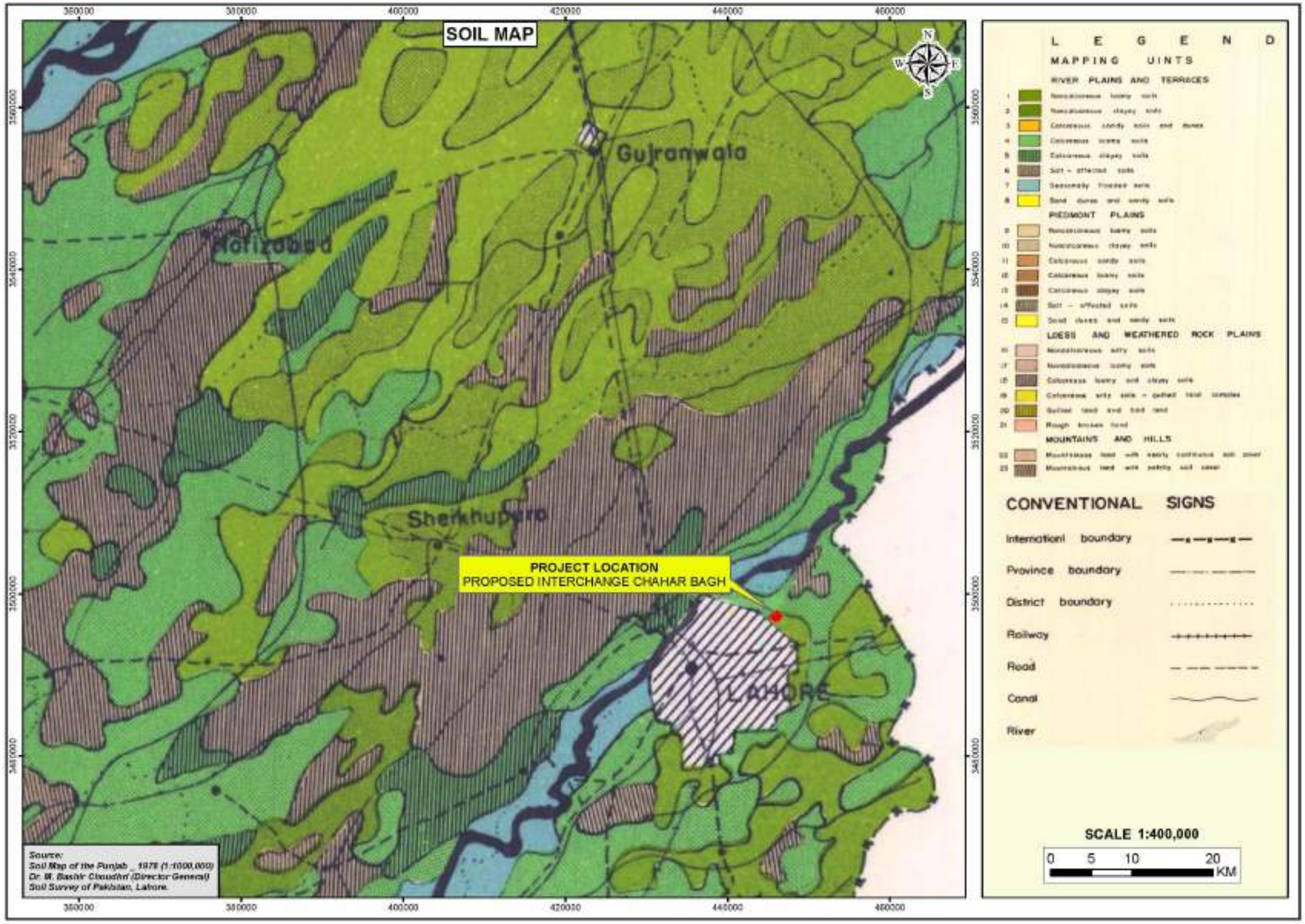


Figure 4.3: Soil Map of the Study Area

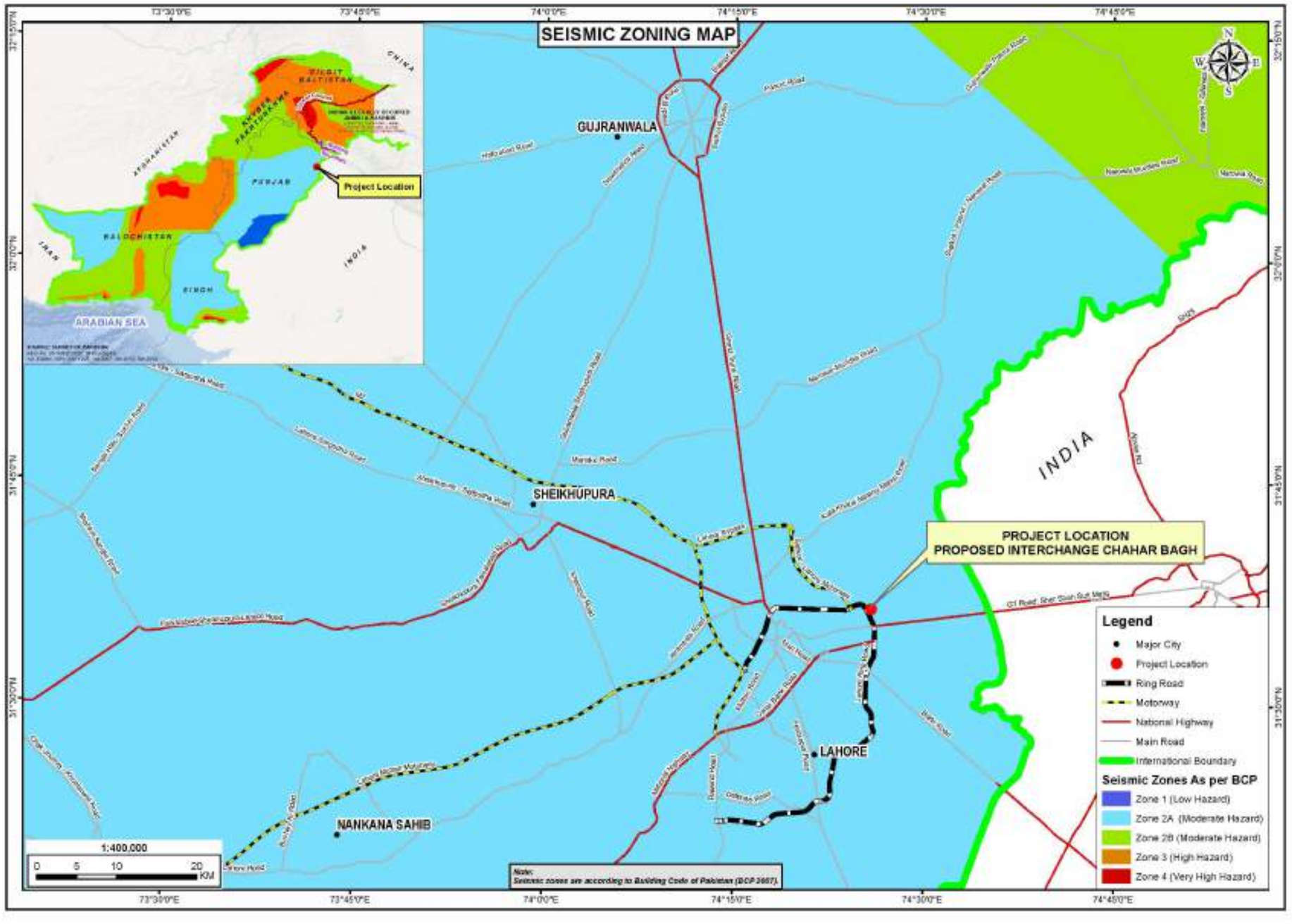


Figure 4.4: Seismic Zoning Map of the Study Area

4.2.5 Climate and Meteorology

The seasonal climatic conditions must be considered for the design and execution of the developmental projects. The climate including air, temperature, precipitation, humidity and evaporation are an influencing factor, affecting the construction of engineering structures. However, to determine the overall effect of the climatic stresses, daily and seasonal temperature changes, site altitude, direct solar radiation, and precipitation must be considered.

The Project area has moderate to extreme climate conditions, with hot summers and cold winters. The summer starts from April and lasts till September, with mean minimum and maximum temperature ranges from 27^0C to 47^0C. The winter seasons lasts from November to March, with mean minimum and mean maximum temperature ranges from 2^0C to 18 ^{0}C.[5]

The project area receives rains in all the seasons but monsoon rain is pronounced and constitutes a definite rainy season between the month of July and September. The average rainfall is about 1,172 mm per year.

Based on climatic elements, following five seasons are recognized in the Project area.

Pre-monsoon Season: Pre-monsoon refers to the period from April to June prior to the setting in of the monsoon. This is the hottest and the driest season, with persistent dry and hot winds. Day time temperature rises to 42^0C. The flows in the rivers begin to rise simultaneously due to snow-melt water in the high mountains. The water table falls to the maximum depth.

Monsoon Season: Monsoon is the main rainy period, which starts at the beginning of July, reaches its climax in August and gradually, subsides in September. The intense rainfall events cause soil erosion, which is a function of erosivity and erodibility. The cool monsoon winds followed by heavy showers lower the temperature to great extent. The part of rain percolates into the soil and is conserved in the subsoil, and adds to the groundwater. The conserved moisture in the soils is generally sufficient to rejuvenate the vegetation. All plants grow rapidly and mature towards the end of the season. With the start of monsoon season, the rivers flow at their peak level. The groundwater level is improved toward the end of the season in September and October.

Post-Monsoon Season: Post monsoon season refers to autumn (October-November). The temperature starts falling but the extreme aridity prevents plants to flower early and set seed toward mid-seasons. Groundwater level rises as a result of infiltration from rainfall.

Winter Season: Winter refers to the period from December to January. The lowest temperature is less than 2^0C, and cold winds characterize this season. The plants become dormant and most of them dry out. Most of the trees shed their leaves and few remain green or partly green. Sometimes this season becomes severe due to cold Siberian winds.

[5]Meteorological Data for Lahore (1981-2010), Pakistan Meteorological Department.

Groundwater level declines in this season due to low flows in the rivers, and no or little rains which usually fall in light showers causing little soil erosion.

Spring Season: Spring refers to the period from February to March. Temperatures become pleasant. The mean maximum temperature is 24.5^{0}C. Some light showers of rain may also fall without generating run off. The vegetation sprouts again because of conserved moisture from winter and spring rains (if any), and the water table starts falling.

Temperature, precipitation, relative humidity, evaporation, wind speed and wind direction of the study area (District Lahore) is discussed below.

4.2.5.1 Temperature

Table 4.1 below displays max and min temperature and rain data for the whole year as an average taken from last 12+ years of historical data for Lahore.

Table 4.1: Mean Maximum Temperatures (°C) between 2010 and 2022[6]

Month	Day	Night	Rain Days
January	19°c	9°c	3
February	23°c	11°c	4
March	29°c	16°c	5
April	36°c	22°c	6
May	41°c	27°c	8
June	42°c	30°c	8
July	38°c	30°c	15
August	36°c	28°c	16
September	36°c	26°c	10
October	34°c	22°c	3
November	27°c	16°c	2
December	22°c	11°c	1

[6] Meteorological Data for Lahore (2010-2022)

Figure 4.5 shows the graphical presentation of mean temperatures in the Study Area for the year 2010-2020.

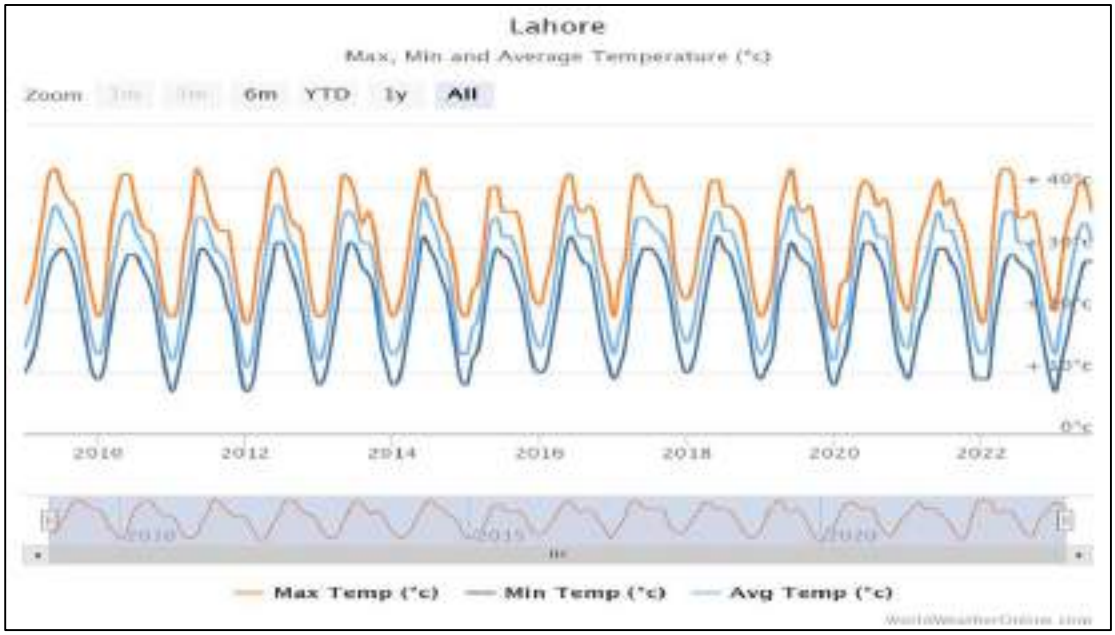
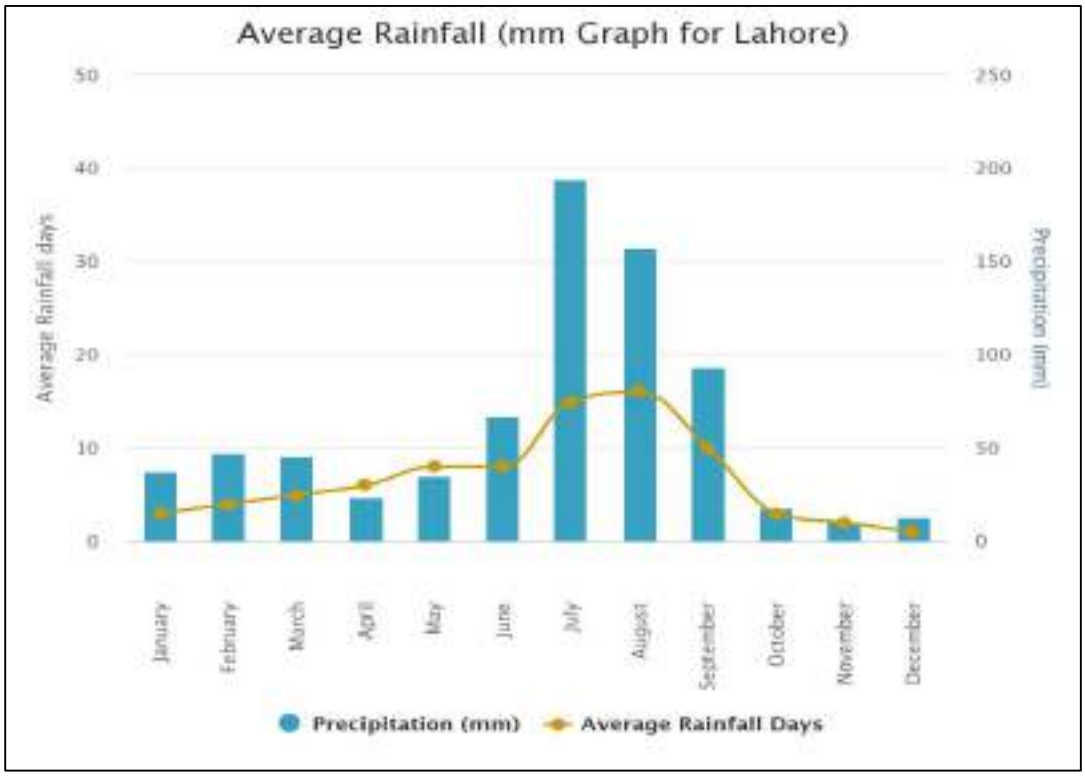


Figure 4.5: Mean Maximum and Minimum Temperature in the Study Area (2010-2022)

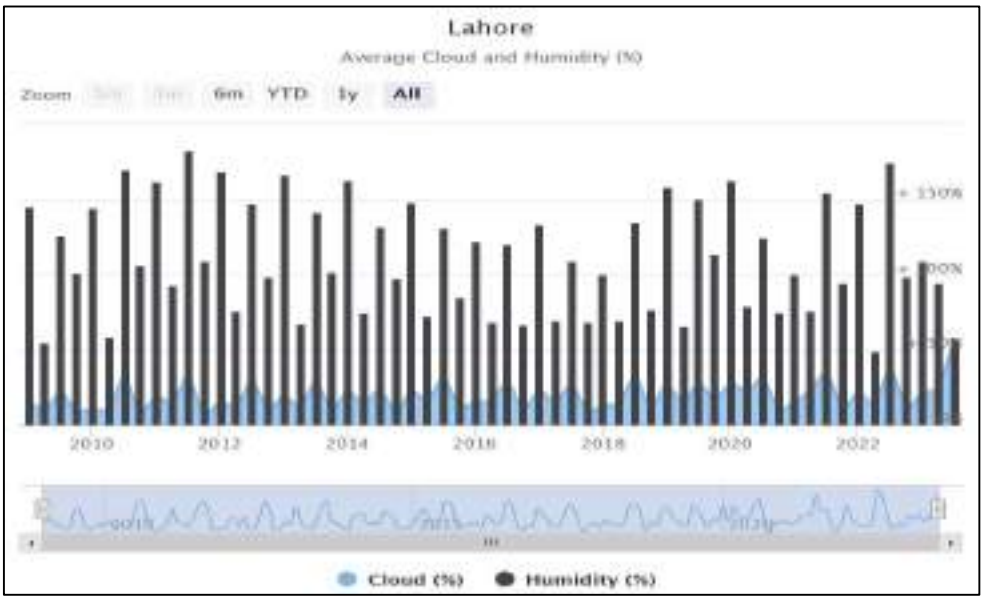
4.2.5.2 Precipitation (Rainfall)

Figure 4.6 shows the mean monthly precipitation in the study area for the year 2010-2022.



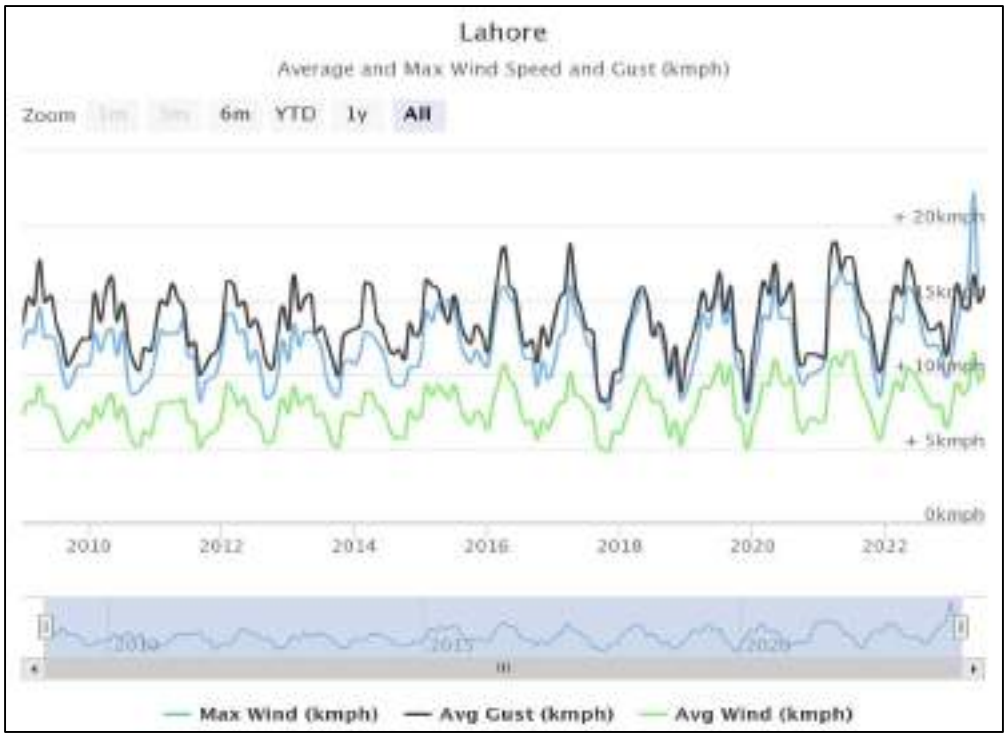
4.2.5.3 Average Cloud and Humidity

The date for average cloud and humidity from 2010 to 2022 is shown **Figure 4.7**.



4.2.5.4 Wind Speed and Wind Gust

Figure 4.8 depicts average wind speed in the study area from year 2010 to 2022.



4.2.6 Ground Water

Presently main clean water source in Lahore is ground water that meets all the requirements including domestic, industrial and commercial, which is being extracted through tube wells installed in the city.

Water and Sanitation Agency (WASA) is the competent authority for the planning, designing, development and maintenance of water supply, sewerage and drainage system in the study area. WASA is responsible for:

- Rehabilitation and augmentation of the existing system.
- Operation and maintenance of water supply, sewerage & drainage system.
- Undertaking bulk production, filtration/treatment, transmission and retail distribution of purifying water.
- Collection, pumping, treatment & disposal of sewage & industrial waste.
- Enforcement against defaulters and unauthorized connections etc.
- Short term and long term planning for tapping additional water sources & its implementation to meet water supply and sewerage demand projected.

WASA Lahore maintains a wide network of about 3,200 Km pipelines for water supply providing water to the residents of Lahore city including Project Area. WASA have installed 316 tubewells in the city for provision of pure and hygienic water to the residents. Average daily water supply to the Lahore city is about 329 MGD through 610,000 water connections.[7]

Besides WASA Lahore, a number of players, including Cantonment Board, Defence Housing Authority (DHA), and a host of private housing schemes are currently managing water and sanitation services in the areas of their respective jurisdictions.

4.2.7 Surface Water Hydrology

The main surface water resources in the Lahore city are Ravi River, Lahore Branch Canal, Khaira Distributary and the Bambawali Ravi Bedian Depalpur (BRBD) canal.

4.2.7.1 Ravi River

The Ravi River is a trans-boundary river crossing north western India and eastern Pakistan. It is one of six rivers of the Indus system in Punjab region. The Ravi River having a total length of about 720 kilometers flows across the city of Lahore. However, besides monsoon season the river is mostly dry due to the fact that water is diverted in India for irrigation and domestic purposes. In the past, River Ravi was the main source for recharge of groundwater aquifer, but due to increasing water demand and diversion of its water in India, it can no longer meet the required aquifer recharge of Lahore city. The quality of water of Ravi River has a direct impact on quality of water present in the adjacent aquifer.

[7] https://wasa.punjab.gov.pk/infodesk_watersupply

4.2.7.2 BRBD Canal

BRBD canal flows in the east of Lahore, from North to South. It crosses Grand Trunk Road, at a distance of about 6 kilometers; from Lahore Ring Road. The Canal takes off from Upper Chenab Canal (UCC) at Bambanwala, itself off takes from Marala Barrage with full discharge. The BRBD is about 175-kilometers long. It is an earthen channel except a short lined central segment. Although design capacity at head is 7,260 cusecs, the maximum discharge is around 4,600 cusecs. Among others, one of the reasons of limiting discharge to 4,600 cusecs is the limited design capacity of Syphon for crossing of River Ravi. The Canal is brick lined from RD 260 to RD 373 and crosses the River Ravi and GT road at RDs 281 and 325[8] respectively.

4.2.7.3 Lahore Branch Canal

The other surface water source is the Lahore Branch Canal (LBC), which takes off from BRBD canal at about RD 230. LBC flows near the project area which is an open channel with lining at both sides. Due to its limited discharge of about 400 cusecs, this canal cannot be considered as surface water source for Lahore, even to draw 100 cusec discharge.

4.2.7.4 Khaira Distributary

This water source lies in the south of Lahore and it also takes off from BRBD canal, and flows from east to west, its flow is even less than the Lahore Branch Canal.

Figure 4.9 shows the Surface Water Resources Map of the study area.

[8] Final Feasibility Study Report on Lahore Water and Wastewater Management Project-February, 2019

4.2.8 Drainage

There are total eight (08) major drains in the Lahore city i.e. Sattu Kattla drain, Lakshami Drain, Suk Nehar Drain, Upper Chota Ravi Drain, Lower Chota Ravi Drain, Siddique Pura Drain, Cantonment Drain and Shahdara Drain along with 76 minor drains which finally fall into aforementioned major drains. At present, all these drains collect wastewater from different areas of Lahore and finally fall into River Ravi and greatly deteriorated the quality of river water.

The nearest disposal station to the project area is the Mehmood Boti Disposl Station which finally discharges the wastewater of the project area into the River Ravi. **Figure 4.9** shows the major drains in the study area.

4.2.9 Solid Waste

Lahore Waste Management Company (LWMC) is responsible to ensure efficient collection, transportation, recovery, treatment and disposal of solid waste generated in the study area. LWMC renders following sanitation services throughout the Lahore city including study area:

- Collection of waste by placement of containers & bins and through door to door collection;
- Collection and removal of waste to the approved disposal sites;
- Manual / Mechanical sweeping of main and arterial roads, streets and squares with vacuumed vehicles; and
- Mechanical washing.

LWMC has placed waste storage containers at different points near the study area, waste collected by pickup from these containers and unloaded into nearby compactor or transfer station. Estimated solid waste generation rate in the study area is about 0.6 kg/person/day[9].

However, from the field survey, it was observed that the situation of solid waste dumping/collection near the study area is not satisfactory as waste was dumped as open heaps along the road sides and in open plots by the public as shown in **Figure 4.9**.

Figure 4.6: A view of Waste Dumping in the Project Area

[9] https://www.lwmc.com.pk/uc-plan.php

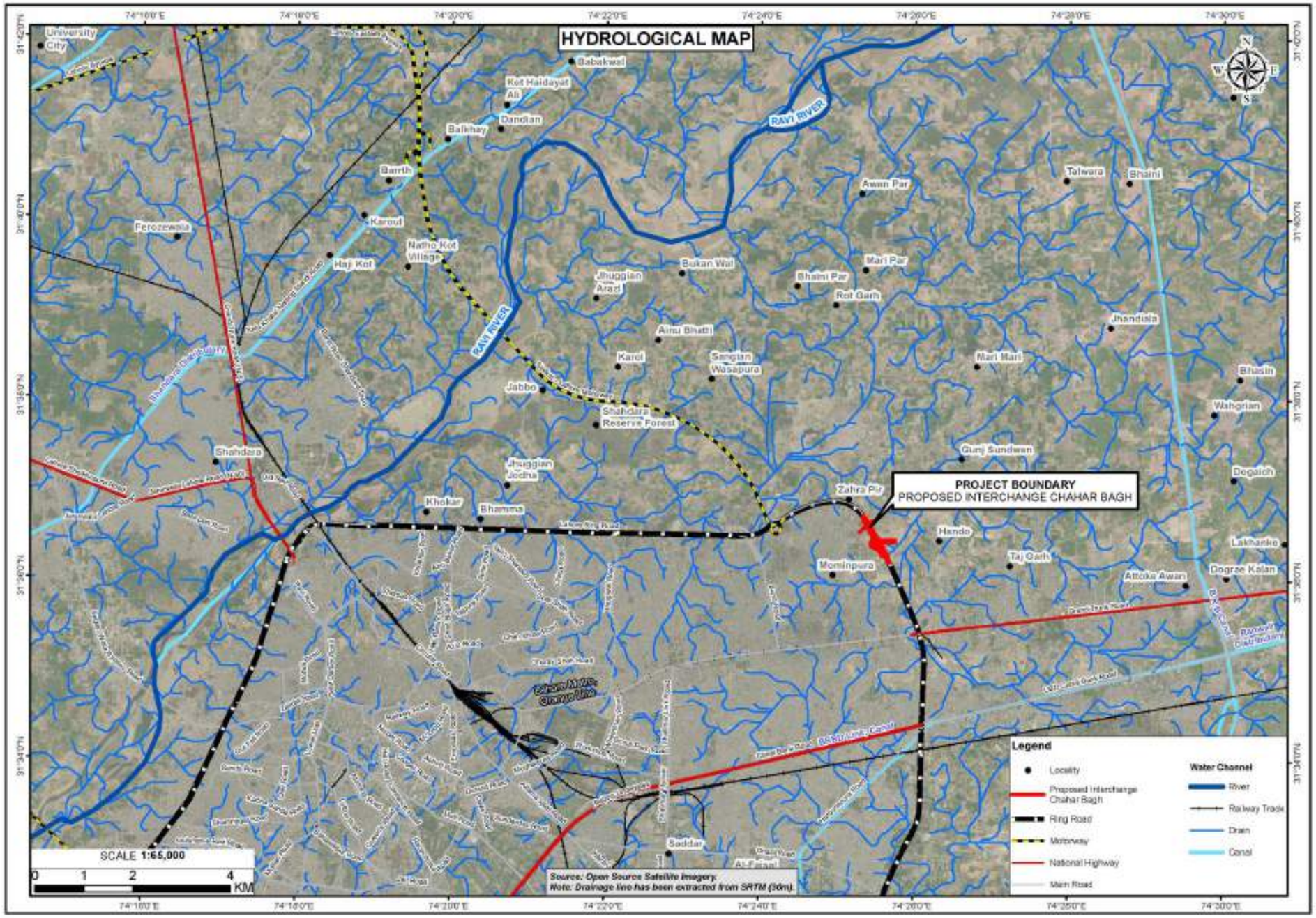


Figure 4.7: Surface Water Resources Map of the Study Area

4.3 ENVIRONMENTAL MONITORING

The environmental monitoring of parameters like ambient air quality, noise level and groundwater help us to analyze the prevailing environment conditions in and around the study area, and to protect it from any adverse activities due to the proposed Project implementation.

The environmental parameters for ambient air, noise level and groundwater were monitored in May, 2023 and these results were used for establishing the baseline profile of the Study Area. Environmental monitoring reports of are attached as **Annex-II**. The pictorial view of environmental monitoring is shown in **Figure 4.11** and the map showing the environmental monitoring and testing points is presented as **Figure 4.12.**

Figure 4.8: A view of Environmental Monitoring at Project Site

4.3.1 Air Quality

The ambient air quality monitoring for Nitrogen Dioxide (NO_2), Nitrogen Oxide (NO), Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Ozone (O_3), Particulate Matter ($PM_{2.5}$), Particulate Matter (PM_{10}) and Suspended Particulate Matter (SPM) was carried out in the Project Area. The sampling was conducted for 24 hours duration for NO_2, NO, SO_2, $PM_{2.5}$, PM_{10} and SPM, 1 hour for O_3 and 8 hours for CO.

The detailed results of ambient air quality monitoring have been attached in **Annex-II**, while the average concentrations of ambient air pollutants are given in **Table 4.6**.

Table 4.2: Average Concentration of Ambient Air Pollutants

Parameter	Unit	Monitoring Duration	Average Concentration of Pollutants Near Haidry Flour Mill Wagha Town, Ring Road Lahore (AA-01)	Average Concentration of Pollutants at Sharifpura Toll Plaza Ring Road Lahore (AA-02)	Limits as Per PEQS, 2016
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	21.01	27.14	80 µg/m³ for 24 Hours
Nitrogen Oxide (NO)	µg/m³	24 Hours	16.92	20.18	40 µg/m³ for 24 Hours
Sulfur Dioxide (SO_2)	µg/m³	24 Hours	17.78	21.94	120 µg/m³ for 24 Hours
Carbon Monoxide (CO)	mg/m³	08 Hours	0.78	1.25	5.0 µg/m³ for 8 Hours
Ozone (O_3)	µg/m³	01 Hours	Nill	Nill	130 µg/m³ for 01 Hours
Particulate Matter (PM_{10})	µg/m³	24 Hours	96.11	129.41	150 µg/m³ for 24 Hours
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	24.52	32.49	35 µg/m³ for 24 Hours
Suspended Particulates Matter (SPM)	µg/m³	24 Hours	218.75	245.13	500 µg/m³ for 24 Hours
Lead	µg/m³	24 Hours	Nill	Nill	1.5 µg/m³ for 24 Hours

µg/m³: micrograms per cubic meter
PEQS: Punjab Environmental Quality Standards

Table 4.6 indicates that all parameters are well within the permissible limits of Punjab Environmental Quality Standards (PEQS), 2016.

4.3.2 Noise Level

Noise level monitoring was carried out in the project area location in the study area. Major sources of noise observed at the site were vehicular traffic in and around the study area.

The detailed results of noise monitoring have been attached in **Annex-II**, while the average concentrations of noise level are given in **Table 4.7**.

Table 4.3: Average Concentration of Noise Level

Averaging Time	PEQS, 2016	NL-01 (Near Haidry Flour Mill)	NL-02 (at Sharifpura Toll)
	Category B (Commercial Area)	Average Value in dB (A)	Average Value in dB (A)
Day-time	65	65.15	76.65
Night-time	55	63.50	75.01

The above results show that the average noise values at day and night time are exceeding the permissible limits of PEQS in the Study Area due to continuous flow of traffic.

4.3.3 Drinking / Ground Water Quality

Drinking water sample was collected from tubewell near the project area and were analyzed for physical, chemical and microbiological parameters. **Table 4.8** shows the results of ground water analysis.

Table 4.4: Results of Ground Water Analysis

Sr. No.	Parameters	Standard Methods	Units	PDWQS	Point 1	Point 2
1.	pH	APHA-4500H+ B	--	6.5-8.5	7.6	7.4
2.	Temperature	---	°C	----	19	17
3.	Taste & Odor	In-house	--	Non Objectionable	Non Objectionable	Non Objectionable
4.	Color	APHA-2120 B/C	TCU	<15	7	5
5.	Turbidity	APHA-2130 B	NTU	<5	3	1.9
6.	Total Dissolved Solids (TDS)	APHA-2540 C	mg/L	<1000	397	361
7.	Total Hardness as $CaCO_3$	APHA-2340 C	mg/L	<500	125	108
8.	Nitrate (NO_3)	APHA-4500NO3 B	mg/L	≤50	6.4	2.2
9.	Nitrite (NO_2)	APHA-4500NO2 B	mg/L	≤3	1.9	0.67
10.	Arsenic (As)	APHA-3500As B	mg/L	≤0.05	N.D.	N.D.
11.	Nickel (Ni)	ASTM E3047-16	mg/L	≤0.02	N.D.	N.D.
12.	Antimony (Sb)	APHA-3500Sb B	mg/L	<0.005	N.D.	N.D.
13.	Chloride (Cl)	APHA-4500Cl- B	mg/L	<250	138	96.4
14.	Chlorine	APHA-4500 CL	mg/L	0.5-1.5	0.9	0.6
15.	Lead (Pb)	APHA-3500 Pb-B	mg/L	≤0.05	0.006	0.003
16.	Fluoride	APHA-4500F- C	mg/L	≤1.5	0.94	0.6
17.	Aluminum	APHA-3500 Al	mg/L	≤0.2	N.D.	N.D.
18.	Manganese (Mn)	APHA-3500 MN-B	mg/L	≤0.5	N.D.	N.D.
19.	Cadmium (Cd)	APHA-3500 Cd-B	mg/L	0.01	N.D.	N.D.
20.	Barium (Ba)	APHA-3500 Ba B	mg/L	0.7	0.2	0.13
21.	Mercury (Hg)	APHA-3500 Hg-B	mg/L	≤0.001	N.D.	N.D.
22.	Copper (Cu)	APHA- 3500 Cu-B	mg/L	2	0.49	0.16
23.	Zinc (Zn)	APHA- 3500 Zn B	mg/L	5	2.73	1.58
24.	Boron (B)	APHA 4500 B- C	mg/L	0.3	N.D.	N.D.
25.	Chromium (Cr)	APHA 3500 cr B	mg/L	≤0.05	N.D.	N.D.
26.	Selenium (Se)	APHA- 3500 Se C	mg/L	0.01	N.D.	N.D.
27.	Cyanide (CN)	APHA 4500-CN	mg/L	≤0.05	N.D.	N.D.
28.	E-Coli	APHA:9222 D	Number/100 mL	0 Number/100 mL	0	0
29.	Total Coliform	APHA:9222 B	Number/100 mL	0 Number/100 mL	0	0

mg/l: Milligram per Liter **ND:** Not Detectable

The above table illustrates that all physical and chemical parameters are well within permissible limits of Punjab Standards for Drinking Water Quality, 2016.

Figure 4.9: Environmental Monitoring Map

4.4 LAND USE PATTERN

The land use of the study area is mainly of barren / open area and including the existing area of Ring Road. **Table 4.6** depicts land use cover of the Project area. Pictorial views of current landuse are provided in **Figure 4.13.** The land use map of the proposed Project site is shown in **Figure 4.14**.

Table 4.5: Land Use Type

Landuse Type	Area (acres)
Barren / Open Area	11.09725728140
Builtup Area	0.86677686409
Cultivated Land	0.01233040782
Divider	3.22354819246
Green Belt	0.46097560486
Overhead Bridge	0.11120041730
Road / Track	14.07635180010
Walkway	0.00232095188

Figure 4.10: Current Land-use of the Project Area

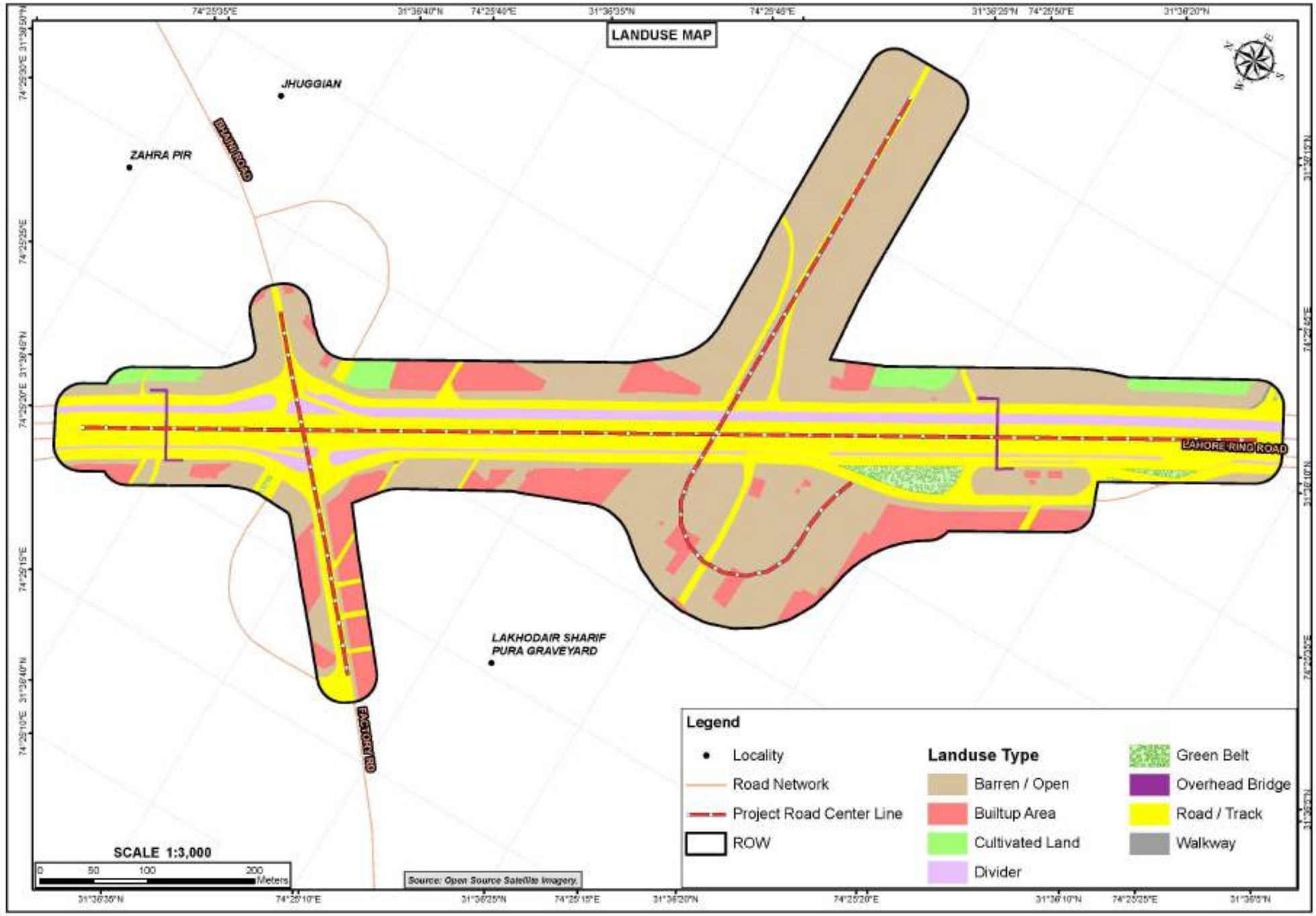


Figure 4.11: Land Use Map of the Study Area

4.5 Ecological Resources

As climate of Lahore is semi-arid and subtropical, the vegetation of the area falls under tropical thorn forest type as per phyto-geographical classification of the area, but no forest and plantations found in the project area.

The tract, in which the project site exists, was once covered with native vegetation consisting, of trees like Kikar (Acacia) Karir (*Capparis deciduas*), Wan (*Salvadora oleoides*) and Jhand (Prosopiss picigera). With the onslaught of civilization, this vegetation was cleared for agricultural and commercial purposes.

Due to rapid increase in the population and anthropogenic activates the land has been degraded and the project area is barren expect few agriculture farms utilized mostly for fodder crops.

4.5.1 Flora

The study area has some trees of different varieties of several types are present in project area, however, some of the principal trees, shrubs (plants) and herbs (ground covering plants) are given below in **Table 4.10**, which illustrates their nomenclature including local names, English names and Botanical names.

Table 4.6: Inventory of Trees Present in Lahore District

Sr. No.	Common Name	Scientific Name
1	Kikar	*Acacia Nilotica*
2	Eucalyptus	*Eucalyptus camaldulensis*
4	Shisham	*Dalbergia sissoo*
6	Bakain	*Melia azedarach*
9	Tooth	*Morus alba*

These trees are mostly of medium size with a girth between 2’ to 4’. Some of the broad leaved trees exist in the area and these few species still survive the on-slaught of urbanization. Same may be found in remote barren areas or in graveyards only. There is probably little natural vegetation left in tract. The project area was not witnessed to any designated forest area during field visits. No compact plantation or woodlots exist in the project area, but scattered trees are growing in lands in scattered pattern consisting of Kikar, Shisham, Eucalyptus etc.

4.5.1.1 Natural Shrubs and Herbs

Shrubs and herbs existing in the open and non-developed areas include Calatropis (calatropis procera), Bhang (cannabis sativa) and Bathu (Chenopodium species).

4.5.1.2 Grasses

The project site is at present covered with mostly Khabbal grass, while Kana grass (Saccharum munja) also exists, along the depressions, where water accumulation occurs.

4.5.2 Fauna

4.5.2.1 Mammals

Common mammals found in the area are dogs, cats, house rats and bats. Small Indian Mongoose and Indian Palm Squirrel have also been reported. These are mostly seen in areas where houses have already been constructed or are under construction.

4.5.2.2 Reptiles

Snakes such as cobra, kraits etc. were once common in the tract, but now cases of snake bites are very rare, as these reptiles have been either killed by expanding urbanization or they have moved away. Lizards such as Spiny tailed lizard (*Uromastix hardwickii*) and fringed toed lizard (*Acanthodactylus cantoris*) are also reported by the residents of the area.

4.5.2.3 Amphibians

Amphibians frequently seen in and around the project area, especially during rainy season, include common Frog (*Rana tigrina*) and Indus valley toad.

4.5.2.4 Birds

House sparrow (*Passer domesticus*), House crow (*Corvuss plendens*) and Mynah (*Acredotheres tristis*) are the most common in the area. In addition, following birds have also been observed in the area.

Table 4.7: Bird in the Project Area

Sr.No.	Scientific Name
1	Nightingale (Pycnontus cafer)
2	Parrot (Psittacula krameri)
3	Pigeon (Columba livia)
4	Hoopoe (Upupa epops)

There are no endangered species of flora and fauna in the study area.

4.5.2.5 Wildlife Sanctuaries and Game Reserves

No wildlife sanctuary or game reserve is located in the vicinity of the study area.

4.5.2.6 Critical Habitats

No wild life sanctuary or game reserve (critical habitats), exists near the project area or the study area and therefore it can be stated that this project does not affect any critical habitat as, no critical habitat is located close to the project area.

4.6 Socio-Economic aspects

The socioeconomic baseline covers the demography, administrative and political settings, religious and cultural, economic aspects, infrastructure and facilities, and gender aspects.

To document the socio-economic conditions of the population settled in the Project Area, social surveys of the selected Households (HH) were carried out. One of the major steps after the identification of the affected areas and their estimated populations during the initial survey of February, 2023 was the calculation of sample size. Total two (02) main settlements named lakhodair and Sharifpura fall near the Project Area. Socio-economic survey was conducted in these areas.

The basic objectives of the social survey were to:

- Observe and document the existing socio-cultural settings of the study area;
- Identify the potential impacts associated with the implementation of the proposed project;
- Get feedback from community about existing and potential social issues; and
- Evaluate the possibilities of addressing them in the report.

Socio-economic survey of the selected households of the study area was carried out. Baseline information was collected from direct and indirect affectees during the field visit. The people whose land or land based assets or any other structure will be directly affected called direct project affected persons (PAPs) while indirectly affected are those people who will have to face impacts of proposed project. Persons who are directly affected due to the land acquisition are termed as PAPs in the report.

4.6.1 General Description of the Project Area

The Project Area of proposed project falls in Ravi Town, District Lahore. PAPs socio-economic condition, family size, educational status and concerns related to the project are same as people of Study Area. Based on social survey, approximate number of HH and their population were estimated. Socio-economic survey was carried out to take maximum information of the Project Area. Study Area included the following major settlements:

- Lakhodair and
- Sharifpura.

4.6.2 Methodology

Relevant secondary data/information was collected from various departments at the central and the provincial level was cross checked to establish their authenticity.

Both qualitative and quantitative assessments were done for the social assessment study covering different social environment parameters of the project location by interacting with social groups and relevant stakeholders of the project area. Quantitative survey methods involved filling up of questionnaires at local areas and household levels by sociologists and enumerators. The questionnaires contained mostly structured questions for collection of the required data.

The study area for socio-economic survey includes the areas which will be directly and indirectly affected due to the proposed Project activities. Estimated population for the calculation of sample size for social survey in the study area is taken from the locals through social survey.

It was difficult to interview respondents from every household in the project area as the time and cost involved in such data collection and analysis is enormous. Thus, for the selection of respondents, Simple Random Sampling Technique was adopted and fifty-eight (58) respondents were interviewed on the basis of simple random sampling technique. The sample size was distributed proportionately among the nearby settlements. Questionnaires were developed to collect the baseline data, based on the demographic and socio-economic indicators. Interviewing technique was used as a tool for data collection. In order to quantify the existing baseline conditions of the study area, collected data was digitized and analyzed.

In addition, the survey was followed by public consultations at the village level through group discussions, key informant interviews, participatory observation and by using a structured proforma.

a. Task Specific Approach

In conducting the social survey, full concentration was given to identify area of impacts and collection of necessary data/information on the existing social environment (economic, social, cultural etc.). This was done by holding discussions / meetings followed by in-depth survey and administering structured / semi-structured questionnaires. Assessment was also made about the project impact on the livelihood of the people.

b. Discussion with Officials

The Consultant had frequent discussions with the client and the concerned project officers to get a clear understanding about the project. This facilitated sharing of ideas, conceptual clarity and minimized constraints in carrying out the task.

c. Reconnaissance Field visit

A reconnaissance visit to the project, before conducting detailed survey was conducted in start of February, 2023 by the consultant, that helped in collection of necessary data/information for primary assessment through consultations with project stakeholders including project beneficiaries and project affected persons.

d. Data Collection and Field Survey

The Consultant conducted field survey/investigation on various socio-economic aspects to assess the existing socio-economic environment of the project area as well as identify likely impacts under a changing situation with and without the proposed Project. Accordingly, the social study covered the beneficiaries, the affected people and concerned stakeholders in the area and elicited their views / suggestions for mitigation / enhancement of different types of impacts.

e. Community/Stakeholders' Participation

Community consultations with different stakeholders, beneficiaries and affected communities of the Project Area were organized to facilitate stakeholders' / peoples' participation in the project activities of the proposed project and their views and feedbacks were incorporated for planning/preparation of the proposed project. Such consultations would strengthen the commitment of a wide cross-section of the affected people, public representatives, government employees and professional groups by giving them an opportunity to participate in key decisions.

4.6.3 Administrative and Political Settings

The Mayor of Lahore is the leader of the municipal government of Lahore (Metropolitan Corporation Lahore) in Lahore, Punjab. The mayor is directly-elected in municipal elections every four years alongside nine (09) deputy town mayors. The mayor is responsible for the administration of government services, the composition of councils and committees overseeing Lahore City District Departments and serves as the chairperson for meeting of Lahore Council.

The mayor is responsible for the administration of government services, the composition of councils and committees overseeing Lahore City District departments and serves as the chairperson for meeting of Lahore Council. The mayor also functions to help devise long term development plans in consultation with other stakeholders and bodies to improve the condition, livability and sustainability of urban areas.

Lahore comprises five tehsils i.e. Lahore city and Lahore Cantt, Model Town, Raiwind Tehsil and Shalimar Tehsil. While these tehsils are further divided into nine towns as under: i. Nishtar Town; ii. Gulberg Town; iii. Aziz Bhatti Town; iv. Allama Iqbal Town; v. Ravi Town; vi. Shalamar Town; vii. Samanabad Town; viii. Wahgah Town; ix. Data GunjBakhsh Town.

Union Councils (UC) is the lowest tier of the local government and fifth tier of government in Pakistan; in rural areas, UCs are often known as "village councils". The territory represented by a village council usually comprises a large village and surrounding areas, often including nearby small villages. The term "union council" may be used for localities that are part of cities. A village council is an elected local government body headed by a mayor and a deputy mayor.
Tehsil Council is the next tier of local government. About 4 to 5 UCs fall in the Tehsil Council (TC). Tehsil is a sub-unit of the district, which is the highest tier of the local government system, dealing with the administrative matters at district level.

A district is composed of Tehsils and is governed by the Deputy Commissioner (DC). Like other districts of the Punjab, the local government system of Lahore comprises UCs consisting of members directly elected by the people through an open competition, which is also from the Electoral College for the selection of the members for the next higher tier.

4.6.4 Demography

a) Population and Family Size

Based on the District Census Report, 2017, Lahore has a population of 11,126,285 while it was 6,318,745 as per 1998 census. The household surveys, indicated that household size is 7.1 persons. Based on the social survey, the gender wise distribution of the 83 respondent's families is given in **Table 4.12.**

Table 4.8: Gender and Age of the Population

Sr. No.	Age Group (Years)	Male		Female		Total	
		No.	Percentage	No.	Percentage	No.	Percentage
1	0-4	42	7.1	38	6.4	80	14
2	5-9	25	4.2	26	4.4	51	9
3	10-19	53	9.0	49	8.3	102	17
4	20-39	73	12.3	69	11.7	142	24
5	40-49	61	10.3	64	10.8	125	21
6	50-59	31	5.2	29	4.9	60	10
7	60 and above	18	3.0	14	2.4	32	5
Total		**303**	**51.2**	**289**	**48.8**	**592**	**100**

Based on the social survey, the maximum population falls in the age group between 20 and 39 years and it is the group which is responsible for most of daily life routine activities.

The sex ratio is an important demographic indicator, which is defined as the "number of males per hundred females". The sex ratio based on the household was 105 males per 100 females. The sex ratio depends on the factors such as the sex ratio at birth, differential mortality rates between the sexes at different ages, and losses and gains through migration. In the local culture, sons are preferred because (i) they have a higher wage-earning capacity, (ii) they continue the family line; and (iii) they are generally recipients of inheritance. Girls are often considered an economic burden because of the dowry system and after marriage they typically become members of the husband's family, ceasing to have responsibility for their parents in illness and old age.

b) Marriage and Marital Status

Endogamy is the prevalent trend of marriage. Most of the people are monogamous as second marriage is expensive. Mothers have very little role in decision-making about marriages of their sons and daughters. Neither the groom nor the bride is allowed to choose his or her life partner in rural areas. The decision of the parents is considered final; however, sometimes the bridegroom is consulted before the final decision. As per social survey, the majority of respondents (i.e. 74%) were married and 26% were unmarried. **Table: 4.13** shows the marital status of the respondents.

Table 4.9: Marital Status of the Respondents

Sr. No.	Marital Status	Number	Percentage
1	Married	43	74
2	Un-Married	15	26
Total		**58**	**100**

c) Literacy

Educational distribution of the respondents shows that (12%) of the respondents were illiterate. 17% were educated up to primary level. However, 25% and 17% were educated up to middle and matric level respectively. Moreover, 14% respondents were educated up to intermediate and 15% respondents described their education level up to graduation and above. Educational level of the respondents is shown in **Table 4.14.**

Table 4.10: Educational Level of the Respondents

Sr. No.	Education of the Respondents	Number	Percentage
1	Illiterate	7	12
2	Primary	10	17
3	Middle	14	25
4	Matric	10	17
5	Intermediate	8	14
6	Graduation and above	9	15
Total		58	100

Based on the field survey and discussion with the locals, it is noted that female literacy rate was lower compared to males. Locals give least importance to female education. However, proposed project area falls in Lahore and considered semi urban area. In the Project area, there was very low trend among low income families to send their girls to school. Although, there are number of schools in local area available in public and private sectors. Following are the reasons of low literacy rate among women in the area:

- The major cause of women illiteracy is increase in population, which is playing a negative role in this deprivation of female education. A family having more children and less income will prefer to educate the boys of the family, while the girls will be given embroidery or sewing skills;
- There is also misconception that females have to manage home after marriage whereas males have to earn for livelihood, so education matters only for males and not for females;
- Some families do not like their daughters to study in co-education institutes thus depriving them of higher education;
- The social setup is male dominated and girls restricted to homes and cannot go out freely thus any male of the family has to take responsibility for grocery purchasing etc. This sometimes seems difficult to them. There is also a sharp division between female oriented work and male oriented work. Females are not allowed to work in all sectors therefore their education is not considered valuable; and

- The number of schools and colleges for females are less with compare to males. Girls have to travel a long distance to reach the schools or colleges. For this reason, most parents prefer to give them religious education.

d) Languages Spoken

Punjabi is the predominant language being spoken in the Area while Urdu is a common language.

e) Housing

A mix housing pattern was observed in the Project area, where majority 86% of the respondents were living in pacca houses, while only 14% respondents had semi- pacca houses. **Table 4.15** shows construction pattern of houses of the respondents.

Table 4.11: Housing Conditions

Sr. No.	Type of House	Number	Percentage
1	Pacca[10]	50	86
2	Semi Pacca[11]	08	14
	Total	**58**	**100**

The majority of the respondents had 2-3 rooms in their houses; few of them were having more than this equation.

The type of the toilet used by the household indicates living conditions and is strongly related to the health and hygiene of the household members. All the people (100%) had flush type of latrine inside of their homes.

4.6.5 Economic Aspects

a) Occupations

Occupation of the respondents were also asked during the field survey. Majority (31%) of the respondents were associated with private service. Fourteen (14%) of the respondents were running their shops while 10% of the respondents were mechanic of different fields. Almost 22% were engaged with different types of labor including agriculture, industrial and general labor for earning their livelihood, while 10% were engaged with their own business to earn their livelihood. Rest of the respondents were associated with farming and government jobs as reflected in **Table 4.16.**

Table 4.12: Occupation of the Respondents

Sr. No.	Profession	Number of Respondent	Percentage
1	Shopkeepers	8	14

[10] Pacca housing refers to dwellings that are designed to be solid and permanent, built of substantial material such as stone, brick, cement, concrete, or timber.
[11] Constructed using a combination of pacca (strong, high-quality) and kutcha (inferior) materials.

Sr. No.	Profession	Number of Respondent	Percentage
2	Mechanic	6	10
3	Laborers	13	22
4	Private Service	18	31
5	Business	6	10
6	Farmers	5	9
7	Govt. Service	2	4
Total		**58**	**100**

b) Income Levels

Socioeconomic findings of the survey revealed that 5% of the respondents were falling in the low income group of up to rupees 25,000. On the other hand, 36% were earning in the range of 25,001 to 35,000 rupees, and 19% of the respondents were earning their monthly income between the ranges of 35,001 to 45,000 rupees per month. Whereas, 26% of the respondents were earning between 45,001 to 55,000 and 14% were earning above 55,000 per month. **Table 4.17** shows the average monthly income of the respondents.

Table 4.13: Average Monthly Income of the Respondents

Sr. No.	Average Monthly Income (Rs.)	Number of Respondent	Percentage
1	Up to 25,000	3	5
2	25,001 – 35,000	21	36
3	35,001 – 45,000	11	19
4	45,001-55,000	15	26
5	Above 55,000	8	14
Total		**58**	**100**

c) Expenditure

Household expenditure depends on the earning of the household members, about 9% of respondents reported their monthly expenditure up to 25,000, and 35% respondents found within the range of 25,000- 35,000 per month. While, 17% were falling between the expenditure range of 35,001 to 45,000 and 26% recorded their monthly expenditures between the ranges of 45,001-55,000 per month. However, 12% of the respondents were having their expenses more than 55,000 per month. **Table 4.18** shows the average monthly expenditures of the respondents.

Table 4.14: Range of Monthly Expenditures of the Respondents

Sr. No.	Average Monthly	Number of	Percentage

	Expenditures	Respondent	
1	Up to 25,000	5	9
2	25,001 – 35,000	21	35
3	35,001 – 45,000	10	17
4	45,001-55,000	15	26
5	Above 55,000	07	12
Total		**58**	**100**

The monthly expenditure and pattern of the expenditure provides an indication for assessing the standard of living of a household. Food expenses include food and non-food items, education and health care for family members.

d) Money Borrowed

Table 4.19 shows that significant majority i.e. 91% of respondents did not borrow money during the fiscal year 2022-2023. While only 07% borrowed money during this time.

Table 4.15: Money Borrowed

Sr. No.	Last Year Borrow Money	Number	Percentage
1	No	53	91
2	Yes	05	07
Total		58	100

Generally, the credit is obtained to supplement the income to meet the routine and some extra expenditure of the household including investment, social needs and other unforeseen situations such as illness (medical care), marriage and education. Credit is also obtained for agricultural needs (such as equipment, seeds and fertilizers) from both the formal (banks) and informal sources (e.g., friends, relatives, and landowners).

4.6.6 Religious and Cultural Aspects

a) Religion, Ethnic and Minority Groups

The population of the settlements in AOI is predominantly Muslim followed by Christians. The core unit of social organization is the caste system (“biraderi” in local language) in which groups are either defined on the basis of specific occupation or lineage. Occupationally defined caste groups are considered as lower status in the social setup. For instance, occupationally defined baradari/caste groups are Mochi (cobbler), Machi (fisherman), Nai (barber), Julahay (weavers) while lineage based baradari/caste groups are e.g., Khokhar, Gujjar, Malik, Rajput, Bhatti, Jutt, Mian, Khurral, Syed, and Cheema. The social life of the local population is traditionally on rural and urban lines.

Based on the household survey, the population in the AOI has many castes due to semi urban area of Lahore. The major caste/ethnic groups are Gujjar, Jutt, Arian, Sheikh, Malik, Rehmani, Muslim Sheikh, Mochi, and Rajpoot. Among all the castes mentioned, Gujjar,

Arain and Jutt are the dominant castes of the AOI. Minority groups like Christians were also found in AOI.

During the field survey, it became apparent that the major castes were important because they have a key role in decision-making regarding the resolution of social issues of family matters. For instance, landlords as well as the head/or elder of the respective caste generally make decisions related to the social issues at local level as well as the social development work in their areas. Prior to any Project/ program to be initiated, it is essential to involve these groups right from start of the Project i.e. planning, design, implementation and operation, to make the Project successful. In the AOI, local councilors, chairman and deputy chairman are the influential persons.

b) Culture

The culture of Lahore is a manifestation of the lifestyle, festivals, literature, music, language, politics, cuisine and socio-economic conditions of its people. It is characterized by the blending of South Asian, Middle Eastern, Central Asian and Western influences. Lahore's culture is unique. It is sometimes referred as the cultural capital or the heart of Pakistan. Presently, it is the capital of the Punjab province of Pakistan. In the AOI, locals are very warm-hearted. People had strong beliefs in reputable saints, black magic, and other superstitions (“pir-faqeers”, “jogi”, “taweez”, “manat-ka-dhaga” in local language). However, recently due to increase in literacy, people have become somewhat factual. Locals have strong belief in caste system but people are getting educated, and the boundaries / differences are getting blurred.

In the AOI, old men wear Pagri (turban), dhoti/lacha, kurta (long shirt), khusa (handcrafted footwear) while women wear colourful shalwar kameez, paranda (colorful hanging worn by the Punjabi women in their hair), choli/duppata (scarf) and kola puri chappal (hand-crafted slippers with embroidery). The young generation (men and women) follow latest trends and fashion; mostly they wear different styles of shalwar kameez. Trouser and shirts are also worn by the locals but in less proportion as compared to shalwar kameez.

The extensive cuisine is both vegetarian and non-vegetarian. In rural areas along the river Ravi, locals use ghee or clarified butter and different spices extensively. Traditional food is also eaten such as, Desi Ghee Paratha (flat bread in clarified butter), Makai ki Rotti (flat bread made from corn flour), Sarson ka Saag (vegetable dish made from mustard leaves).

c) Family System

Joint family system is the dominant culture in the AOI. It was observed that the family structure in the area was very strong and members played a pivot role in solving their social and cultural problems.

Most of the families were living in joint family system, whereas only a small percentage of families were living as a single family (nuclear family system). Although the joint family system is generally undergoing a radical change, with a greater influence of media and education and people of the AOI do not feel good about this change. The major reason is

that by living in a joint family system a lot of emotional attachments are enhanced and they feel that by separating in nuclear family system, their relationships will be damaged and family ties will be weakened.

As per the locals, joint family system is basically a form of organization. In this organization, there are defined norms and values to be followed strictly by all the members. All the members have their defined tasks and responsibilities to perform. There is equal share of each and every member of the family in the available resources in the form of money, food and other requirements and locals feels better in joint family system as compare to nuclear family. During the discussion with the locals, it was clarified that large family size is also treated as the strength of the family.

d) Decision-making Methods and Conflict Resolutions System

The methods for decision-making about social conflicts in the Project are “Panchayat” (an assembly of wise and respected elders), court and caste groups. If the cases are not resolved at the local level, then parties approach the police and courts of law.

The people have a tradition to help each other in the hour of need. Common conflicts arise from time to time which are solved by the community at the local level through Numberdars, Councillors or Deputy Mayor of the UC. Generally, in case of a conflict between two individuals, only the families or closest friends take sides of the conflicting rivals so there are rare chances that personal conflict will transform into an ethnic dispute.

4.6.7 Infrastructure Facilities

a) Educational Facilities

The educational facilities comprise Middle schools for boys and girls in the Project area. However, to avail higher secondary level education facilities locals have to go nearby areas of Lahore city. There are number of educational institutions exist in private and public sector in nearby areas.

The proposed Project is close to the Lahore City where almost every type of educational facilities are available. Educational facilities in Lahore are mainly being provided by the Government of Punjab, the city government, the private sector and voluntary organizations. To a limited extent, the high school education is also being managed by the Federal Government through the operation of few institutes located in the cantonment area.

During the field visit, it was noted that few institutions (private sector) provide education at matric or secondary level. Locals prefer to go to other areas of Lahore for higher education as it is a first class place of learning in Pakistan.

b) Health Facilities

Health facilities are generally inadequate in the Project area and its adjacent settlements. Bad sanitary conditions, contaminated underground water, insufficient medical facilities and

meagre parental care, all contribute to the prevalence of ill health in the area. To avail health facilities locals, go to the main city. As per findings of the socioeconomic survey and community consultations, there was no proper health facility for the local people in the surrounding settlements of the Project area.

Ample medical and health facilities are available in the Lahore Metropolitan Corporation area and its suburbs. Shaukat Khanam Hospital and Pakistan Kidney and Liver Institute and Research Center (PKLI&RC) are the latest addition in the medical care facilities in Lahore for cancer and the most dangerous disease of liver and kidney in the country. There are also other hospitals of voluntary organizations which provide health cover to the general public. Shalamar Hospital is one of the nearest hospital for the people of proposed project area. Moreover, King Zaid Bin Sultan Hospital is also a very advanced addition in the medical care for Lahore. Among the prominent hospitals are General Hospital, Lady Willington Hospital, Mayo Hospital, Fatima Jinnah Hospital, The Children Hospital, Services Hospital, and Ganga Ram Hospital etc.

c) Civic Facilities

The civic facilities i.e. road, electricity sui-gas and sewerage system are available in most of the Project area.

d) Sources of Drinking Water

Water supply is available for drinking and domestic use in the Project area and its adjacent settlements, but local people are not satisfied with the quality of water.

e) Security Situation and Movement of the Foreigners

At present, security and safety situation in Lahore is satisfactory. During the social survey, locals informed that there has been no incident of any threat to lives or goods of foreigners visiting the area and there is no animosity towards foreigners. In the AOI there is a reasonably liberal atmosphere for women. The local culture recommends modest dress for both men and women.

4.6.8 Gender Aspects

Conditions of the women of the Study Area were assessed by carrying out women sample survey. The women and girls of the study area were observed busy in doing laundry, looking after the children, preparing food etc. There is a lack of employment opportunities for women. However, some women doing jobs in different professions like factory workers, teaching, medical and Government and Private Sector were reported.

The emancipation of women is a campaign to give women equal rights and status with men. The emancipation of women (i.e., their liberation from economic and sexual oppression, their access to higher education and their escape from narrow gender roles) is not easily achieved due to the traditional setup. In this rural society, males dominate. Cultural tradition, social practices and low female literacy ratio have left women in a vulnerable position.

Women are restricted to performing household work and are excluded from decision-making both on the domestic front and at the community level. Women's access to education and health care is limited close to home in the AOI.

Women in the AOI are also vulnerable through economic, social and psychological poverty. Economic poverty is due to lack of assets and low endowment of human capital. Social poverty derives from the inability of the society to accept women's equality and their economic, political and cultural rights, while psychological poverty is a product of the subjugation of women, under the dictates of customs and traditions, which deprives them even of control over their own lives.

In the semi-urban set-up women are kept under-educated or uneducated. They are mainly dependent on male members of the family for economic reasons and cannot take decisions regarding their own lives. They have nominal say in family matters and are occasionally asked about their preference for marriage. Yet for the paucity of rights, women play a vital part in the society through performing essential, albeit menial, tasks and supporting their families (e.g., working as maid servant, factory workers, nurturing children, and cooking and cleaning for the family).

However, for the development of women in the area the Provincial Government has started many programs including skill training, small loan scheme. Different NGOs were also present in the area to facilitate local female with micro finance assistance and enhancing education of females of the area.

Information which was collected through secondary sources and group discussion with locals shows that major problems faced by women in the area are lack of primary health care facilities in local hospitals and the lack of education opportunities.

5 STAKEHOLDER CONSULTATION

5.1 GENERAL

Timely and broad-based stakeholder involvement is an essential element for an effective environmental assessment, as it is linked with project Planning, appraisal and development in general. Public involvement during EIA has a tendency to improve project design environmental soundness and social acceptability.

Public involvement, undertaken in a positive manner and supported by a real desire to use the information gained to improve the project design, will lead to better outcomes and lay the basis for on-going positive relationships between the stakeholders. It gives the feeling of an ownership to the local population. Public involvement is necessary for smooth implementation of the project and especially the local community whose support is also required for the success of the project.

The project management and implementation authorities are committed for undertaking public consultation at Provincial and local levels as a part of project planning/design for getting necessary environmental permissions.

This Chapter presents the objectives, process, and outcome of the consultations carried out with the key stakeholders of the project during the present EIA study. A consultation framework, describing the consultations to be carried out during the subsequent phases of the project implementation ensuring ongoing and inclusive dialogues with key stakeholder is also provided in this chapter.

5.2 OBJECTIVES

The objectives of stakeholder consultation were to contribute to the openness, transparency and dialogue. Special efforts were made to ensure that the communication with the public should be efficient and well balanced. The concerned stakeholder groups were identified to participate in the assessment process. Specific tasks and purposes of consultations with stakeholders have been given in the Table 5.1.

Table 5.1: Tasks and Purposes of Consultations

Task	Purpose of Consultation with Stakeholders
Why consultation with the stakeholders?	• To build trust to ensure sustained support for the project and build resilience for times of crisis. • To learn about public concerns that need to be addressed and taken into account in designing of the project concept and preparation mitigation measures and programs. • To learn about the strengths, skills and organizations that the stakeholders can bring to support project planning and implementation.
Modes and benefits of consultation	• Listening and dialogue with stakeholders to keep the project at tuned to public concerns early, to pre-empt breakdowns in public confidence. • Engaging the public as advocates for the project construction and to support the implementation of social, resettlement, and environment and health programs.

Other objectives of public involvement include:

- Informing the stakeholders about the proposed project;
- Providing an opportunity to those who remained unable to present their views and values, therefore allowing more sensitive consideration of mitigation measures and trade-offs;
- Providing those involved with planning the proposal with an opportunity to ensure that the benefits of the proposal are maximized and that no major impacts have been overlooked;
- Providing an opportunity for the public to influence the project design in a positive manner;
- Increasing public confidence in front of proponent, reviewers and decision makers;
- Providing better transparency and accountability in decision making;
- Reducing conflict through the early identification of contentious issues, and working through these to find acceptable solutions;
- Creating a sense of ownership of the proposal in the minds of the stakeholders; and
- Developing the project which is truly sustainable.

5.3 IDENTIFICATION OF STAKEHOLDERS

Identification of stakeholder is an important step which ensures that all the concerned stakeholders are identified for the following:

- Sharing of information with stakeholders about the proposed project activities and potential impacts of proposed project on the physical, ecological and socio-economic conditions in the CoI; and
- To address the most relevant concerns of the stakeholders on project and its activities including the upfront negative impacts.

5.3.1 Primary Stakeholders

Primary stakeholders are those who are directly concerned with the project or directly affected both positively and negatively by the project interventions. The primary stakeholders of this project include land owner, local residents and the proposed Project Affected Persons (PAPs). Apart from this, the beneficiaries of the project and the implementing agency are also primary stakeholders for the proposed project.

5.3.2 Secondary Stakeholders

Secondary stakeholders are people or groups that are indirectly affected from the project activities or have their interest in the proposed project such as Punjab-EPA, RUDA, Forest Department, Wildlife Department, Pakistan Horticulture Authority (PHA) and other various line agencies / departments of GoP.

Details regarding roles and responsibilities of the concerned agencies and departments are given below Table 5.2.

Table 5.2: Role of Concerned Agencies/Departments

Project Stakeholders	Roles and Responsibilities
Punjab Environmental Protection Agency	• Punjab-EPA is the regulatory authorities and mainly responsible for the development and implementation of the environmental policies and strategies in order to integrate the environmental issues and sustainable development approaches into the legal and regulatory frameworks as per Punjab Environmental Protection Act, 2012 (Amended 2017). • Punjab-EPA is responsible for the issuance of NOC of the Proposed Project. • EPA is responsible for the compliance of EMP and NOC provision during the construction and operation stages of the Project.
Wildlife Department	• To save and protect wildlife

Considering the importance of the project, consultations were carried out at all possible levels i.e., departmental and local level. The process of consultation is an on-going process which continues during the project life cycle and even after the submission of this report and so on. Stakeholders were identified, categorized and consulted at departments and community's level.

During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. Key stakeholders of the Project include government departments such as Environmental Protection Agency, Forest Department, Wildlife Department, Lahore Ring Road Authority and local communities including PAPs.

5.4 APPROACH FOR THE CONSULTATION AND INFORMATION DISSEMINATION

A series of public consultations were required to get the feedback/concerns of the different category of stakeholders including provincial departments, district level departments, potential PAPs, local community and other general public residing in the Project area.

Consultation process included meetings with specific proposed project PAPs, community meetings/consultations and semi-structured interviews and one to one meeting/ interviews with the government, private and civil society institutions. During the consultation process, the stakeholders were briefed about the project objectives and scope. Their fears and suggestions were recorded.

Consultations were conducted at two levels:

- Institutions/Departments Level and
- Community level consultations.

5.4.1 Consultations with Stakeholders at Departments Level

The stakeholder consultations were held with officials of the relevant departments. Details of department officials contacted are given in **Table 5.3.**

Table 5.3: List of Government Officials Consulted

Sr. No.	Department/Venue	Name/Designation
1.	Punjab-EPA	Mr. Imran DD EIA
2.	Wildlife Department	Mr. Tanveer Ahmad AD
3.	Pakistan Horticulture Department (PHA)	MS. Muneeb ur Rehman ADG
4.	Lahore Ring Road Authority	Mr. Muhammad Nadeem (Deputy incharge Traffic) Ring Road Authority

The Table 5.4 indicates the detail of issues raised/discussed and suggestions given during the consultation:

Table 5.4: Detail of Issues/Points Raised/Discussed during Departmental Consultations

Sr. No.	Department/ Organization	Suggestions
1.	Punjab- EPA	• It was suggested that all the relevant Acts, laws, regulations, guidelines especially Punjab Environmental Protection Act, 2014 should be followed during the preparation of EIA report; • Stakeholder Consultations with all the relevant departments should be carried out • Environmental Monitoring at all environmental sensitive areas along the route should be considered; • NOCs of all utility departments should be acquired prior to project construction.
2.	Wildlife Department	• The representatives of wildlife department were briefed about the proposed activities of the project. • Minimum/no damages to the habitats were recommended • Loss of trees will have discouraged to keep the eco balance and to protect habitat of wildlife of the region, if any. • The official shared that No project area is falling under any protected area of wildlife department. • Required details of the faunal species of the region were also provided.
3.	Parks and Horticulture Department (PHA)	• Tree cutting should be avoided up to maximum • During design stage green area should be planned • Proper area for Parks and landscaping must be designated. • Extensive Plantation should be carried out to compensate losses. • Proponent should provide budget and resources to PHA for all the activities.
4.	Ring Road Authority	• The representatives of were briefed about the proposed activities of the project. • It was suggested by the officials that the traffic management should be ensured during the construction of the project. • Ring Road traffic police will ensure their cooperation throughout the project.

Pictorial View of the Departmental/Community Consultations

Consultation with Deputy incharge Traffic of Ring Road Authority

Consultation with Assistant Director Wildlife Department

Consultation with Additional Director General, Pakistan Horticulture Authority

Consultation with Deputy Director EIA, EPA

A view of Consultation with Property Dealer

A View of Consultation with Haidary Flour Mill

A view of Consultation

A view of Consultation with Residents of Sharifpura

A View of Socioeconomic Survey Residents of Lakhodair

A View of Socioeconomic Survey with Residents of Sharifpura

5.5 COMMUNITY CONSULTATION AND PARTICIPATION PROCESS

For ascertaining the perceptions of different stakeholders about the project, meetings were held with communities within the project area of influence as well as with the PAPs in the COI specifically. Informal group discussions were also held as an additional tool for the assessment of the perceptions of the stakeholders about the project and potential impacts both positive and adverse likely to occur due to its implementation.

5.5.1 Methods of Public Consultation

The following methods were used for public consultations with project stakeholders in order to ascertain their stakes regarding project implementation. The views of the beneficiaries were formally recorded. The specific project PAPs were also consulted along with general public (randomly selected) who were residing or working in the COI of the proposed project.

- Community/Public Consultations
- Individual meetings with PAPs

5.5.2 Locations of the Public Consultations

The public consultations were conducted with the community members of the following locations;

- Lakhodair
- Sharifpura

5.5.3 Categories of Stakeholders Contacted

Different categories of stakeholders contacted, during consultation is shown in the Table 5.5.

Table 5.5: Stakeholders Contacted in the Project Area

Sr. No.	Stakeholder Category
1	Proposed Project PAPs
2	Local Residents
4	Business/ shop owners
5	Government and private Servants
6	Drivers

5.6 CONSULTATIONS WITH LOCAL COMMUNITIES AND PROJECT AFFECTED PERSONS

Extensive consultations were conducted with the local communities and project PAPs in the Project area to record their views and incorporating in the project planning. Consultations were held with the participants at four locations in the proposed project area. The major categories participated in these meetings were local population, community groups, landowners, and particular Project PAPs. The details of the participants with location is annexed as **Annexure-III.**

The participants were briefed about the proposed project site with the help of design maps. During the consultations, participants were informed/briefed about the project objectives and extensive question and answer sessions were conducted to clarify the project related works and activities to resolve the environmental, social and resettlement issues. They were briefed that the purpose of the consultations and discussions is to find out the possible solutions of the issues which may be faced before and during the construction of the proposed project. The concerns and their possible solutions presented by the participants regarding proposed project were recorded to make further possible recommendations. The summary findings of the consultations is presented in an annotated form given below in **Table 5.6.**

Table 5.6: Summary Findings of the Consultations

Sr. No.	Concerns Raised by Participants	Mitigation Proposed by Participants	Action to be taken by Project Executors
1	Provision of market based rates	Market based rates should be applied for the affected land and land based assets.	Proper market based rates will be applied.
2	During the construction period, mobility of the local community will be disturbed. Requested to provide proper access to road.	Alternate route should be provided to the local communities for convenience in mobility.	Possible alternate route will be provided before the commencement of the civil work on the proposed project.
3	Disturbance of the social amenities.	Participants were of the view that due to construction of the proposed project, several social amenities will be disturbed. These social amenities should be restored before commencement of the construction work to avoid any inconvenience for the local community.	Social amenities should be restored before execution of the civil work.
4	Due to construction activities as well as influx of labor, movement of the citizens particularly of females (working in fields), residing in the local area will be restricted.	In order to tackle this situation, construction should be carried out in scheduled hours. So that after construction hours, local community, particularly females can easily move in the area.	People should be aware about complete construction activity plans so that they can move in the area freely and safely.
5	Dust and noise will disturb the nearby residential and commercial structures.	All protective measures should be taken to keep safe the local community from noise and dust.	Contractor should be bound to take all protective and precautionary measures to keep safe the health and properties of the local people.
6	Job and labor opportunities for local people.	Skilled and unskilled work force should be hired from local community. It will enhance the acceptability of the proposed project among local people.	Contractor should be bound to hire the skilled and unskilled work force from the local community at priority.

5.7 PROPOSED CONSULTATIONS PROGRAM AND STAKEHOLDER WORKSHOP

The stakeholder consultation and engagement is an ongoing process and will continue throughout the project's construction as well as operation and maintenance phases. The ongoing consultation process could be scheduled on need basis with the stakeholders including but not limited to the concerned government departments, local administration, community representatives and PAPs from the proposed project area.

The overarching goal of consultations and community engagement is to support and facilitate the project's design and implementation, to reduce conflicts and project opposition, and to increase project's acceptability.

The community members will be compensated by the GoP and they will be encouraged to participate in project activities during construction and operation phases. The consultations will be made in future to facilitate the community at the local level.
The consultations will be carried out during the construction and operation phases of project. Consultations will be undertaken in all the communities twice or more time in a year, depending on the number of concerns raised under each consultation. Ongoing stakeholders' engagement activities include:

- Ongoing reporting on progress on the implementation of environmental and social management measures identified during the EIA process and recording of comments on the effectiveness of these measures;
- Updating communities and other stakeholders about project developments and recording comments on these; and
- Ongoing action of the grievance mechanism.

Efforts will be made to maximize the consultations during the project implementation. The consultations will be carried out with the objectives to develop and maintain communication linkages between the project promoters and stakeholders, provide key project information to the stakeholders, and to solicit their views on the project and its potential or perceived impacts, and ensure that views and concerns of the stakeholders are incorporated during the implementation with the objectives of reducing or offsetting negative impacts and enhancing benefits of the proposed project. The framework for the future consultations is elaborated in **Table 5.7,** but not limited to the following:

Table 5.7: Proposed Consultations Framework

Sr. No.	Stakeholders	Project Phase	Frequency of Consultation
1	Institutions/Departments	• Pre-Implementation • During the Project Implementation • At Closure period	• One round of consultation before start of implementation of project. • Bi-annually during operation phase • Once before the closure of the project.
2	Local Communities/ Key Persons	• Pre-Implementation • During the Project Implementation • At Closure period	• Consultation at different stages, before implementation, periodic meetings during construction phase and at the time of project completion.
3	NGOs/CBOs	• Pre-Implementation • During project Implementation • At Closure period	• Periodic meetings will be conducted as per requirement of the Project.

During the operational phase of the project consultation of stakeholder are important to assess the benefits of the project and impacts on the local communities. A comprehensive stakeholder consultation plan should be prepared by the contractor(s) to get feedback from the stakeholders and to resolve the issues during the operational phase of the project.

5.8 INFORMATION DISCLOSURE PLAN

After suggesting the possible solutions of the stakeholders' concerns, the solutions will be disclosed once again before the stakeholders and general public in the form of workshop.

EIA report will be accessible to interested parties on request and the version of final report will be available in the project office and RUDA website and its summary will also be available in national language.

6 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1 GENERAL

This chapter identifies the beneficial as well as the potentially significant adverse environmental and social impacts during design/pre-construction, construction and operation phases of the proposed project on the physical, ecological and socio-economic domains of the environment. The appropriate mitigation and remedial measures are proposed in this chapter. A project impact evaluation matrix has been developed to evaluate the potential impacts of the proposed Project. A brief qualitative description of each aspect and the affected environment in both RoW and the project's corridor of impact is presented below:

6.2 NOTION OF SIGNIFICANCE

The term ***"Environmental Impact"*** or simply *"**Impact**"* covers the negative, adverse or harmful as well as positive, desirable or beneficial impacts of the project on environmental settings. Prediction of impacts of the proposed activity is based on factual data; however, the significance of these impacts involves a value judgment technique. The nature of the impacts may be categorised in terms of:

Direction	-	Positive or Negative
Intensity	-	Low, Medium & High
Duration	-	Long or Short Term
Extent	-	Wide or Local
Reversibility	-	Reversible / Irreversible

Impact significance depends on both the nature of the impact and on the sensitivity of the receptor. The more sensitive the receptor the greater will be the significance of impact from that proposed activity. For this EIA, activities and nature of impact are combined with the sensitivity of the receptor to evaluate the significance of the impact. The significance of impact is characterized as very low, low, moderate, high and very high. Environmental issues having "moderate", "high" and "very high" significance are provided with mitigation measures.

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the impact significance criteria matrix as shown below. Most of the potential impacts can be mitigated by implementation of various types of mitigation measures; however, some residual environmental impacts may remain after mitigation.

Table 6.1: **Notion of Significance**

Impact Significance	Positive Impacts Score	Adverse Impacts Score
Very High	> 12	> 12
High	9 – 12	9 – 12
Medium	5 – 8	5 – 8
Low	2 – 4	2 – 4
Negligible	O	O

6.3 METHODOLOGY FOR IMPACT EVALUATION

The methodology adopted for the evaluation of the impacts included the following assessment tools, (i) project impact evaluation matrix and (ii) overlays. These tools were used to identify the significance and magnitude of the impact as well as the nature, reversibility, extent etc.

a) Project Impact Evaluation Matrix

The Impact Evaluation Matrix was developed by placing project activities along one axis (i.e., Y-axis), and on the other axis (i.e., X-axis) the different environmental parameters likely to be affected by the proposed Project actions grouped into categories i.e. physical, ecological and socio-economic environment. For the impact assessment, project impact evaluation matrix was used by dividing the project action into different phases (design/pre-construction, construction and operational phases). A Project Impact Evaluation Matrix is given as **Table 6.1**.

b) Overlays

In order to identify spatial based impacts, overlays were used. An overlay is based on a set of transparent maps, each of which represents the spatial distribution of an environmental characteristics. Information for an array of variables such as land use, infrastructure, vegetation etc. was collected for the standard geographical units within the project's CoI, recorded on a series of maps, typically one for each variable. These maps were overlaid to produce a composite map. The resulting composite maps characterize the Project area's land use, physical, social, ecological and other relevant parameters related to proposed intervention. The overlays maps used in this EIA study for the quantification of the landuse categories referred in Chapter 4.

Table 6.2: Project Impact Evaluation Matrix

Environmental Component / Project Component	Physical Environment					Ecological Environment							Socio Economic Environment												
	Soil (Erosion / Stability / Contamination)	Air Quality	Noise Level	Surface & Ground Water Quality	Solid Waste Generation	Aquatic Ecosystem	Terrestrial Ecosystem	Endangered Species	Migratory Birds	Beneficial Plants	Loss of Trees	Loss of Crops/Orchards	Conflict over Resources	Mobility of Locals	Public Infrastructure	Accessibility	Housing Infrastructure	Cultural Properties (Mosque, Shrine, Graveyard	Community Stability	Tourism And Recreation	Gender Issues	Cultural & Social Issues	Health& Safety	Aesthetic	Security Situation	Employment Opportunities
A. Planning & Design Phase	1	2	3	4	5	8	8	9	10	11	12	13	14	15	16	17	18	18	20	21	23	24	25	26	27	29
Topographic Survey of Project	o	o	o	o	o	o	0	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	0	o	o	o
Geotechnical Investigation	o	o	2	o	o	o	o	o	o	o	2	0	o	o	o	o	o	o	o	o	o	0	2	o	o	o
Temporary Acquisition of Land	o	o	o	o	o	o	o	o	o	o	4	o	o	o	o	o	o	o	3	o	o	0	o	o	o	o
Parmanent Acquisition of Land	o	o	o	o	o	o	o	o	o	4	8	0	12	o	12	o	0	0	7	o	o	0	o	o	0	o
B. Construction Phase																										
Site Clearance	9	9	9	2	8	o	12	o	o	9	12	0	6	6	12	3	0	0	o	10	o	2	9	4	2	6
Earthwork in Filling and Excavation	9	9	9	2	8	o	12	o	o	9	8	o	6	6	2	3	o	o	2	o	o	2	9	4	2	6
Establishment of Construction Camps & Workshop	2	2	4	o	o	o	4	o	o	o	o	0	8	o	o	o	o	0	4	o	4	4	8	4	o	6
Transportation & Storage of Construction Materials	4	6	6	2	4	o	2	o	o	o	o	0	o	4	o	o	o	o	4	o	o	4	6	4	o	4
Use of Construction Material and Heavy Machinery	3	8	9	o	4	o	4	o	o	o	o	o	o	2	2	2	o	o	o	o	o	2	8	o	4	4
Installation and operation of Batching and Asphalt Plants	4	8	8	2	4	o	2	o	o	o	o	o	2	o	o	o	o	0	o	o	o	o	6	4	o	4
Spoil Disposal	3	3	o	2	6	o	6	o	o	o	4	o	o	o	o	o	o	o	2	o	o	4	4	6	o	o
Structural & Civil Work	8	8	8	2	7	o	6	o	o	o	o	o	2	o	2	o	o	o	2	o	4	4	9	4	3	8
Drainage Work	6	6	6	2	6	o	6	o	o	o	o	o	2	o	2	o	o	o	2	o	4	4	9	4	4	8
Miscellaneous Work (Road Ancillaries, Traffic Signs and Signals etc.)	o	4	6	4	4	o	2	o	o	o	o	o	o	o	2	o	o	o	o	o	o	o	6	o	o	6
Pavement Work	2	4	6	2	4	o	2	o	o	o	o	o	o	o	o	o	o	o	o	o	2	2	8	o	o	6
Finishing and Comissioning	o	2	4	o	4	o	2	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	4	o	o	4
C. Operational Phase																										
Operation of Project	o	2	2	o	o	o	2	o	o	o	6	o	o	6	4	0	o	o	4	4	o	6	6	8	3	6
Inspection & Monitoring	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	0	o	o	o	o	o	2	4	o	3	4
Maintenance of Miscellaneous Work	o	o	2	o	o	o	o	o	o	o	o	o	o	2	2	0	o	o	o	o	o	o	4	o	o	4

Positive Impact Score	Impact Significance
0	Negligible
2 to 4	Low
5 to 8	Medium
9 to 12	High
>12	Very High

6.4 DELINEATION OF PROJECT STUDY AREA FOR IMPACT ASSESSMENT

Before proceeding to the environmental analysis of the Project, it is imperative to delineate the study area for impact assessment. It has already been described in Chapter-1, **Figure 1.3**. The study area which has been used for the environmental baseline information, impacts assessment and mitigation purposes and is described briefly below.

6.4.1 Study Area/Area of Influence (AOI)

Study area is a limit that identifies the area where direct and indirect impacts of the project activities are envisaged like existence of crops, built up structures, public utilities, etc. The study area of the proposed project is considered as 25m.

The location of Construction/Contractor camps, vehicle, equipment yard, material quarry areas and access tracks will be finalized by the Contractor. The assessment for those components is generic in nature and will be updated accordingly as the project information is made available.

6.5 POTENTIAL ADVERSE IMPACTS

Apart from positive impacts, there are some potential significant adverse environmental and social impacts on the local environment. The proposed Project is divided into three (03) phases i.e., Pre-construction / Planning and Design phase, Construction phase and Operation and Maintenance (O&M) phase. The Pre-Construction phase includes all stages before the construction Stage (i.e., site investigation work i.e., topographical, geo-technical studies, etc.); Construction phase includes all stages from mobilization of Contractor to the completion of Project; and Operation Stage starts after the Construction Stage which includes the inspection and repair works.

Adverse impacts envisaged at these three (03) stages of the proposed road project along with their proposed remedial or mitigation measures are detailed below:

6.6 ADVERSE IMPACTS DURING PLANNING AND DESIGN PHASE

Potential adverse impacts during the planning and design stage of the Project are given below:

6.6.1 Technical Design and Layout Planning

Incompatible layout plan and engineering design of the project's structures (retaining walls, ramps, bridges, etc.) can undermine the overall aesthetic beauty and ambience of the project area. Also low utilization of the available spaces and designing the structures without considering the prospective and futuristic needs can result in structures with low social acceptability and functionality. This future traffic factor if not considered in the design properly, will also affect the project road and public safety of the Project Area. Similarly, the

locals may also face access problems. This impact is temporary and minor negative in nature.

Mitigation Measures

- The technical design of the proposed project must consider all the above mentioned factors for the final design and should meet all the local and international (e.g., AASHTO) standards; and
- The proponent must review and validate all the design parameters considering the possible impacts (as mentioned) before the start of construction of proposed Project.

6.6.2 Topography

The project area has plain topography and no cutting/excavation of land is involved except for piling. No significant physical change in the topography is expected. This impact is minor negative and permanent in nature.

Mitigation Measures

Mitigation measures will involve adoption of best engineering design measures keeping in view of the aesthetics of the project area and provision of green belts for the landscape in design.

6.6.3 Storm Water Drainage / Urban Flooding

The construction of proposed Project may be subjected to urban flooding as the project area has high frequency of rainfall during monsoon season. Improper design of storm water drainage of the proposed Project may result in stagnant water on the road due to which following impacts are expected to arise:

- Deterioration of road surface and reduction of its bearing capacity;
- Inconvenience for commuters/pedestrians;
- Stagnant water may provide the breeding ground for disease vector; and
- Foul odour may be generated.

This impact is temporary and medium negative in nature.

Mitigation Measures

Mitigation measures will include provision of appropriate drainage structures with appropriate design capacity to avoid urban flooding especially during the rains. Proper slopes shall be incorporated in design to avoid the stagnant water on at-grade road surface.

6.6.4 Seismicity

In Building Code of Pakistan (Seismic Provisions, 2007), the whole region of Pakistan is classified into five main Seismic Hazard zones i.e., i) Zone-1, ii) Zone-2A, iii) Zone-2B, iv) Zone-3, v) Zone-4 based on the peak horizontal ground acceleration and its ultimate tendency to damages during seismic events. The proposed Project Area falls in the seismic zone classified as “Zone-2A” with g-value 0.08 to 0.16, and is considered as Moderate Hazard seismicity zone.

In case of an earthquake, the proposed road expected to suffer damages if designed without consideration of seismic activities. This would be permanent and major negative in nature. However, No change in the impact of seismology risk of the area is expected during the project construction phase as none of the project activities is expected to be of such a powerful extent to influence the tectonic risk.

Mitigation Measures

- The proposed structures (bridges, etc.) should be designed and constructed keeping in consideration high intensity earthquakes. For seismic hazard analysis, updated structural and seismic evaluations should be conducted by the design engineer/consultant. Moreover, geo-technical investigations must be conducted prior to construction phase;
- Seismic Building Code of Pakistan 2007 (SBC-07) should be adopted. This code specifies minimum requirements for seismic safety of buildings and has to be applied and used by engineers in conjunction with the necessary understanding of the concepts of structural, geotechnical and earthquake engineering; and
- The structure of the proposed project should also be studied by the proponent (RUDA) to evaluate its durability/strength to withstand moderate to high intensity earthquake.

6.6.5 Land Procurement

About 54 kanals of Land will be required for the proposed project. This may result in loss of land, infrastructure, commercial activities and disturbance to local people.

The detail of land under the impact and record of ownership status will be prepared by the Revenue Department and RUDA.

Mitigation Measures

The process of land procurement will be followed in a transparent manner to minimize the impacts to provide judicious compensation to the affected persons by providing sufficient budget in the project cost.

6.6.6 Resource Conservation

Resources involved in the construction of proposed project would include water, fuel and construction materials.

Excessive water consumption by the construction staff may stress water resources in the project area and in certain cases may disturb the existing water supplies in the project area.

Construction material to be used for construction includes coarse aggregates, fine aggregates, asphalt, cement, lining material, earthworks, reinforced and structural steel etc. Almost all the materials to be used in the construction of proposed project are non-renewable and therefore their efficient use is necessary to make it available for future use.

Fuel will be used to operate construction machinery. Efficient use of energy resources is important to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is important. The impact is medium negative and permanent in nature.

Mitigation Measures

Following practices shall be adopted to conserve these natural resources:

- Use potable water bowsers for construction works and filtered or treated ground water for drinking purpose;
- Plan for the provision/purchase of adequate insulation to reduce heat loss through batching plants;
- Reduction of wastage of water through training of workers involved in water use;
- Reuse of construction waste materials may be adopted wherever possible;
- Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment;
- Efficient and well maintained equipment and machinery should be used with fitness certificate;
- The equipment and machinery should be turned off when not in use;
- Ensure adequate insulation to reduce heat loss through batching plants;
- Regularly monitor CO and CO_2 content of the flue gases to verify that combustion systems are using practical excess air volumes;
- Use of solar panels at construction camps may be considered and plan for use of solar panels at operational phase may also be considered; and
- A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels.
- Resource Conservation Plan is attached as **Annex-IV.**

6.6.7 Route (Alignment) Optimization

Improper route selection of proposed project will lead to disturbance to environmental and social issues related to resettlement and displacement of people. This impact would be of moderate significance.

Mitigation Measures

Most of the significant environmental, ecological and social impacts of the project have been addressed at the design phase. In order to minimize environmental, ecological and social

issues at the detailed design stage, various features have been considered. The route alignment has been finalized and efforts have been made to avoid or minimize impacts on habitat, resettlement and relocation issues and disturbance to sensitive receptors.

By considering the optimization of route, the impact of route alignment has been reduced to low significance.

6.6.8 Public Utilities

Due to the proposed project, public utilities i.e., Electricity Polls, Power/Telephone Lines, etc. will be affected creating disruption of public services and inconvenience to the local residents. This impact is temporary and may be considered as moderately negative in nature.

Mitigation Measures

Mitigation measures will include:

- The provision in the design and budget for the relocation of the existing utility infrastructures wherever required shall be finalized in consultation with the concerned department; and
- All public utilities (e.g., electric lines, water pipes, power/ telephone lines, etc.) likely to be affected by the proposed project will be relocated well ahead of time before the actual commencement of the construction works.

6.6.9 Flora

During the pre-construction phase, activities such as installation of construction camps, construction of temporary roads and mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed that require significant space due to which available vegetation is expected to be removed. This impact is site-specific, temporary, medium significant and needs to be encountered prior to the start of construction stage.

Mitigation Measures

- The camps, mobility of machinery and construction of temporary road should be properly planned and well designed to avoid any loss to local green cover;
- It is recommended to establish the construction camps where minimum or no vegetation exists;
- Similarly, the alternate routes for roads and points for camps are recommended where no loss of vegetation is expected; and
- The location of construction camp(s) will be selected so, as to have limited environmental effect during construction phase and to reduce the cost and land requirement.

6.6.10 Fauna

As movement and installations of machinery and vehicles will take place during this pre-construction phase so noise and habitat loss is expected. The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements and installations. Temporary road may also affect the habitat of locally available fauna. This impact is site-specific, temporary, and low significant.

Mitigation Measures

- The standard measures must be considered prior to construction phase to minimize noise due to machinery movements and installations;
- The alternate routes and points are recommended to avoid any damage to locally available fauna;
- The construction camp management plan during the planning stage must consider fencing and gating to check the entry of animals in search of eatable goods;
- Similarly, Waste Management Plan of the camps must be considered at the planning stage to prevent wild animals and birds.

6.6.11 Socio-economic Environment

During the planning and design phase of the project, it is anticipated that there will not be any potentially significant adverse impact on the socio-economic environment. Locals may be temporarily disturbed due to the field investigations and drilling activities. This impact can be categorized as indirect, low, site-specific, short term, temporary, low probable.

Mitigation Measures

No mitigations measures are required except good engineering practices to avoid and reduce these low adverse impacts.

6.7 IMPACTS DURING CONSTRUCTION PHASE

6.7.1 Soil Erosion

Construction activities such as clearing of earth, levelling, piling, compaction, carpeting, pavement finishing will affect the existing soil condition in the study area. The clearing of vegetation can also loosen the soil and make it more susceptible to erosion due to wind and rain. There is also a possibility of silt runoff during rainy season causing soil erosion. During the rain, the eroded soil mix with stagnant water to transform into slush, which can affect movement of vehicles and machinery and construction work as well as limit the movements of local people.

Soil erosion may also occur in the workshop areas as a result of improper drainage system of equipment washing-yards and improper management of construction activities. This impact can be categorized as site-specific, long term, moderate negative and irreversible.

Mitigation Measures

Good engineering practices will help to control or minimize the soil erosion both at the construction sites and in peripheral areas. All the disturbed areas need to be protected against soil erosion by stripping and stockpiling of all the available topsoil for later re-vegetation. Special slope protection measures will be adopted in the sensitive areas and along the shoulders of roads and excavations shall be kept confined to the specified foundation spots as per the approved engineering drawings. Unnecessary excavations should be avoided.

The provision for vegetation with a fast growing crops/trees and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization will be made in the design. Use of stone pitching or riprap will also be provided in the design at appropriate places especially around bridges and culverts. Provision for rip-rap in discharge zones from drainage structures will be made in the design to reduce erosion. Down drains/chutes will be lined with rip-rap/masonry or concrete to prevent erosion. Side slopes will be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion. Site restoration plan for the Project should be strictly followed.

6.7.2 Soil Contamination

The soil contamination occurs at all construction stages: during the design and survey work, during the construction, directly during the work on the construction site. Land may be contaminated due to the spillage of chemicals, fuels, solvents, oils, paints, concrete, solid waste generated at campsites etc. This normally happens when these materials are transported in open or loosely capped containers. Various types of machinery will be used at the construction sites. This machinery will not only pollute the atmosphere at the construction sites and adjacent communities, but also have a negative impact on the soil surface layer.

The possible contamination of soil by oils and chemicals at camp sites, workshop area and equipment washing-yards may limit the future use of land for agricultural purposes. This impact can be categorized as site-specific, long term, moderate negative.

Mitigation Measures

The following practice will be adopted to minimize the risk of soil contamination:

- The Contractors will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination;
- Material Safety Data Sheets (MSDS) will be strictly followed during handling and storage of chemicals;
- Soil contamination due to concrete transportation will be minimized by placing all containers in casings;

- Solid waste generated at the camp sites will be properly treated and safely disposed only in the demarcated waste disposal sites/areas;
- If any contaminated soils are found, they shall be removed and deposited in a sealed pit in an area agreed with the concerned; and
- Use of modern, well-maintained machinery and vehicles by the contractor to avoid emissions and leakages;
- Soils removed during construction would be stockpiled for reuse where possible; and
- Runoff from washing of equipment and gadgets should be drained into either a septic tank or a sand-gravel bed for removal of the grit and contaminants.

6.7.3 Borrow/ Open Pits

Borrow/ open pits and associated excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation and landscape degradation. Borrow/ Open pits may also become potential sources of mosquito breeding and may prove hazardous to humans, livestock and wildlife. This will also degrade hygienic condition of the Project Area. This impact is permanent and moderate negative in nature.

Mitigation Measures

Mitigation measures will include:

- Necessary permits will be obtained for any borrow pits from the competent authorities;
- In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4;
- Soil erosion along the borrow pit will be regularly checked to prevent/ mitigate impacts on adjacent lands;
- In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and
- Borrow pits will be used for construction waste, but during the excavation, top 20 cm soil cover will be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.

Quarry Management Plan is attached as **Annex-V.**

6.7.4 Air Quality

Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles. Emissions may be carried over longer distances depending upon the wind speed, direction, temperature of surrounding air and atmospheric stability. The operation of an asphalt plant causes the emission of many different pollutants. The most common pollutants emitted from hot mix asphalt plants are particulate matter (PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and carbon monoxides (CO).

Potential impacts on the air quality during the construction stage will be due to the fugitive dust and the exhaust gases generated in and around the construction site. Dust is a major

component of air pollution during road construction. Emissions are generated mainly from the following construction activities:

- Site clearance and use of heavy vehicles and machinery/equipment etc. at construction site;
- Procurement and transport of construction materials such as sand, cement, etc. to the construction site;
- Other Gaseous emissions during construction result from operating of construction vehicles, plant and equipment;
- Increase in air pollution levels without project and with project during construction period (for mobile & stationary sources) is predicted from construction machinery, equipment, which reveals that there shall not be significant contribution towards pollution due to the construction activity of the project if mitigation plan will be implemented and monitored in proper sense; and
- Asphalt heating.

The construction activities will also result in increased air pollution in the area. The overall impact on the quality of air during the construction phase will be temporary, moderate negative and limited to the project's implementation phase only.

Mitigation Measures

The impacts associated with the construction phase of the proposed project could be effectively mitigated by the implementation of simple procedures by the Contractor including but not limited to the following:

- All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions;
- Open burning of solid waste from the Contractor's camps and at construction site should be strictly banned;
- Preventive measures against dust should be adopted for on-site mixing and unloading operations;
- Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS (as amended) for carbon emissions and noise;
- Regular water sprinkling of the site or use of chemical dust suppressants should be carried out to suppress excessive dust emission(s);
- Emissions from power generators and construction machinery are important point sources at the construction sites. Proper maintenance and repair is needed to minimize the hazardous emissions;
- Emissions from batching / asphalt plants can be controlled efficiently by the installation of cyclone / scrubbers. Diesel operated equipment should be equipped with well-maintained fuel filter and may be replaced timely (if required). In addition to that, regular maintenance activities comprising changing of lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators;

- Construction equipment is generally left idling while the operators are on break or waiting for the completion of another task. Emissions from idling equipment tend to be high. Existing idling control technologies, which automatically shut the engine off after a pre-set time can reduce emissions, without intervention of the operators;
- PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works;
- Construction workers should be provided with masks for protection against the inhalation of dust;
- Vehicles used for construction should be tuned properly and regularly to control emission of exhaust gases;
- Ensure precautions to reduce the level of dust emissions from hot mix plants, crushers and batching plants; by providing dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards. Moreover, ensure that the batching and asphalt plants are equipped with emission control devices like scrubbers, electrostatic precipitators or bag filters; and
- Regular monitoring of air quality in accordance with PEQS.

6.7.5 Noise/Vibration

The noise and vibration will be produced due to the operation of construction machinery and equipment (refer **Table 3.1**: Machinery and Equipment Requirement for the Proposed Project). Sources of noise and vibration during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers, asphalt plants and other equipment's. Noise and vibration are perceived as one of the most undesirable consequences of construction activities. The above machinery is expected to generate noise levels that would be severe in the project area.

The cumulative effects from several machines can be significant and may cause significant nuisances. However, these increased noise levels will prevail only for a short duration during the pre-construction and construction phase.

The likely impacts due to noise are:

- Psychological effects of distraction of attention, irritation and short temperedness in the exposed persons due to persistently higher noise levels; and
- Noisy settings and higher background levels can cause temporary threshold shift and the consequent habit of speaking loud, which may cause damage to vocal cords in the persons exposed.

Though the construction method that has not been determined yet, however it is believed that the adopted method of construction shall produce less noise and vibration if the suggested mitigation measures are adopted.

Mitigation Measures

There are a variety of ways by which construction equipment and worksite noise can be controlled. The following is a list of ways to control noise level at the worksite of the proposed project:

Quieter Equipment

A cost-effective way to reduce noise at a construction worksite is to buy quiet equipment. In addition, equipment in use should be the most suitable for the job. Avoid using equipment that is over-powered and, conversely, avoid using under powered equipment. Whenever possible the quietest equipment alternative should be used. In general, electronic powered equipment is quieter than diesel powered equipment and hydraulically powered equipment is quieter than pneumatic power.

Modifying Existing Old Equipment

The most common way to reduce the noise levels of common construction equipment is through worksite modifications. Some common worksite modifications consist of retro-fitting existing equipment with damping materials and mufflers.

Barrier Protection

An effective way of reducing noise is to locate noisy equipment behind purpose-built barriers. The barriers can be constructed on the work site from common construction building material (plywood, block, stacks or spoils) or the barriers can be constructed from commercial panels which are lined with sound absorbing material to achieve the maximum shielding effect possible. To be effective, the length of the barrier should be greater than its height. The noise source should not be visible and barrier should be located as close as possible to either the noise source or the receiver.

Work Activity Scheduling

Work activity scheduling are administrative means to control noise exposure. Planning how noise sources are sited and organized on a work site can reduce noise hazards. Jobs can be rotated so that exposure time is limited. Transferring workers from a high exposure task to a lower exposure task could make the employee's daily noise exposure acceptable. Administrative controls include activity planning, for example, scheduling pavement breaking operations so as to reduce the number of work site workers exposed. In addition, noisy equipment should not be run for periods longer than necessary and should be switched off when not in use.

Maintenance

Increased attention to maintenance of tools and equipment will reduce worksite noise levels. Maintaining plant and equipment in good order not only increases its life, but makes it safer to use and quieter. Loose and worn parts should be fixed as soon as possible. Ideally, the worksite should have a system in place for checking and servicing the various machines and power tools.

Noise Perimeter Zones

Noise Perimeter Zones (NPZ) are another administrative control to limit exposure to noisy processes or equipment to as few workers as possible. NPZ are areas where noise levels of 90 dB (A) or more are roped off and marked to keep out all workers who don't have to be there. NPZ can be set up using a sound level meter to find the safe distance from the source (90 dB (A)) and the NPZ can be set up at that distance. Noise does not radiate from the source at the same level in all directions. Noise from machinery can be higher in one

direction than another because the noise can also be either absorbed or reflected from surfaces it contacts, such as the ground or a wall. Therefore, measurements should be taken at several points in an area where people might be working. Once noise levels that are 90 dB (A) or more are determined, rope off this area as the Noise Perimeter Zone. Exclude all workers who do not need to be in that zone. All workers who need to work within the zone must wear hearing protection.

6.7.6 Construction Camps/Camp Sites

Due to the construction camps[12], loss of vegetation and dis-satisfaction of rehabilitation measures during and after completion of construction phase may occur. These impacts may include waste, soil pollution, groundwater pollution, dust, etc. However, the impact will be temporary and moderate adverse in nature. For these impacts, mitigation measures have been developed to minimize the likelihood, extent or duration of their occurrence and any associated adverse effects. **Table 6.3** summarizes potential impacts and proposed mitigation measures associated with construction camps.

Table 6.3: Summary of Workers Camp Impacts & Mitigation Measures

Potential Impact	Proposed Avoidance and Mitigation Measures
Environmental ▪ Temporary habitat loss or disturbance ▪ Temporary visual intrusion ▪ Noise emissions at a single location ▪ Waste generation ▪ Discharge of sanitary effluents and rainwater run-off to nearby water bodies	***Environmental*** ▪ Reinstate any temporary facilities to pre-existing conditions in ecologically sensitive areas. ▪ Implement landscaping plan for all facilities in areas where high landscape value and visual vulnerability to the proposed activities warrants site-specific landscape restoration measures. ▪ Operate equipment in a manner sympathetic to the ambient noise environment. Do not leave equipment idling unnecessary. ▪ Provide adequate warnings of impeding works to all potential receptors within a 1 km corridor surrounding the RoW via public notices and local news.
Social ▪ Worker camp site: consultation surrounding potential construction camp sites revealed concerns regarding the location of proposed sites for Worker Camps.	***Social*** State land will be a second preference for worker camp locations, followed by land where there is a willing lessee. Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different socio-cultural values. Training will be provided to all staff on camp management rules and overall discipline and cultural awareness. This will include, in appropriate languages: ▪ A briefing on camp rules

[12] The location of construction camps will be provided by the Contractor in coordination with the RUDA before mobilization.

Potential Impact	Proposed Avoidance and Mitigation Measures
	▪ A community relations orientation to increase awareness about the local area, cultural sensitivities and the project Code of Conduct ▪ Awareness-raising on health considerations, including Sexually Transmitted Diseases (STDs). The construction contractor is required to develop a Construction Camp Management Plan to address: ▪ Discipline; ▪ Community liaison; ▪ Ethnic tensions and; ▪ Communicable diseases. A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan, which provides policies and a disciplinary framework with respect to worker behavior.
Camp Location The final location will be determined by the construction contractors and agreed with the RUDA.	***Camp Location*** The construction contractor will be required to assess the environmental/social sensitivity of any additional or alternative sites prior to their approval for adoption.

Some additional mitigation measures should include:

- The contractor(s) should provide plan to RUDA for removal & rehabilitation of site upon completion;
- Photographical and botanical inventory of vegetation before clearing the site; and
- Compensatory plantation to be scheduled when construction works near end.

6.7.7 Wastewater Generation at Construction Camps

Wastewater will be generated at the construction camps by the workers. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as river Ravi, water channels, etc. apart from soil contamination. The wastewater generation is estimated to be 3,200 liters/day[13] for 100 construction workers during construction phase of the proposed Project. This impact can be categorized as moderate, site-specific, temporary and reversible.

Mitigation Measures

To dispose the liquid waste generated from the construction activities, the following steps will be taken by the Contractor:

[13] Tentative Work Force Requirements Including Client and Contractor Staff"
= (100) x (40) = 4,000 liters/day
= (100) x (80% of wastewater) =3,200 liters/day

- Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e., septic tanks (as shown in **Figure 6.1**).
- Proper monitoring to check the compliance of PEQS will be carried out; and
- Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit.
- The Contractor(s) will be responsible to submit details of site-specific wastewater management plan along with details of wastewater collection, transportation and its disposal.

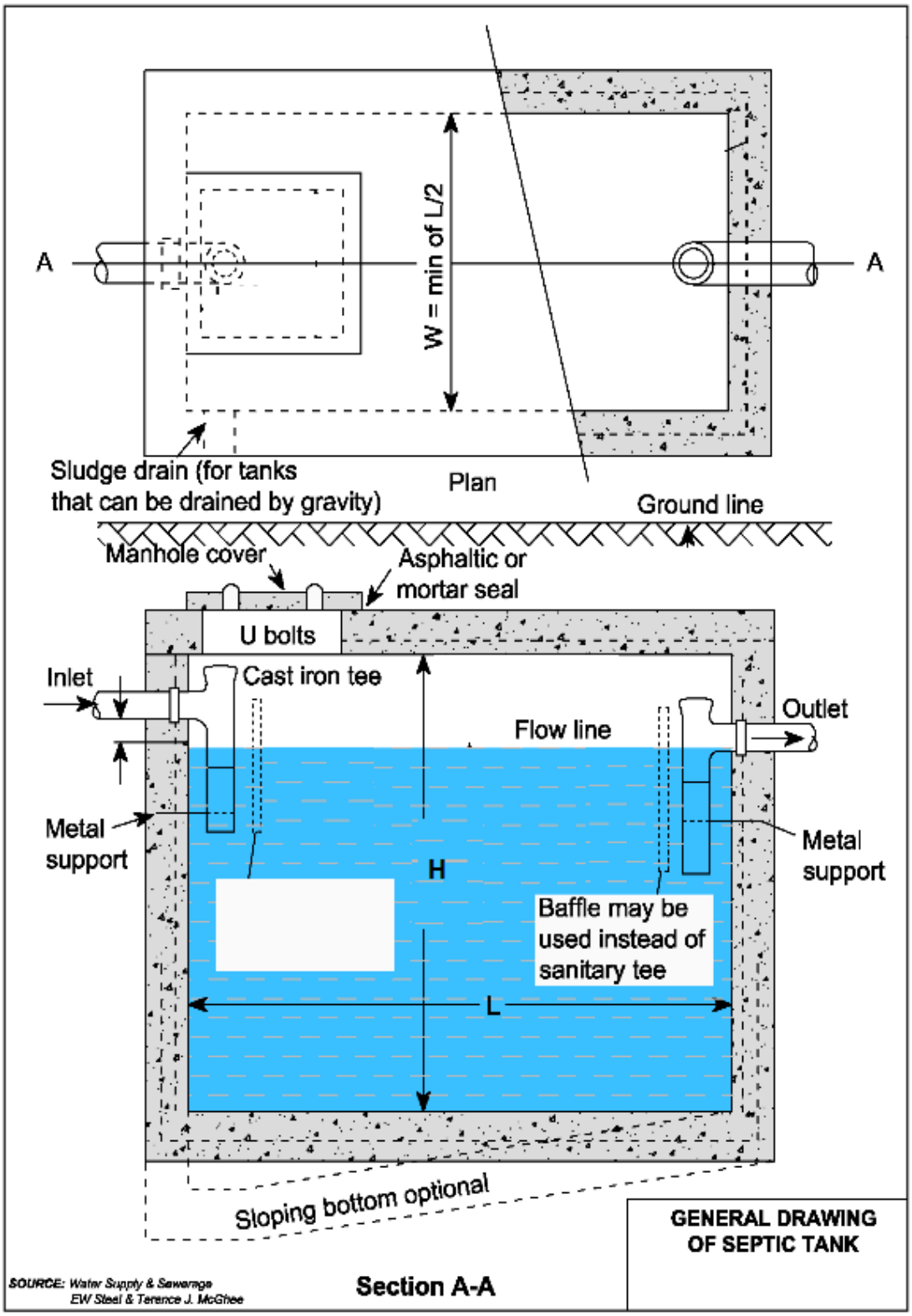


Figure 6.1: General Drawing of Septic Tank

6.7.8 Solid Waste Generation at Construction Camps

Considering the labourers (about 100 in numbers) residing in the construction camp and the locally available labour, an average solid waste generation rate of 0.45 kg/capita/day[14] is adopted for the estimation of solid waste generation. Based on this assumption, a total of about 45 kg of solid waste will be generated from construction camps on daily basis. The major components of the labour camp waste will be garbage, putrescible waste, rubbish and small portion of ashes and residues Insecure and unhygienic disposal of the solid wastes particularly garbage and trash may cause degradation of soil and land.

Insecurely disposed off heaps of wastes containing kitchen garbage and food waste can serve as breeding grounds for the disease spreading vectors and rodents. Throwing away of solid wastes into water channels and the wastewater network can result into choking of the latter. These impacts are temporary and moderate negative in nature.

Mitigation Measures

- All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration of the concerned solid waste management department for the disposal of solid waste;
- The Contractor must develop a plan of action with the help of concerned solid waste management department for transporting the waste to the disposal site;
- Toxic waste will be handled, stored, transported and disposed-off separately. Safe handling precautions and product specific information is found in Material Safety Data Sheets (MSDS) which must be located on site and accessible to all workers
- All persons interacting with hazardous wastes will be required to wear the appropriate PPE; and
- The waste will be properly sealed in containers with proper labels indicating the nature of the waste.

6.7.9 Waste Generation at Construction Site

The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials etc.). The handling and storage of oil and other hazardous waste will be a source of environmental pollution during the excavation, foundation, levelling, carpeting and pavement activities. The quantification of construction material waste is not available but it is anticipated that less amount of such waste will be generated along the route length.

Improper disposal of construction waste can lead to nuisance and hazards towards environment and local population. The unspent materials and debris produced from consumed up materials, if left as such and allowed to mix with soil underneath, can degrade

Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day.

the quality of receiving soils and render them unfit for plantation. Leakages of oils, lubricants, chemicals, and other similar substances from their storage sites can spoil the receiving soils and may undermine ability of the spoiled soils to support growth of vegetation and plants.

The estimated quantity of excavation material for clearance cannot be provided at design stage. The contractor will provide the estimated quantity of excavation material during the construction phase. These wastes will be generated due to the construction activities and the materials used for construction. This waste would also require proper disposal to minimize any contamination of land and water resources. This impact can be categorized as moderate negative, site-specific, temporary and reversible.

Mitigation Measures

Mitigation measures will include:

- Waste Management Plan (**Annex-VI**) will be implemented to ensure safe handling, storage, collection and disposal of construction wastes and the training of employees who handle waste;
- Recyclable wastes e.g. steel bars will be sold to waste vendors;
- Reusable material will be used as a filling material during ground levelling;
- Solid waste generated during construction will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan; and
- The site will be restored back to its original conditions after construction completion.

6.7.10 Impact on Water Resources (Surface and Groundwater Contamination)

The runoff from the chemical storage areas may also contaminate the near by surface water bodies. The construction waste, if left un-attended will result in leachate formation, which will percolate through the soil strata and reach to groundwater table and will contaminate it. This impact can be categorized as local, temporary, moderate negative and reversible.

Mitigation Measures

As a mandatory step, all the effluents will be disposed as per the requirements of PEQS 2016. Moreover, to reduce the risk of surface and groundwater contamination, good management practices will be adopted to ensure that fuels, chemicals, raw sewage and wastewater effluent are disposed of in a controlled manner. These measures are described below:

- Construction camps will be established in areas with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met;
- The surface and groundwater reserves will be adequately protected by installing screens and barriers to protect the source of contamination such as construction and oily waste that will degrade its potable quality;

- The proponent will ensure that the construction work is confined within the Study area and water bodies are prevented from pollution during construction;
- The solid waste will be disposed of at designated landfill sites to sustain the water quality for domestic requirements;
- Regular water quality monitoring according to determined sampling schedule;
- The contractor will ensure that construction debris do not find their way into the drainage or irrigation channels which may get clogged;
- To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas;
- Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond;
- Construction work close to the distributaries or other water bodies will be avoided, especially during monsoon period;
- Wastewater effluent from the Contractors' workshops and equipment washing-yards will be passed through gravel/sand beds to remove oil/grease contaminants before discharging into the natural streams. According to the PEQS, the BOD concentration in sewage must be brought down to less or equal to 80 mg/l before being discharged into a natural stream having capacity to dilute the effluent. For wastewater apart from BOD, COD of 150 mg/l will also be checked; and
- Similarly, if the sewage after treatment is to be discharged on to the land it will meet the requirements of the PEQS for disposal of wastewater.

6.7.11 Traffic Issues

The project area will be approached through main ring road (L-20). This road serve as main approach roads to the Project Area and due to the proposed construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling to the Project Area. The problems will include traffic jams and inconvenience to the public passing through the Project Area. It will also increase traffic load on the existing road network or access roads ultimately deteriorating the existing condition of the roads. The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions, vibrational impacts, etc. Considering these consequences, this impact can be categorized as medium term, temporary and irreversible.

Mitigation Measures

To minimize traffic problems in the project area, following measures will be considered:

- Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime to reduce traffic load and inconvenience to the local population;
- Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary congestions along the major roads;
- The speed of the vehicles will be controlled (at 30 to 40 km/hr) to reduce the probability of severe accidents, soil erosion, debris flows due to vibrations and dust emission;
- Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work;

- Proper sign boards will be provided for smooth flow of traffic;
- Period of construction and area / location of construction site shall be informed to public in general and specifically to local residents; and
- Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays.

Traffic Management Plan (TMP) will be implemented by the contractor to avoid traffic accidents, jams/public inconvenience. A TMP framework is attached as **Annex-VII** for contractor guidance, whereas site specific TMP will be submitted by the contractor.

6.7.12 Occupational Health and Safety

Occupational Health and Safety (OHS) related impacts will arise during construction activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. The falls during inspection or maintaining pile rigs, erection of framework and other related activities may also occur. Eye injury can be caused by stone or metal particles. Hazard of being hit by falling objects, major hand-arm and whole body vibration hazards, skin and respiratory tract irritation from exposure to cement dust, overexertion and awkward postures etc. will be another impact. Welding hazards include electric shock, fumes and gases, fire and explosions, falls from height, eye and head injuries etc.

Other impacts will be fall from height, contact with heavy electrical and mechanical equipment, equipment failure, uncontrolled movement, unguarded moving mechanical equipment parts, fatigue, unbalanced load, falling objects, hand injury, slip and trip hazards, wind / storm activity, injury from releasing load too soon etc. Operating mechanical and electrical equipment will trigger the H&S issues e.g., struck by moving vehicles or other equipment, slips or trips, struck by flying objects, such as dirt or splashed fluids, caught in pinch points, shear points, crush points, falling from machine etc. The proposed project area is also sensitive from the law and order point of view and the security as well as the safety of the Contractor and Consultant staff will be a major issue. Considering these consequences, this impact can be categorized as site-specific, medium negative and irreversible.

Mitigation Measures

Following mitigation is given to avoid the accidental risks:

- A Occupational Health and Safety Framework is attached as **Annex-VIII** for contractor guidance, whereas site specific HSE Plan will be submitted by the contractor.
- Punjab Occupational Safety and Health Act 2019 ensures the compliance of occupational safety and health of the persons at workplace and to protect them against risks arising out of the occupational hazards;
- Compliance with the safety precautions for the construction workers as per International Labour Organization (ILO) Convention No. 62, as far as applicable to the Project Contract;

- Training of workers in construction safety procedures, environmental awareness, equipping all construction workers with safety boots, helmets, gloves and protective masks, goggles, shields and monitoring their proper and sustained usage;
- Contractor will ensure the provision of medicines, first aid kits, ambulance etc. at the camp site;
- Work areas will be cordoned off where necessary;
- Contractors will instruct their staff to use Personnel Protective Equipment (PPE) (e.g., wire containment, displaying warning signs along the work site, communicating advance warnings to mats) to enhance the safety; and
- Safety lookouts will be built to prevent people and vehicles from passing at the time of hot or cold work; and
- An emergency management plan must be devised by the contactor in close coordination with the provincial emergency services (Rescue 1122).

6.7.13 Community Health and Safety

The construction activities and vehicular movement at construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. 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 proposed Project will also have potential of air (dust pollution), noise and vibrational impacts on nearby community. The labour works with different transmittable diseases may cause spread out of those diseases in the local residents. The construction areas located near the residential, settlements, may cause accident for the people moving near to those areas. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Tensions may also arise between different groups within the labor force, and pre-existing conflicts in the local community may be exacerbated. Ethnic and regional conflicts may also be aggravated if workers from one group are moving into the territory of the other. Considering these consequences, this impact can be categorized as site-specific, medium term, temporary and irreversible.

Mitigation Measures

- Providing basic medical training to specified work staff and basic medical service and supplies to workers;
- There will be proper control on construction activities and oil spillage leakage of vehicles;
- The labourers with different transmittable diseases will be restricted within the construction site;
- Ensure that the site is restricted for the entry of irrelevant people particularly children;
- 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 and social links;

- Seeking cooperation with local educational facilities (school teachers) at each village along the route for road safety campaigns;
- Provision of proper safety and diversion signage at sensitive/accident-prone spots;
- Setting up speed limits in close consultation with the local stakeholders;
- The mitigation measures provided in the following sub-sections for air and noise shall be adopted to reduce the air pollution, noise pollution and vibrational impacts on nearby community;
- The communicable disease of most concern during construction phase, like Sexually-Transmitted Disease (STDs) such as HIV/AIDS, will 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 will be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which include prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat close to human settlements and by eliminating any unusable impounding of water;
- The Contractor will prepare the construction camp management plan which, in addition to other components, will include the labor influx management plan. This will be reviewed and approved by RUDA; and
- Contractor will take due care of the local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions.

6.7.14 COVID-19 Scenario

The COVID-19 belongs to a family of viruses known as the Coronaviruses, which can cause illnesses ranging from the common cold to more severe diseases, such as the severe acute respiratory syndrome (SARS) and Middle East Respiratory Syndrome (MERS). Infected people can spread COVID-19 through their respiratory secretions via droplets produced when an infected person coughs or sneezes, etc.

To avoid the risk of exposure to COVID-19 Contractor must consider the physical well-being and safety of all the persons entitled to be on the Site and follow reasonable guidelines and recommendations of Government authorities and healthcare professionals.

Mitigation Measures

- Use Covid-19 Vaccine;
- Cover your mouth while cough or sneeze;
- Avoid close contact with people who are sick;
- Avoid the use of hard soap;
- Wash your hands often with liquid soap and water for at least 20 seconds;
- All the employees should ensure sanitization of hands at appropriate time;
- Avoid touching your eyes, nose, and mouth with unwashed hands;

- Use of Personal Protective Equipment (PPE) according to risk (a surgical or N95 mask);
- Do not spit, wrap your oral and nasal secretion with tissue and throw it in a covered dustbin;
- Balance your nutrition and exercise moderately; and
- Sterilization / disinfection of medical devices at Site dispensaries.

Guidelines to combat with COVID-19 are attached as **Annex-IX.**

6.7.15 Climate Change and Green House Gas (GHG) Abatement

The main sources of Greenhouse Gases (CO_2, CH_4, NO_x etc.) during the construction activities of the proposed Project will include both mobile and stationary sources. The mobile sources will be the construction and transportation vehicles while the stationary source will be the batching and asphalt plants. Emission of greenhouse gases cause global warming and other climatic changes on regional and global scale. The climate change due to global warming, may result in following impacts over a period of time:

- Extended summer season;
- Higher temperatures may result in more precipitation falling as rain rather than snow, hence earlier and greater runoffs, increased runoff may pose greater challenges for water management;
- Increased natural hazards such as extreme/unpredictable rainfall events, wind storms, droughts and wildfire.
- Due to shift in temperatures and precipitation patterns runoff, stream/lake temperatures, suitable habitats may move upland, thereby declining in size, ecosystems become fragmented, number and composition of species will change with particular threats to sensitive species; and
- Increased damages to transportation infrastructure from extreme events, causing difficulties for access and emergency evacuation, and involves higher maintenance costs.

Mitigation Measures

- Integration of careful planning on construction equipment activities with appropriate equipment selection could contribute to the reduction of carbon gas emissions as well as savings of construction cost;
- Regular motioning of the equipment and vehicles for engine efficiency;
- Avoid idling of construction vehicles;
- Alternative energy resources shall be considered where possible;
- PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.

6.7.16 Discovery of Heritage Sites and Structures during Excavation

During excavation, there is a chance of finding artifacts. In case of finding any artifact, the contractor shall immediately report through Supervision Consultant/Client to Directorate of Archeology and Museums Punjab to take further suitable action to preserve those antiques

or sensitive remains. Chance find procedure (attached as **Annex-X**) shall be adopted in case of any accidental discovery of cultural heritage.

6.7.17 Natural and Man-Made Disasters

Natural disasters (earthquakes) and accidents such as fire, falls, slips and trips may result in injuries, financial losses and may even lead to deaths. The workers shall be trained and facilitated to cope with such disasters.

Mitigation Measures

Mitigation measures include the following:

- An Emergency Response Plan (ERP) for earthquakes and manmade disasters should be developed by contractor in coordination with RUDA and implemented in close consultation with the RESCUE Services and other concerned departments;
- Training of the Contractor and RUDA staff and employees regarding the emergency procedures and plans should be regularly conducted;
- Emergency numbers should be clearly posted at all disposal stations; and
- Minor incidents and near misses should be reported, and preventive measures should be formulated accordingly by the RUDA Management.

An ERP is attached as **Annex-XI**.

6.7.18 Accidental Risks

The proposed project involves number of operations simultaneously i.e. site clearing, excavation, piling, etc. This increases probability of accidental injuries to workers and general public.

Mitigation Measures

Following mitigation measures are suggested:

- Contractor should designate one of the staff members to act as lead person for emergency response and safety issues;
- Contractor should be responsible to provide first aid facilities at construction site as well as camp;
- Contractor should provide safety equipment such as helmets, goggles, ear plugs, gloves, safety shoes etc. to the workers;
- Safety signage should be erected at potentially dangerous working areas;
- Proper lighting arrangements should be ensured for night shift working, if required;
- Contractor should be responsible to provide insurance against accidental death and injuries to workers and public; and
- Public and animal access to construction site should be restricted by providing fences.

6.7.19 Flora

The project will involve cutting of vegetation cover. It is initially examined that approximately 175 trees may be affected. The provided number of trees is approximate and tentative which needs to be verified with the help of forest department and PHA as the EIA scope is limited. The number of possibly impacted trees is provided by field surveys complemented by GIS mapping. Moreover, trees of small and medium sizes will be removed due the layout of the project for which compensation will be made to concerned parties (Local community, forest and other relevant departments.)

Mitigation Measures

- Incorporate technical design measures to minimize removal of trees, if possible;
- Cutting of trees and disturbance shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized and possible alternate route must be considered for proposed road, in which minimum ecological and environmental losses are expected;
- A Tree Plantation Plan has been formulated (**Annex-XII**) that shall be implemented with the technical support of concerned Agriculture and Forest Department;
- As a principal, ten trees shall be planted in place of felling of one tree (i.e.,1:10) in consideration of mortality. Moreover, due consideration should be given to invasive/non-invasive species factor while replantation process;
- The Forest Department and PHA shall involve the local communities to carry out plantation;
- Total 1750 trees are recommended for plantation
- Open fires should be banned in the Project Area to avoid fire hazards;
- Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the natural vegetation may be minimized by establishing camp sites, workshops and batching plants on waste/barren land rather than on forested or agriculturally productive land;
- However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation will be carried out and minimum damage will be caused to trees and undergrowth;
- Construction vehicles, machinery and equipment will remain confined within their designated areas of movement;
- The Contractor's staff and labor shall be strictly directed not to damage any vegetation such as trees or bushes. The contractor' workforce shall use the paths and roads for movement and shall not be allowed to trespass through farmlands or forest areas; and
- Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed.

6.7.20 Fauna

During construction phase the existing population of mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving excavation, blasting, movement of machinery and vehicular traffic, movement of labor, camping, etc. The existing animals will leave the directly affected areas due to construction activities and human intervention. Some animals particularly reptiles may get

killed during the earthworks operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase.

Birds will also tend to move away from the construction areas and find shelter and food elsewhere due to the activities mentioned above for fear of being hunted / trapped.

Noise generated from construction machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers. This impact is site-specific, temporary and medium significant.

Mitigation Measures

- Care shall be taken during construction activities to avoid purposely or chance killing of animals;
- If found any wild species and habitat during construction that must deal carefully and local wildlife department officials should be called;
- Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labour force accordingly and clear orders should be given in this regard;
- The Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department;
- Provision of culvert/tunnel for the movement of different faunal species across the project road present in the project area;
- Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding;
- Noise generating activities shall not be carried out during the night by the work force, clear orders should be given by the contractor;
- Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and
- Efforts should be made to keep noise levels at acceptable levels (as per PEQS) produced by the construction activities.

6.7.20.1 Social/ Cultural Conflicts

During the construction phase of the project, conflicts may arise between labor force and Local communities. Use of local resources (existing infrastructure and utilities) by the construction workers can generate stress on the local residents. Furthermore, difference in cultural values may also cause discomfort to local residents. This impact is temporary and moderate adverse in nature.

Mitigation Measures

- Local labor should be preferably employed for the construction works;
- Careful planning and training of work force to minimize disturbance to the local people; and

- Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals.

6.7.20.2 Employment

Due to construction of the proposed Project, economic and commercial activities will be generated in the study area, as the laborers and semi-skilled staff from nearby communities will have an opportunity to work for the construction of the proposed Project. Similarly, the restaurants, hotels, and tea stalls present in and around the proposed Project Area will also get benefits in an income generation, as workers will visit them for food and nourishment. The impact is temporary and positive in nature.

6.7.20.3 Impacts on Livelihood

The construction activity may disturb the business and livelihoods of the business operators, shopkeepers, workshop owners and workers doing their work in the AOI due to the excavation activities. At this stage the assessment of livelihood impacts has been carried out on the basis of the proposed AOI. During the construction phase, these locations will be finalized and on that basis the livelihood impacts will be determined more accurately.

Mitigation Measures

- Proper compensation should be provided to all the affectees losing their livelihoods along the AOI;
- Relevant stakeholders should be engaged to design livelihood restoration measures including affectees of the proposed Project Area;
- Livelihood restoration should be provided to mitigate the adverse impacts on livelihood and restoration of commercial activates which will be monitored;
- Initial assessment of compensation should be carried out for the income loss of the affectees based upon the current approximation of the AOI and construction camps. This assessment should be reviewed and revised on the basis of final AOI and construction camp site determined during the construction phase;
- Project Construction should be completed on time; and
- Proper awareness and training should be conducted among the affectees regarding Project benefits, reasons for acquiring lands and compensations to be provided.

6.8 Anticipated Impacts during Operational Phase

The anticipated impacts related to the proposed project have been studied for the operational phase and discussed hereunder:

6.8.1 Landscape

During the operation stage, new saplings of different plants and trees would be planted to enhance the aesthetics and compensate the loss of affected trees. This will have a positive impact of permanent nature. The presence of adequate flora at available spaces along the

proposed alignment will help in absorbing flue gases emitting from vehicles and public transport passing through the project area, which shall help to improve the air quality.

Mitigation Measures

The saplings planted in the project area against the trees affected should be properly maintained throughout their growth.

6.8.2 Air Quality

Increased traffic levels in the project area may lead to higher values of air emissions that will affect the ambient air quality of the Project Area. The impact is permanent and minor negative in nature.

Mitigation Measures

Following mitigating measures are needed to be suggested:

- RUDA with the help of PEPA may set up system to monitor air quality along project area at important intersections/sensitive receptors in accordance with PEQS for a specific period to record the quality of air during the operation phase. This may help in comparing the baseline conditions with the operation phase of the project;
- Setting up to system to monitor air quality along the project area in accordance with acceptable International Standards; Monitoring emissions of vehicle as per PEQS;
- Helping the owners and occupants of the affected premises/settlements to identify and implement special measure such as hedges and vegetation to reduce air pollution; and
- Increasing vegetation in the form of greenbelt is one of the preferred methods to mitigate air pollution. Plants generate oxygen, serve as a sink for pollutants, reduce the flow of dust and reduce the noise pollution too alongside the proposed project.

6.8.3 Noise and Vibration

The movement of vehicles and usage of horns will create noise which will be a hazard for the nearby residents/built-up areas. Impact of noise generated from the vehicles moving on the proposed road will be permanent and moderate adverse in nature.

Mitigation Measures

- Provision of adequate noise barriers such as hedges and indigenous tree species will reduce the noise. Further Improvement can be made by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a certificate. Noise measurements should be carried out at locations with respect to the schedule specified in the Environmental Monitoring Plan (EMMP) to ensure the effectiveness of mitigation measures;
- Use of horn should be strictly prohibited in the close proximity of the built-up areas;
- Proper signboards should be installed to ensure reduce noise levels in the project area;

- Enforcement and penalties against traffic rules violators; and
- Noise barriers may be installed/constructed near the built-up areas.

6.8.4 Road Maintenance

During the operation phase related road maintenance works will be conducted time to time which may lead to social and environmental issues like traffic management, inconvenience to local residents, public safety, vehicular emissions, dust and increase in noise. This is a temporary and moderate negative impact.

Mitigation Measures

- Best Management Practices should be used for all the maintenance works;
- Timely completion of all the maintenance works according to the agreed schedule;
- Traffic management plan should be devised and implemented; and
- HSE protocols should be strictly followed and implemented to avoid any incident/accident.

6.8.5 Drainage

During the operational phase, poor maintenance of the road drainage system, particularly during the monsoon season can cause nuisance to the travellers and public due to flooding in the existing drainage line. In case of chocking of road drainage, the increased surface runoff due to heavy rains will accumulate at the surface and can cause traffic jams. The impact may consider to be moderate adverse in nature.

Mitigation Measures

- The impact can be controlled/reduced by timely and continuous maintenance/ cleaning of the drainage system; and
- Placement of sign boards instructing not to dispose of solid waste to avoid chocking of drain along the road alignment.

6.8.6 Flora

During Operational stage, the Project will not affect flora (trees and agricultural crops) or release any significant pressure detrimental to flora. Low level impact is expected at operational phase on vegetation due to the Operational and Maintenance activities. This impact is site-specific, temporary, irreversible and low significant.

Mitigation Measures

- The implementation of tree plantation plan recommended in compensation for cutting of trees should start working during operational stage, to ensure the ecological balance and to avoid any impact on local Environment;
- Large scale planting with suitable indigenous fruit and forest trees, shrubs and ornamental plants in the form of Tree Groves, and Linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and

offset the effect of removal of vegetation. It will help in absorbing flue gases, emitting from a large number of vehicles and public transport passing through the project area, which shall improve the air quality;

- The saplings planted in the project area against the trees affected should be properly maintained throughout their initial growth period in terms of water requirement and necessary nutrients by RUDA or relevant department;
- Proper check and balance for above activities is highly recommended. Plantations raised, must be maintained according to the Silvicultural practices, which include proper irrigation, cleaning, pruning, thinning at prescribed intensity, Silt clearance and Trench-opening, etc.
- Maintenance and security of the plantation should be done for at-least five years (in consultation with the forest department). Measures such as fencing, watch guards and fire protection should be considered; and
- All activities must be done under the technical supervision of Forest Department.

6.8.7 Fauna

There is no protected area, game reserve, game sanctuary or national park in the project area so no major impact on wildlife & livestock in the area is expected through, noise, vibration and any type of normal activity in the project area, thus will have no effect on productivity.

This impact is site-specific, permanent, irreversible, and minor significant.

Mitigation Measures

- The pathways of locally available wildlife and livestock for food, shelter and other normal activities must be compensated with proper alternative routes/pathways and water points must be provided to minimize the impact and movement of available wild and domesticated animals.;
- In proper consultations with Forest and Wildlife Department, permanent water points for available fauna may be provided to conserve local ecosystems and biodiversity.
- Strict control must be exercised for stoppage of killing/poaching of available wildlife species by enhancing protection practices and deploying effective watch and ward system;
- The precautionary measures described for future shall also be applicable during operation phase as relevant for the conservation of wildlife species in the Study Area; and
- Proper fence must be provided along the roadside to avoid road killing of wildlife, livestock and most importantly any inconvenient for local inhabitants.

7 ENVIRONMENTAL MONITORING PROGRAM AND INSTITUTIONAL REQUIREMENTS

7.1 GENERAL

This section provides brief description of environmental issues, mitigation measures to eliminate or reduce environmental and social impacts to an acceptable level, institutional framework for the implementation of the mitigation measures and environmental monitoring plan for air quality, water quality, and noise pollution parameters during construction and operational phase. A budgetary plan is also developed, indicating estimated costs to be incurred to mitigate potential adverse impacts of the proposed Project.

7.2 OBJECTIVES OF ENVIRONMENTAL MANAGEMENT/ MONITORING PLAN (EMP)

The main objectives of the EMP are to:

- Provide the details of the Project impacts along with the proposed mitigation measures, and the corresponding implementation activities;
- To ensure that all necessary corrective actions are carried out and monitored in time to counter any adverse environmental impact under a systematic monitoring approach;
- Provide a procedure for timely action in the face of unanticipated environmental situation;
- Define the role and responsibilities of the Project Proponent (RUDA), Contractor(s), Supervisory Consultant(s) and other key players in order to effectively communicate environmental and social issues among them;
- Define a monitoring mechanism, reporting frequency and identify monitoring parameters to ensure that all the mitigation measures are completely and effectively implemented;
- Design the training and capacity building plan for enhancing the capacities of the Project Proponent (RUDA), Contractor(s), Supervisory Consultant(s) on environmental and social management;
- Identify the resources required to implement the EMP and outline the corresponding financing arrangements; and
- Define the requirements necessary for documenting compliance with EMP and communicating it to all the concerned regulatory agencies.

7.3 INSTITUTIONAL REQUIREMENTS

The institutional requirements for the Construction and Operations & Maintenance (O&M) phases of the proposed Project are provided in below sections.

7.3.1 Institutional Setup for Implementation and Management of EMP

The key players involved during construction phase of the proposed Project are the RUDA as employer/proponent, PEPA, the Supervisory Consultant (SC) and the Contractor. The roles and responsibilities of these organizations are outlined below.

The following staff will be involved in the implementation of EMP:

- RUDA/Proponent/Employer;
- SC's; and
- Contractor's Environmental Manager.

The employer/ proponent (RUDA) will make Contractor bond through contract documents to implement the EIA including EMP and other terms and conditions of the Environmental Permit. The whole EMP will be included as a clause of the contract documents. Construction camps will be established after necessary approvals and submission of Site-Specific EMPs to be developed in the light of the relevant agencies requirements, before commencement of construction works. The organizational setup for implementation of EMP during construction phase is provided in **Figure 7.1.**

7.3.2 Overall Oversight Arrangements

A Project Steering Committee comprising of Chairman RUDA, Project Director RUDA and Deputy Director, RUDA will provide overall guidance and oversight and will be responsible for ensuring effective implementation of the project.

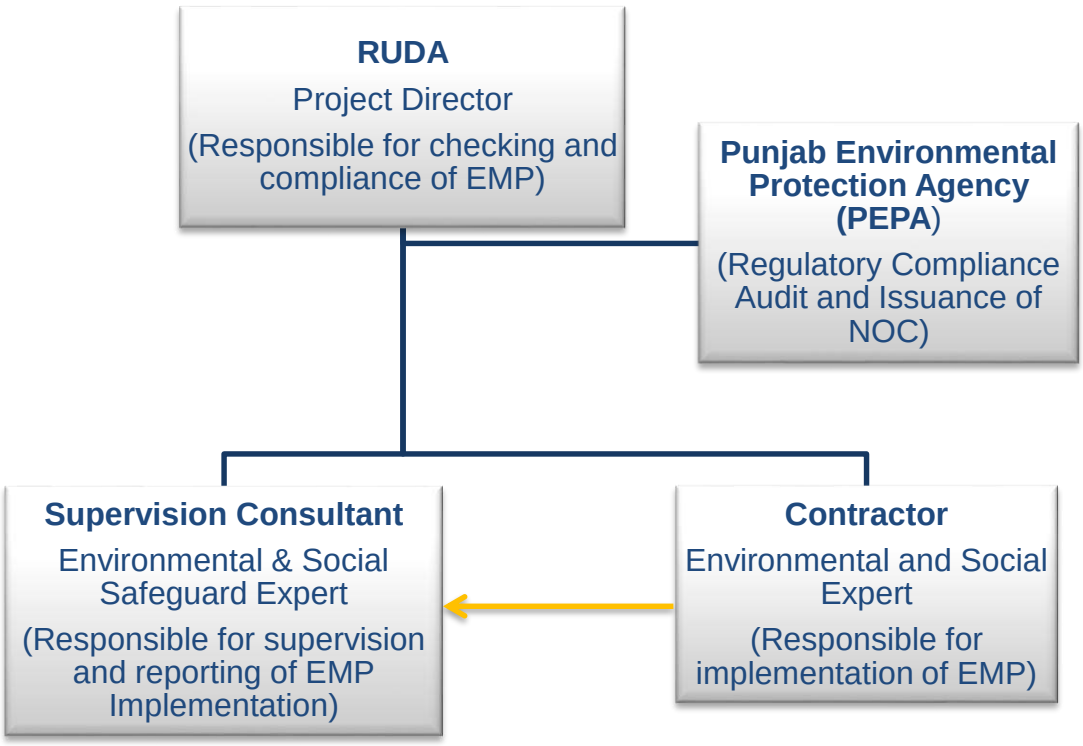


Figure 7.1: Organizational Setup for the Implementation of EMP at Construction Stage

7.3.3 Roles and Responsibilities for EMP Implementation during construction Phase

a. RUDA/ Employer Concerned Staff

The specific responsibilities are as follows:

- To ensure implementation of mitigation measures proposed in EMP during the construction and operational phase of the Project;
- To organize monitoring of ambient air quality, water and noise. In case, the noise and emission levels exceed the acceptable levels; a penalty or ban must be enforced;
- To develop operational guidelines and implementation schedule;
- Receiving complaints from nearby community and assisting the local authority including liaison with Punjab-EPA;
- Ensuring availability of committed human resources and sufficient budget for successful implementation of EMP;
- To ensure that the proposed project is implemented in an environment friendly manner,
- Maintaining interface with the other lined departments/stakeholders; and
- Reporting to the EPA-Punjab on status of EMP implementation.

b. Supervision Consultant (SC)

Environmental and Social Safeguard Experts (ESSEs) of SC will oversee the performance of contractor to make sure that the contractor is carrying out the work in accordance with EMP as mentioned in the contract documents. He will provide guidance to the contractor's ESE for implementing each of the activity as given in EMP. ESSEs will be responsible for record keeping, providing instruction through the Resident Engineer (RE) for corrective actions and will ensure the compliance of various statutory and legislative requirements.

However, overall responsibilities of ESSEs are as follows:

- To oversee the performance of the Contractor to make sure that the Contractor is complying with EMP;
- Ensuring that the day-to-day construction activities are carried out in an environmentally and socially sound and sustainable manner;
- Discussing various environmental and social issues and environmental mitigation, enhancement and monitoring actions with all concerned personnel's;
- Inspect, supervise and monitor all the construction and allied activities related to the EMP for the project and oversee the performance of the Contractor to make sure that the Contractor is complying with EMP;
- Visiting construction sites including incomplete construction work sites, where there is 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 to ensure contractors compliance with EMP stipulations and conditions of statutory bodies;
- Assisting contractor in all matters related to public contacts including public consultation pertaining to environmental and community issues;
- To organize periodic environmental training programs and workshops for the consultant's and contractor's environmental staff;
- Periodic reporting as mentioned in EMP; and
- Suggest any additional mitigation measures (if required).

c. Responsibilities of Contractor

Contractor will be bound through contract documents to appoint the Site Environmental and Social Expert (ESE) with relevant educational background and experience. ESE of contractor will carry out the implementation of the mitigation measures at construction site. The responsibilities of ESE of Contractor are as follows:

- ESE of contractor will be responsible for Implementation of the mitigation measures at construction site;
- Preparation of Site Specific Environmental and Management Plan (SSEMP) including Evacuation Plan, HSE Management Plan, Material Transportation Plan, Traffic Management Plan, Emergency Response Plan, Monitoring Plan, and asphalt and batching plant area plans, and will submit all the plans to the SC.
- Implementation of the EMP and to take effective measures against corrective actions plan;
- ESE will prepare the monthly compliance and monitoring reports as per schedule and will submit it to the SC;
- Provision of proper Personal Protective Equipment's (PPEs) to the workers and train them for their proper use; and
- The Contractor shall submit the Code of Conduct that will apply to all of the contractor's staff. The contractor shall submit an outline of how the Code of Conduct will be implemented. The aspects to be addressed include:

    - Ensure compliance with applicable environment, health and safety standards and procedures associated with risks of Project activities;
    - Ensure compliance with all acquired approvals, applicable to the proposed Project;
    - Ensure protection of local community (including vulnerable and disable assemblies), and the Contractor's staff, sub-contractors and daily wage workers;
    - Ensure employment of fulltime security guards, and necessary security measures and instruments (CCTV) at site;
    - Ensure provision of adequately stocked first aid kit at site for dealing with accidental injuries, and natural hazards;
    - Prohibit use of illegal items such as weapons, alcohol and drugs at site;
    - Ensure that Project property is protected against vandalism, theft, and noxious activity;
    - Ensure that positive attitude of respect and warmth is given to staff and community members;
    - Ensure good housekeeping practices shall be adopted at site;
    - Ensure that employment decisions are not made on the basis of personal characteristics unrelated to inherent job requirements, including race, gender, nationality, religion or belief, disability, age, sexual orientation, or ethnic, social and indigenous origin;
    - Ensure establishment and strictly enforcement of "No Sexual Harassment Policy";
    - Ensure provision of necessary sanitation requirements for site workers (both for men and women);
    - Ensure workers only use specified sanitary facilities provided by their employer and not in open areas;
    - Restriction on burning solid waste;
    - Restriction on dumping solid and liquid waste into nearby water bodies;

- Prohibition for cutting trees, and clearing vegetative areas for construction camps, and for cooking purpose as a source of fuel; and
- Prohibition on illegal hunting of local fauna.

The Code of Conduct should be written in local and simple language (Urdu and English) and signed by each site staff to specify that they have received a copy of the code; code explained and clarified to them; acknowledged adherence to this Code of Conduct as a condition of employment; and understood that violations of the Code can result in serious consequences. A copy of the code shall be displayed at strategic location of the site, and mainly in the contractor's site office.

d. Punjab Environmental Protection Department (PEPA)

EPA is the regulatory authority for issuance of NOC for the proposed Project. As part of its mandate, protection of environment is their responsibility. Therefore, the agency will undertake an audit (as and when required) of the activities of the Project (both phases i.e. Construction and Operation) with respect to the protocols as defined in EMP and in NOC. The specific responsibilities are as follows:

- Liaison with the Environmental Committee of RUDA on the proposed Project to ensure compliance of measures as given in the EMP and in NOC issued by them for the construction activities of the proposed Project;
- Environmental Audit of the activities being undertaken by the Environmental Committee of RUDA and all other relevant stakeholders as provided in the EMP and NOC through random site visits and meetings.

7.3.4 Institutional Arrangement for Implementation of EMP during O&M Phase

The proposed Project will be administrated by RUDA during the O&M phase. Therefore; it is suggested that the Project Director of the proposed Project shall depute / hire Environment and Social Expert through District Support & Monitoring Department to monitor and implement EMP during operation phase.

The specific responsibilities of Environment and Social Expert are as follows:

- Coordinating with the operational staff working under the Regional General Manager and Project Director to monitor environmental compliance during operation phase;
- Advising on, and monitoring tree plantations along the road alignment as suggested in EMP;
- Reporting on the progress of environmental compliance to the Project Director and EPA-Punjab;
- Assess and propose mitigation measures for unforeseen long-term environmental and social impacts of operation; and
- Sustaining a working partnership among the RUDA, EPA-Punjab, Agriculture, Irrigation, Forest and Wildlife departments of Lahore District to ensure compliance of EMP during operation phase.

7.4 ENVIRONMENTAL MITIGATION AND MANAGEMENT MATRIX

Environmental Mitigation and Management Matrix (EMMM) is considered as one of the main elements of EMP. The EMMM provides the framework for the implementation of the mitigating measures against each identified potential adverse impacts, and management and monitoring of the same during the design, construction and operation phases of the proposed Project. **Table 7.1** shows impacts, mitigations and the responsible authority and organization for the implementation of the same during design, construction and operation phase.

The Contractor(s) will be responsible for the preparation of Site Specific EMP (SSEMP) on the same format of this EMMP along with the site-specific plans based on the guidelines provided in this Section.

Table 7.1: Environmental Mitigation and Management Plan

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
Preconstruction / Design Phase					
1.	**Technical Design and Layout Planning** Incompatible layout plan and engineering design of the project's structures (retaining walls, ramps, bridges, etc.) can undermine the overall aesthetic beauty and ambience of the project area. Also low utilization of the available spaces and designing the structures without considering the prospective and futuristic needs can result in structures with low social acceptability and functionality. This future traffic factor if not considered in the design properly, will also affect the project road and public safety of the Project Area. Similarly, the locals may also face access problems. This impact is temporary and minor negative in nature.	• The technical design of the proposed project must consider all the above mentioned factors for the final design and should meet all the local and international (e.g., AASHTO) standards; and • The proponent must review and validate all the design parameters considering the possible impacts (as mentioned) before the start of construction of proposed Project.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent
2.	**Topography** The project area has plain topography and no cutting/excavation of land is involved except for piling. No significant physical change in the topography is expected. This impact is minor negative and permanent in nature.	• Mitigation measures will involve adoption of best engineering design measures keeping in view of the aesthetics of the project area and provision of green belts for the landscape in design.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
3.	**Storm Water Drainage / Urban Flooding** The construction of proposed Project may be subjected to urban flooding as the project area has high frequency of rainfall during monsoon season. Improper design of storm water drainage of the proposed Project may result in stagnant water on the road due to which following impacts are expected to arise: • Deterioration of road surface and reduction of its bearing capacity; • Inconvenience for commuters/pedestrians; • Stagnant water may provide the breeding ground for disease vector; and • Foul odour may be generated.	Mitigation measures will include provision of appropriate drainage structures with appropriate design capacity to avoid urban flooding especially during the rains. Proper slopes shall be incorporated in design to avoid the stagnant water on at-grade road surface.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent
4.	**Seismicity** In Building Code of Pakistan (Seismic Provisions, 2007), the whole region of Pakistan is classified into five main Seismic Hazard zones i.e., i) Zone-1, ii) Zone-2A, iii) Zone-2B, iv) Zone-3, v) Zone-4 based on the peak horizontal ground acceleration and its ultimate tendency to damages during seismic events. The proposed Project Area falls in the seismic zone classified as "Zone-	• The proposed structures (bridges, etc.) should be designed and constructed keeping in consideration high intensity earthquakes. For seismic hazard analysis, updated structural and seismic evaluations should be conducted by the design engineer/consultant. Moreover, geo-technical investigations must be conducted prior to construction phase; • Seismic Building Code of Pakistan 2007 (SBC-07) should be adopted. This code specifies minimum	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	2A" with g-value 0.08 to 0.16, and is considered as Moderate Hazard seismicity zone. In case of an earthquake, the proposed road expected to suffer damages if designed without consideration of seismic activities. This would be permanent and major negative in nature. However, No change in the impact of seismology risk of the area is expected during the project construction phase as none of the project activities is expected to be of such a powerful extent to influence the tectonic risk.	requirements for seismic safety of buildings and has to be applied and used by engineers in conjunction with the necessary understanding of the concepts of structural, geotechnical and earthquake engineering; and • The structure of the proposed project should also be studied by the proponent (RUDA) to evaluate its durability/strength to withstand moderate to high intensity earthquake.			
5.	**Land Procurement** About 54 kanals of Land will be required for the proposed project. This may result in loss of land, infrastructure, commercial activities and disturbance to local people. The detail of land under the impact and record of ownership status will be prepared by the Revenue Department.	The process of land procurement will be done on market rates.	• Confirmation of design incorporation. • Audits and Checks	Proponent	Proponent
6.	**Resource Conservation** Resources involved in the construction of proposed project would include water, fuel and construction materials.	• Use potable water bowsers for construction works and filtered or treated ground water for drinking purpose; • Plan for the provision/purchase of	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Excessive water consumption by the construction staff may stress water resources in the project area and in certain cases may disturb the existing water supplies in the project area. Construction material to be used for construction includes coarse aggregates, fine aggregates, asphalt, cement, lining material, earthworks, reinforced and structural steel etc. Almost all the materials to be used in the construction of proposed project are non-renewable and therefore their efficient use is necessary to make it available for future use. Fuel will be used to operate construction machinery. Efficient use of energy resources is important to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is important. The impact is medium negative and permanent in nature.	adequate insulation to reduce heat loss through batching plants; • Reduction of wastage of water through training of workers involved in water use; • Reuse of construction waste materials may be adopted wherever possible; • Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment; • Efficient and well maintained equipment and machinery should be used with fitness certificate; • The equipment and machinery should be turned off when not in use; • Ensure adequate insulation to reduce heat loss through batching plants; • Regularly monitor CO and CO_2 content of the flue gases to verify that combustion systems are using practical excess air volumes; • Use of solar panels at construction camps may be considered and plan for use of solar panels at operational phase may also be considered; and • A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels. • Resource Conservation Plan is attached as Annex-IV.			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
7.	**Route (Alignment) Optimization** Improper route selection of proposed project will lead to disturbance to environmental and social issues related to resettlement and displacement of people. This impact would be of moderate significance.	• Most of the significant environmental, ecological and social impacts of the project have been addressed at the design phase. In order to minimize environmental, ecological and social issues at the detailed design stage, various features have been considered. The route alignment has been finalized and efforts have been made to avoid or minimize impacts on habitat, resettlement and relocation issues and disturbance to sensitive receptors. • By considering the optimization of route, the impact of route alignment has been reduced to low significance.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent
8.	**Public Utilities** Due to the proposed project, public utilities i.e., Electricity Polls, Power/Telephone Lines, etc. will be affected creating disruption of public services and inconvenience to the local residents. This impact is temporary and may be considered as moderately negative in nature.	• The provision in the design and budget for the relocation of the existing utility infrastructures wherever required shall be finalized in consultation with the concerned department; and • All public utilities (e.g., electric lines, water pipes, power/ telephone lines, etc.) likely to be affected by the proposed project will be relocated well ahead of time before the actual commencement of the construction works.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent
9.	**Flora** During the pre-construction phase, activities such as installation of construction camps, construction of	• The camps, mobility of machinery and construction of temporary road should be properly planned and well designed to avoid any loss to local green cover;	• Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	temporary roads and mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed that require significant space due to which available vegetation is expected to be removed. This impact is site-specific, temporary, medium significant and needs to be encountered prior to the start of construction stage.	• It is recommended to establish the construction camps where minimum or no vegetation exists; • Similarly, the alternate routes for roads and points for camps are recommended where no loss of vegetation is expected; and • The location of construction camp(s) will be selected so, as to have limited environmental effect during construction phase and to reduce the cost and land requirement.			
10.	**Fauna** As movement and installations of machinery and vehicles will take place during this pre-construction phase so noise and habitat loss is expected. The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements and installations. Temporary road may also affect the habitat of locally available fauna. This impact is site-specific, temporary, and low significant.	• The standard measures must be considered prior to construction phase to minimize noise due to machinery movements and installations; • The alternate routes and points are recommended to avoid any damage to locally available fauna; • The construction camp management plan during the planning stage must consider fencing and gating to check the entry of animals in search of eatable goods; • Similarly, Waste Management Plan of the camps must be considered at the planning stage to prevent wild animals and birds.	• Audits and Checks	Design Consultant	Proponent
11.	**Socio-economic Environment** During the planning and design phase of the project, it is anticipated that there will not be any potentially significant adverse	• No mitigations measures are required except good engineering practices to avoid and reduce these low adverse impacts.	• Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	impact on the socio-economic environment. Locals may be temporarily disturbed due to the field investigations and drilling activities. This impact can be categorized as indirect, low, site-specific, short term, temporary, low probable.				
		Construction Phase			
12.	**Soil Erosion** Construction activities such as clearing of earth, levelling, piling, compaction, carpeting, pavement finishing will affect the existing soil condition in the study area. The clearing of vegetation can also loosen the soil and make it more susceptible to erosion due to wind and rain. There is also a possibility of silt runoff during rainy season causing soil erosion. During the rain, the eroded soil mix with stagnant water to transform into slush, which can affect movement of vehicles and machinery and construction work as well as limit the movements of local people. Soil erosion may also occur in the workshop areas as a result of improper drainage system of equipment washing-yards and improper management of	• Good engineering practices will help to control or minimize the soil erosion both at the construction sites and in peripheral areas. All the disturbed areas need to be protected against soil erosion by stripping and stockpiling of all the available topsoil for later re-vegetation. Special slope protection measures will be adopted in the sensitive areas and along the shoulders of roads and excavations shall be kept confined to the specified foundation spots as per the approved engineering drawings. Unnecessary excavations should be avoided. • The provision for vegetation with a fast growing crops/trees and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization will be made in the design. Use of stone pitching or riprap will also be provided in the design at appropriate places especially around bridges and culverts. Provision for rip-rap in	• Visual observation and photographic record • Site restoration and rehabilitation plan implementation	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	construction activities. This impact can be categorized as site-specific, long term, moderate negative and irreversible.	discharge zones from drainage structures will be made in the design to reduce erosion. Down drains/chutes will be lined with rip-rap/masonry or concrete to prevent erosion. Side slopes will be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion. Site restoration plan for the Project should be strictly followed.			
13.	**Soil Contamination** The soil contamination occurs at all construction stages: during the design and survey work, during the construction, directly during the work on the construction site. Land may be contaminated due to the spillage of chemicals, fuels, solvents, oils, paints, concrete, solid waste generated at campsites etc. This normally happens when these materials are transported in open or loosely capped containers. Various types of machinery will be used at the construction sites. This machinery will not only pollute the atmosphere at the construction sites and adjacent communities, but also have a negative impact on the soil surface layer.	• The Contractors will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination; • Material Safety Data Sheets (MSDS) will be strictly followed during handling and storage of chemicals; • Soil contamination due to concrete transportation will be minimized by placing all containers in casings; • Solid waste generated at the camp sites will be properly treated and safely disposed only in the demarcated waste disposal sites/areas; • If any contaminated soils are found, they shall be removed and deposited in a sealed pit in an area agreed with the concerned; and • Use of modern, well-maintained machinery and vehicles by the	• Visual observation and photographic record • Site restoration and rehabilitation plan implementation	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	The possible contamination of soil by oils and chemicals at camp sites, workshop area and equipment washing-yards may limit the future use of land for agricultural purposes. This impact can be categorized as site-specific, long term, moderate negative.	contractor to avoid emissions and leakages; • Soils removed during construction would be stockpiled for reuse where possible; and • Runoff from washing of equipment and gadgets should be drained into either a septic tank or a sand-gravel bed for removal of the grit and contaminants.			
14.	**Borrow/ Open Pits** Borrow/ open pits and associated excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation and landscape degradation. Borrow/ Open pits may also become potential sources of mosquito breeding and may prove hazardous to humans, livestock and wildlife. This will also degrade hygienic condition of the Project Area. This impact is permanent and moderate negative in nature.	• Necessary permits will be obtained for any borrow pits from the competent authorities; • In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4; • Soil erosion along the borrow pit will be regularly checked to prevent/ mitigate impacts on adjacent lands; • In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and • Borrow pits will be used for construction waste, but during the excavation, top 20 cm soil cover will be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area. Quarry Management Plan is attached as **Annex-V.**	• Visual observation and photographic record • Site restoration and rehabilitation plan implementation	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
15.	**Air Quality** Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles. Emissions may be carried over longer distances depending upon the wind speed, direction, temperature of surrounding air and atmospheric stability. The operation of an asphalt plant causes the emission of many different pollutants. The most common pollutants emitted from hot mix asphalt plants are particulate matter (PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and carbon monoxides (CO). Potential impacts on the air quality during the construction stage will be due to the fugitive dust and the exhaust gases generated in and around the construction site. Dust is a major component of air pollution during road construction. Emissions are generated mainly from the following construction activities: • Site clearance and use of heavy vehicles and machinery/equipment	• All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions; • Open burning of solid waste from the Contractor's camps and at construction site should be strictly banned; • Preventive measures against dust should be adopted for on-site mixing and unloading operations; • Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS (as amended) for carbon emissions and noise; • Regular water sprinkling of the site or use of chemical dust suppressants should be carried out to suppress excessive dust emission(s); • Emissions from power generators and construction machinery are important point sources at the construction sites. Proper maintenance and repair is needed to minimize the hazardous emissions; • Emissions from batching / asphalt plants can be controlled efficiently by	• Physical observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	etc. at construction site; • Procurement and transport of construction materials such as sand, cement, etc. to the construction site; • Other Gaseous emissions during construction result from operating of construction vehicles, plant and equipment; • Increase in air pollution levels without project and with project during construction period (for mobile & stationary sources) is predicted from construction machinery, equipment, which reveals that there shall not be significant contribution towards pollution due to the construction activity of the project if mitigation plan will be implemented and monitored in proper sense; and • Asphalt heating. The construction activities will also result in increased air pollution in the area. The overall impact on the quality of air during the construction phase will be temporary, moderate negative and limited to the project's implementation phase only.	the installation of cyclone / scrubbers. Diesel operated equipment should be equipped with well-maintained fuel filter and may be replaced timely (if required). In addition to that, regular maintenance activities comprising changing of lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators; • Construction equipment is generally left idling while the operators are on break or waiting for the completion of another task. Emissions from idling equipment tend to be high. Existing idling control technologies, which automatically shut the engine off after a pre-set time can reduce emissions, without intervention of the operators; • PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works; • Construction workers should be provided with masks for protection against the inhalation of dust; • Vehicles used for construction should be tuned properly and regularly to control emission of exhaust gases; • Ensure precautions to reduce the level of dust emissions from hot mix plants, crushers and batching plants;			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		by providing dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards. Moreover, ensure that the batching and asphalt plants are equipped with emission control devices like scrubbers, electrostatic precipitators or bag filters; and • Regular monitoring of air quality in accordance with PEQS.			
16.	**Noise/Vibration** The noise and vibration will be produced due to the operation of construction machinery and equipment (refer **Table 3.1**: Machinery and Equipment Requirement for the Proposed Project). Sources of noise and vibration during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers, asphalt plants and other equipment's. Noise and vibration are perceived as one of the most undesirable consequences of construction activities. The above machinery is expected to generate noise levels that would be severe in the project area. The cumulative effects from several machines can be significant and may	• There are a variety of ways including Quieter Equipment; Modifying Existing Old Equipment; Barrier Protection; Work Activity Scheduling; Maintenance; Noise Perimeter Zones (NPZs) by which construction equipment and worksite noise can be controlled.	• Physical observation • Regular environmental monitoring, sampling and testing • Vehicle maintenance records	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	cause significant nuisances. However, these increased noise levels will prevail only for a short duration during the pre-construction and construction phase. The likely impacts due to noise are: • Psychological effects of distraction of attention, irritation and short temperedness in the exposed persons due to persistently higher noise levels; and • Noisy settings and higher background levels can cause temporary threshold shift and the consequent habit of speaking loud, which may cause damage to vocal cords in the persons exposed. Though the construction method that has not been determined yet, however it is believed that the adopted method of construction shall produce less noise and vibration if the suggested mitigation measures are adopted.				
17.	**Construction Camps/Camp Sites** Due to the construction camps[15], loss of vegetation and dis-satisfaction of rehabilitation measures during and after completion of construction phase may	***Environmental*** ▪ Reinstate any temporary facilities to pre-existing conditions in ecologically sensitive areas. ▪ Implement landscaping plan for all facilities in areas where high	• Visual observation and photographic record. • Waste Management plan implementation	Construction Contractor	Proponent

[15] The location of construction camps will be provided by the Contractor in coordination with the RUDA before mobilization.

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	occur. These impacts may include waste, soil pollution, groundwater pollution, dust, etc. However, the impact will be temporary and moderate adverse in nature. For these impacts, mitigation measures have been developed to minimize the likelihood, extent or duration of their occurrence and any associated adverse effects.	landscape value and visual vulnerability to the proposed activities warrants site-specific landscape restoration measures. ▪ Operate equipment in a manner sympathetic to the ambient noise environment. Do not leave equipment idling unnecessary. Provide adequate warnings of impeding works to all potential receptors within a 1 km corridor surrounding the RoW via public notices and local news. ***Social*** State land will be a second preference for worker camp locations, followed by land where there is a willing lessee. Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different socio-cultural values. Training will be provided to all staff on camp management rules and overall discipline and cultural awareness. This will include, in appropriate languages: ▪ A briefing on camp rules ▪ A community relations orientation to increase awareness about the local area, cultural sensitivities and the project Code of Conduct			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		▪ Awareness-raising on health considerations, including Sexually Transmitted Diseases (STDs). The construction contractor is required to develop a Construction Camp Management Plan to address: ▪ Discipline; ▪ Community liaison; ▪ Ethnic tensions and; ▪ Communicable diseases. A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan, which provides policies and a disciplinary framework with respect to worker behavior. ***Camp Location*** The construction contractor will be required to assess the environmental/social sensitivity of any additional or alternative sites prior to their approval for adoption. Some additional mitigation measures should include: • The contractor(s) should provide plan to RUDA for removal & rehabilitation of site upon completion; • Photographical and botanical			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		inventory of vegetation before clearing the site; and • Compensatory plantation to be scheduled when construction works near end.			
18.	**Wastewater Generation at Construction Camps** Wastewater will be generated at the construction camps by the workers. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as river Ravi, water channels, etc. apart from soil contamination. The wastewater generation is estimated to be 3,200 liters/day[16] for 100 construction workers during construction phase of the proposed Project. This impact can be categorized as moderate, site-specific, temporary and reversible.	• Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e., septic tanks (as shown in Figure 6.1). • Proper monitoring to check the compliance of PEQS will be carried out; and • Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit. • The Contractor(s) will be responsible to submit details of site-specific wastewater management plan along with details of wastewater collection, transportation and its disposal.	• Visual observation and photographic record. • Waste Management plan implementation	Construction Contractor	Proponent
19.	**Solid Waste Generation at Construction Camps** Considering the labourers (about 100 in numbers) residing in the construction camp and the locally available labour,	• All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration of	• Visual observation and photographic record. • Waste Management plan implementation	Construction Contractor	Proponent

[16] Tentative Work Force Requirements Including Client and Contractor Staff"
= (100) x (40) = 4,000 liters/day
= (100) x (80% of wastewater) =3,200 liters/day

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	an average solid waste generation rate of 0.45 kg/capita/day[17] is adopted for the estimation of solid waste generation. Based on this assumption, a total of about 45 kg of solid waste will be generated from construction camps on daily basis. The major components of the labour camp waste will be garbage, putrescible waste, rubbish and small portion of ashes and residues Insecure and unhygienic disposal of the solid wastes particularly garbage and trash may cause degradation of soil and land. Insecurely disposed off heaps of wastes containing kitchen garbage and food waste can serve as breeding grounds for the disease spreading vectors and rodents. Throwing away of solid wastes into water channels and the wastewater network can result into choking of the latter. These impacts are temporary and moderate negative in nature..	the concerned solid waste management department for the disposal of solid waste; • The Contractor must develop a plan of action with the help of concerned solid waste management department for transporting the waste to the disposal site; • Toxic waste will be handled, stored, transported and disposed-off separately. Safe handling precautions and product specific information is found in Material Safety Data Sheets (MSDS) which must be located on site and accessible to all workers • All persons interacting with hazardous wastes will be required to wear the appropriate PPE; and • The waste will be properly sealed in containers with proper labels indicating the nature of the waste.			
20.	**Waste Generation at Construction Site**	• Waste Management Plan (Annex-VI) will be implemented to ensure safe handling, storage, collection and	• Physical observation • Regular environmental	Construction Contractor	Proponent

[17]ource: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day.

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials etc.). The handling and storage of oil and other hazardous waste will be a source of environmental pollution during the excavation, foundation, levelling, carpeting and pavement activities. The quantification of construction material waste is not available but it is anticipated that less amount of such waste will be generated along the route length. Improper disposal of construction waste can lead to nuisance and hazards towards environment and local population. The unspent materials and debris produced from consumed up materials, if left as such and allowed to mix with soil underneath, can degrade the quality of receiving soils and render them unfit for plantation. Leakages of oils, lubricants, chemicals, and other similar substances from their storage sites can spoil the receiving soils and may undermine ability of the spoiled soils to support growth of vegetation and	disposal of construction wastes and the training of employees who handle waste; • Recyclable wastes e.g. steel bars will be sold to waste vendors; • Reusable material will be used as a filling material during ground levelling; • Solid waste generated during construction will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan; and • The site will be restored back to its original conditions after construction completion	monitoring, sampling and testing		

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	plants. The estimated quantity of excavation material for clearance cannot be provided at design stage. The contractor will provide the estimated quantity of excavation material during the construction phase. These wastes will be generated due to the construction activities and the materials used for construction. This waste would also require proper disposal to minimize any contamination of land and water resources. This impact can be categorized as moderate negative, site-specific, temporary and reversible.				
21.	**Impact on Water Resources (Surface and Groundwater Contamination)** The runoff from the chemical storage areas may also contaminate the near by surface water bodies. The construction waste, if left un-attended will result in leachate formation, which will percolate through the soil strata and reach to groundwater table and will contaminate it. This impact can be categorized as local, temporary, moderate negative and reversible.	• Construction camps will be established in areas with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met; • The surface and groundwater reserves will be adequately protected by installing screens and barriers to protect the source of contamination such as construction and oily waste that will degrade its potable quality; • The proponent will ensure that the construction work is confined within the Study area and water bodies are prevented from pollution during	•		

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		construction; • The solid waste will be disposed of at designated landfill sites to sustain the water quality for domestic requirements; • Regular water quality monitoring according to determined sampling schedule; • The contractor will ensure that construction debris do not find their way into the drainage or irrigation channels which may get clogged; • To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas; • Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond; • Construction work close to the distributaries or other water bodies will be avoided, especially during monsoon period; • Wastewater effluent from the Contractors' workshops and equipment washing-yards will be passed through gravel/sand beds to remove oil/grease contaminants before discharging into the natural streams. According to the PEQS, the BOD concentration in sewage must			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		be brought down to less or equal to 80 mg/l before being discharged into a natural stream having capacity to dilute the effluent. For wastewater apart from BOD, COD of 150 mg/l will also be checked; and • Similarly, if the sewage after treatment is to be discharged on to the land it will meet the requirements of the PEQS for disposal of wastewater.			
22.	**Traffic Issues** The project area will be approached through main ring road (L-20). This road serve as main approach roads to the Project Area and due to the proposed construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling to the Project Area. The problems will include traffic jams and inconvenience to the public passing through the Project Area. It will also increase traffic load on the existing road network or access roads ultimately deteriorating the existing condition of the roads. The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions, vibrational impacts, etc. Considering these consequences, this impact can be	• Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime to reduce traffic load and inconvenience to the local population; • Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary congestions along the major roads; • The speed of the vehicles will be controlled (at 30 to 40 km/hr) to reduce the probability of severe accidents, soil erosion, debris flows due to vibrations and dust emission; • Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work; • Proper sign boards will be provided for smooth flow of traffic; • Period of construction and area / location of construction site shall be	• Vehicle maintenance record • Training record • Implementation of TMP • Regular visual observations	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	categorized as medium term, temporary and irreversible.	informed to public in general and specifically to local residents; and • Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays. Traffic Management Plan (TMP) will be implemented by the contractor to avoid traffic accidents, jams/public inconvenience. A TMP framework is attached as **Annex-VII** for contractor guidance, whereas site specific TMP will be submitted by the contractor.			
23.	**Occupational Health and Safety** Occupational Health and Safety (OHS) related impacts will arise during construction activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. The falls during inspection or maintaining pile rigs, erection of framework and other related activities may also occur. Eye injury can be caused by stone or metal particles. Hazard of being hit by falling objects, major hand-arm and whole body vibration hazards, skin and respiratory tract irritation from exposure	• A Occupational Health and Safety Framework is attached as Annex-VIII for contractor guidance, whereas site specific HSE Plan will be submitted by the contractor. • Punjab Occupational Safety and Health Act 2019 ensures the compliance of occupational safety and health of the persons at workplace and to protect them against risks arising out of the occupational hazards; • Compliance with the safety precautions for the construction workers as per International Labour Organization (ILO) Convention No. 62, as far as applicable to the Project Contract; • Training of workers in construction	• Implementation of HSE Plan • Use of PPEs • Training Records • Work permits • Implementation of Emergency response plan and disaster management plan in case of natural disaster occurrence	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	to cement dust, overexertion and awkward postures etc. will be another impact. Welding hazards include electric shock, fumes and gases, fire and explosions, falls from height, eye and head injuries etc. Other impacts will be fall from height, contact with heavy electrical and mechanical equipment, equipment failure, uncontrolled movement, unguarded moving mechanical equipment parts, fatigue, unbalanced load, falling objects, hand injury, slip and trip hazards, wind / storm activity, injury from releasing load too soon etc. Operating mechanical and electrical equipment will trigger the H&S issues e.g. struck by moving vehicles or other equipment, slips or trips, struck by flying objects, such as dirt or splashed fluids, caught in pinch points, shear points, crush points, falling from machine etc. The proposed project area is also sensitive from the law and order point of view and the security as well as the safety of the Contractor and Consultant staff will be a major issue. Considering these consequences, this impact can be categorized as site-specific, medium	safety procedures, environmental awareness, equipping all construction workers with safety boots, helmets, gloves and protective masks, goggles, shields and monitoring their proper and sustained usage; • Contractor will ensure the provision of medicines, first aid kits, ambulance etc. at the camp site; • Work areas will be cordoned off where necessary; • Contractors will instruct their staff to use Personnel Protective Equipment (PPE) (e.g., wire containment, displaying warning signs along the work site, communicating advance warnings to mats) to enhance the safety; and • Safety lookouts will be built to prevent people and vehicles from passing at the time of hot or cold work; and • An emergency management plan must be devised by the contactor in close coordination with the provincial emergency services (Rescue 1122).			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	negative and irreversible.				
24.	**Community Health and Safety** The construction activities and vehicular movement at construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. 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 proposed Project will also have potential of air (dust pollution), noise and vibrational impacts on nearby community. The labour works with different transmittable diseases may cause spread out of those diseases in the local residents. The construction areas located near the residential, settlements, may cause accident for the people moving near to those areas. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Tensions may also arise between different groups within the labor force, and pre-existing conflicts in	• Providing basic medical training to specified work staff and basic medical service and supplies to workers; • There will be proper control on construction activities and oil spillage leakage of vehicles; • The labourers with different transmittable diseases will be restricted within the construction site; • Ensure that the site is restricted for the entry of irrelevant people particularly children; • 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 and social links; • Seeking cooperation with local educational facilities (school teachers) at each village along the route for road safety campaigns; • Provision of proper safety and diversion signage at sensitive/accident-prone spots; • Setting up speed limits in close consultation with the local stakeholders; • The mitigation measures provided in	• Implementation of HSE Plan • Use of PPEs • Community concerns record • Medical reports of worker	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	the local community may be exacerbated. Ethnic and regional conflicts may also be aggravated if workers from one group are moving into the territory of the other. Considering these consequences, this impact can be categorized as site-specific, medium term, temporary and irreversible.	the following sub-sections for air and noise shall be adopted to reduce the air pollution, noise pollution and vibrational impacts on nearby community; • The communicable disease of most concern during construction phase, like Sexually-Transmitted Disease (STDs) such as HIV/AIDS, will 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 will be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which include prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat close to human settlements and by eliminating any unusable impounding of water; • The Contractor will prepare the construction camp management plan which, in addition to other components, will include the labor influx management plan. This will be reviewed and approved by RUDA; and • Contractor will take due care of the			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions.			
25.	**7.4.1.1 COVID-19 Scenario** The COVID-19 belongs to a family of viruses known as the Coronaviruses, which can cause illnesses ranging from the common cold to more severe diseases, such as the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). Infected people can spread COVID-19 through their respiratory secretions via droplets produced when an infected person coughs or sneezes, etc. To avoid the risk of exposure to COVID-19 Contractor must consider the physical well-being and safety of all the persons entitled to be on the Site and follow reasonable guidelines and recommendations of Government authorities and healthcare professionals.	• Use Covid-19 Vaccine; • Cover your mouth while cough or sneeze; • Avoid close contact with people who are sick; • Avoid the use of hard soap; • Wash your hands often with liquid soap and water for at least 20 seconds; • All the employees should ensure sanitization of hands at appropriate time; • Avoid touching your eyes, nose, and mouth with unwashed hands; • Use of Personal Protective Equipment (PPE) according to risk (a surgical or N95 mask); • Do not spit, wrap your oral and nasal secretion with tissue and throw it in a covered dustbin; • Balance your nutrition and exercise moderately; and • Sterilization / disinfection of medical devices at Site dispensaries. Guidelines to combat with COVID-19 are attached as **Annex-IX.**	• Implementation of HSE Plan • Use of PPEs • Implementation of COVID-19 Guidelines; • Medical reports of worker	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
26.	**Climate Change and Green House Gas (GHG) Abatement** The main sources of Greenhouse Gases (CO_2, CH_4, NO_x etc.) during the construction activities of the proposed Project will include both mobile and stationary sources. The mobile sources will be the construction and transportation vehicles while the stationary source will be the batching and asphalt plants. Emission of greenhouse gases cause global warming and other climatic changes on regional and global scale. The climate change due to global warming, may result in following impacts over a period of time: • Extended summer season; • Higher temperatures may result in more precipitation falling as rain rather than snow, hence earlier and greater runoffs, increased runoff may pose greater challenges for water management; • Increased natural hazards such as extreme/unpredictable rainfall events, wind storms, droughts and wildfire. • Due to shift in temperatures and precipitation patterns runoff,	• Integration of careful planning on construction equipment activities with appropriate equipment selection could contribute to the reduction of carbon gas emissions as well as savings of construction cost; • Regular motioning of the equipment and vehicles for engine efficiency; • Avoid idling of construction vehicles; • Alternative energy resources shall be considered where possible; • PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.	• Implementation of chance find procedure	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	stream/lake temperatures, suitable habitats may move upland, thereby declining in size, ecosystems become fragmented, number and composition of species will change with particular threats to sensitive species; and • Increased damages to transportation infrastructure from extreme events, causing difficulties for access and emergency evacuation, and involves higher maintenance costs.				
27.	**Discovery of Heritage Sites and Structures during Excavation** During excavation, there is a chance of finding artifacts. In case of finding any artifact, the contractor shall immediately report through Supervision Consultant/Client to Directorate of Archeology and Museums Punjab to take further suitable action to preserve those antiques or sensitive remains.	• Chance find procedure (attached as Annex-X) shall be adopted in case of any accidental discovery of cultural heritage.	• Implementation of chance find procedure	Construction Contractor	Proponent
28.	**Natural and Man-Made Disasters** Natural disasters (earthquakes) and accidents such as fire, falls, slips and trips may result in injuries, financial losses and may even lead to deaths. The workers shall be trained and facilitated to cope with such disasters.	• An Emergency Response Plan (ERP) for earthquakes and manmade disasters should be developed by contractor in coordination with RUDA and implemented in close consultation with the RESCUE Services and other concerned departments; • Training of the Contractor and RUDA staff and employees regarding the emergency procedures and plans	• Implementation of Tree Plantation Plan • Visual Observations	Construction Contractor in association with Forest Department	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		should be regularly conducted; • Emergency numbers should be clearly posted at all disposal stations; and • Minor incidents and near misses should be reported, and preventive measures should be formulated accordingly by the RUDA Management. An ERP is attached as **Annex-XI**.			
29.	**Accidental Risks** The proposed project involves number of operations simultaneously i.e. site clearing, excavation, piling, etc. This increases probability of accidental injuries to workers and general public.	• Contractor should designate one of the staff members to act as lead person for emergency response and safety issues; • Contractor should be responsible to provide first aid facilities at construction site as well as camp; • Contractor should provide safety equipment such as helmets, goggles, ear plugs, gloves, safety shoes etc. to the workers; • Safety signage should be erected at potentially dangerous working areas; • Proper lighting arrangements should be ensured for night shift working, if required; • Contractor should be responsible to provide insurance against accidental death and injuries to workers and public; and • Public and animal access to construction site should be restricted by providing fences.	• Visual Observations	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
30.	**Flora** The project will involve cutting of vegetation cover. It is initially examined that approximately 175 trees may be affected. The provided number of trees is approximate and tentative which needs to be verified with the help of forest department and PHA as the EIA scope is limited. The number of possibly impacted trees is provided by field surveys complemented by GIS mapping. Moreover, trees of small and medium sizes will be removed due the layout of the project for which compensation will be made to concerned parties (Local community, forest and other relevant departments.)	• Incorporate technical design measures to minimize removal of trees, if possible; • Cutting of trees and disturbance shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized and possible alternate route must be considered for proposed road, in which minimum ecological and environmental losses are expected; • A Tree Plantation Plan has been formulated (Annex-XII) that shall be implemented with the technical support of concerned Agriculture and Forest Department; • As a principal, ten trees shall be planted in place of felling of one tree (i.e.1:10) in consideration of mortality. Moreover, due consideration should be given to invasive/non-invasive species factor while replantation process; • The Forest Department and PHA shall involve the local communities to carry out plantation; • Total 1750 trees are recommended for plantation • Open fires should be banned in the Project Area to avoid fire hazards; • Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the	• Visual Observations	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		natural vegetation may be minimized by establishing camp sites, workshops and batching plants on waste/barren land rather than on forested or agriculturally productive land; • However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation will be carried out and minimum damage will be caused to trees and undergrowth; • Construction vehicles, machinery and equipment will remain confined within their designated areas of movement; • The Contractor's staff and labor shall be strictly directed not to damage any vegetation such as trees or bushes. The contractor' workforce shall use the paths and roads for movement and shall not be allowed to trespass through farmlands or forest areas; and • Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed.			
31.	**7.4.1.2 Fauna** During construction phase the existing population of mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving excavation, blasting, movement of	• Care shall be taken during construction activities to avoid purposely or chance killing of animals; • If found any wild species and habitat during construction that must deal carefully and local wildlife department officials should be called; • Hunting, poaching and harassing of wild animals shall be strictly	•		

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	machinery and vehicular traffic, movement of labor, camping, etc. The existing animals will leave the directly affected areas due to construction activities and human intervention. Some animals particularly reptiles may get killed during the earthworks operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase. Birds will also tend to move away from the construction areas and find shelter and food elsewhere due to the activities mentioned above for fear of being hunted / trapped. Noise generated from construction machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers. This impact is site-specific, temporary and medium significant.	prohibited, and Contractor shall be required to instruct and supervise its labour force accordingly and clear orders should be given in this regard; • The Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department; • Provision of culvert/tunnel for the movement of different faunal species across the project road present in the project area; • Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding; • Noise generating activities shall not be carried out during the night by the work force, clear orders should be given by the contractor; • Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and • Efforts should be made to keep noise levels at acceptable levels (as per PEQS) produced by the construction activities.			
32.	**7.4.1.3 Social/ Cultural Conflicts** During the construction phase of the	• Local labor should be preferably employed for the construction works; • Careful planning and training of work			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	project, conflicts may arise between labor force and Local communities. Use of local resources (existing infrastructure and utilities) by the construction workers can generate stress on the local residents. Furthermore, difference in cultural values may also cause discomfort to local residents. This impact is temporary and moderate adverse in nature.	force to minimize disturbance to the local people; and • Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals.			
33.	**7.4.1.4 Impacts on Livelihood** The construction activity may disturb the business and livelihoods of the business operators, shopkeepers, workshop owners and workers doing their work in the AOI due to the excavation activities. At this stage the assessment of livelihood impacts has been carried out on the basis of the proposed AOI. During the construction phase, these locations will be finalized and on that basis the livelihood impacts will be determined more accurately.	• Proper compensation should be provided to all the affectees losing their livelihoods along the AOI; • Relevant stakeholders should be engaged to design livelihood restoration measures including affectees of the proposed Project Area; • Livelihood restoration should be provided to mitigate the adverse impacts on livelihood and restoration of commercial activates which will be monitored; • Initial assessment of compensation should be carried out for the income loss of the affectees based upon the current approximation of the AOI and construction camps. This assessment should be reviewed and revised on the basis of final AOI and construction camp site determined during the construction phase; • Project Construction should be	•		

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		completed on time; and • Proper awareness and training should be conducted among the affectees regarding Project benefits, reasons for acquiring lands and compensations to be provided.			
		Operational Phase			
34.	**Landscape** During the operation stage, new saplings of different plants and trees would be planted to enhance the aesthetics and compensate the loss of affected trees. This will have a positive impact of permanent nature. The presence of adequate flora at available spaces along the proposed alignment will help in absorbing flue gases emitting from vehicles and public transport passing through the project area, which shall help to improve the air quality.	• The saplings planted in the project area against the trees affected should be properly maintained throughout their growth.	• Monitoring of plant maintenance activities records	Proponent	
35.	**Air Quality** Increased traffic levels in the project area may lead to higher values of air emissions that will affect the ambient air quality of the Project Area. The impact is permanent and minor negative in nature.	• RUDA with the help of PEPA may set up system to monitor air quality along project area at important intersections/sensitive receptors in accordance with PEQS for a specific period to record the quality of air during the operation phase. This may help in comparing the baseline conditions with the operation phase of the project; • Setting up to system to monitor air quality along the project area in	• Visual observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		accordance with acceptable International Standards; Monitoring emissions of vehicle as per PEQS; • Helping the owners and occupants of the affected premises/settlements to identify and implement special measure such as hedges and vegetation to reduce air pollution; and • Increasing vegetation in the form of greenbelt is one of the preferred methods to mitigate air pollution. Plants generate oxygen, serve as a sink for pollutants, reduce the flow of dust and reduce the noise pollution too alongside the proposed project.			
36.	**Noise and Vibration** The movement of vehicles and usage of horns will create noise which will be a hazard for the nearby residents/built-up areas. Impact of noise generated from the vehicles moving on the proposed road will be permanent and moderate adverse in nature.	• Provision of adequate noise barriers such as hedges and indigenous tree species will reduce the noise. Further Improvement can be made by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a certificate. Noise measurements should be carried out at locations with respect to the schedule specified in the Environmental Monitoring Plan (EMMP) to ensure the effectiveness of mitigation measures; • Use of horn should be strictly prohibited in the close proximity of the built-up areas; • Proper signboards should be installed to ensure reduce noise levels in the	• Physical observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		project area; • Enforcement and penalties against traffic rules violators; and • Noise barriers may be installed/constructed near the built-up areas.			
37.	**Road Maintenance** During the operation phase related road maintenance works will be conducted time to time which may lead to social and environmental issues like traffic management, inconvenience to local residents, public safety, vehicular emissions, dust and increase in noise. This is a temporary and moderate negative impact.	• Best Management Practices should be used for all the maintenance works; • Timely completion of all the maintenance works according to the agreed schedule; • Traffic management plan should be devised and implemented; and • HSE protocols should be strictly followed and implemented to avoid any incident/accident.	• Physical observation • Road maintenance records	Proponent	
38.	**Drainage** During the operational phase, poor maintenance of the road drainage system, particularly during the monsoon season can cause nuisance to the travellers and public due to flooding in the existing drainage line. In case of chocking of road drainage, the increased surface runoff due to heavy rains will accumulate at the surface and can cause traffic jams. The impact may consider to be moderate adverse in nature.	• The impact can be controlled/reduced by timely and continuous maintenance/ cleaning of the drainage system; and • Placement of sign boards instructing not to dispose of solid waste to avoid chocking of drain along the road alignment.	• Physical observation • Road maintenance records	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
39.	**Flora** During Operational stage, the Project will not affect flora (trees and agricultural crops) or release any significant pressure detrimental to flora. Low level impact is expected at operational phase on vegetation due to the Operational and Maintenance activities. This impact is site-specific, temporary, irreversible and low significant.	• The implementation of tree plantation plan recommended in compensation for cutting of trees should start working during operational stage, to ensure the ecological balance and to avoid any impact on local Environment; • Large scale planting with suitable indigenous fruit and forest trees, shrubs and ornamental plants in the form of Tree Groves, and Linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation. It will help in absorbing flue gases, emitting from a large number of vehicles and public transport passing through the project area, which shall improve the air quality; • The saplings planted in the project area against the trees affected should be properly maintained throughout their initial growth period in terms of water requirement and necessary nutrients by RUDA or relevant department; • Proper check and balance for above activities is highly recommended. Plantations raised, must be maintained according to the Silvicultural practices, which include proper irrigation, cleaning, pruning, thinning at prescribed intensity, Silt	• Tree plantation plan • Visual observations • Audit and Checks	Proponent in association with PHA or Forest Department	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		clearance and Trench-opening, etc. • Maintenance and security of the plantation should be done for at-least five years (in consultation with the forest department). Measures such as fencing, watch guards and fire protection should be considered; and • All activities must be done under the technical supervision of Forest Department.			
40.	**Fauna** There is no protected area, game reserve, game sanctuary or national park in the project area so no major impact on wildlife & livestock in the area is expected through, noise, vibration and any type of normal activity in the project area, thus will have no effect on productivity. This impact is site-specific, permanent, irreversible, and minor significant.	• The pathways of locally available wildlife and livestock for food, shelter and other normal activities must be compensated with proper alternative routes/pathways and water points must be provided to minimize the impact and movement of available wild and domesticated animals.; • In proper consultations with Forest and Wildlife Department, permanent water points for available fauna may be provided to conserve local ecosystems and biodiversity. • Strict control must be exercised for stoppage of killing/poaching of available wildlife species by enhancing protection practices and deploying effective watch and ward system; • The precautionary measures described for future shall also be applicable during operation phase as relevant for the conservation of wildlife species in the Study Area; and	• Visual observations • Audit and Checks	Proponent in association with Wildlife Department	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• Proper fence must be provided along the roadside to avoid road killing of wildlife, livestock and most importantly any inconvenient for local inhabitants.			

KEY

DC	Design Consultant
CC	Construction Contractor
SC	Supervision Consultant
RUDA	Ravi Urban Development Authority

7.5 ENVIRONMENTAL MONITORING

Environmental Monitoring is undertaken during both the construction and operational phases, to ensure the effectiveness of the proposed mitigation measures against identified adverse environmental impacts in the EIA report.

The main objectives of the construction phase monitoring plan will be to:

- Monitor the actual impact of the works on the project site physical, biological and socio-economic receptors;
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds the anticipated impact;
- Ensure compliance with legal obligations including safety on construction site; and
- Monitor the rehabilitation of borrow areas and the restoration of construction campsites as described in the EMP; and
- Ensure the safe disposal of excess construction materials.

The main objectives of monitoring during the operational phase will be to:

- Appraise the adequacy of the EIA with respect to the Project's predicted long term impacts of operation on physical, biological and socio-economic environment;
- Evaluate the effectiveness of the mitigation measures proposed in the EMMP and recommend improvements, if and when necessary; and
- Compile periodic Environmental Monitoring reports on the basis of recommendations in EMP.

7.5.1 Monitoring Strategy

Under the proposed monitoring strategy, it is recommended RUDA should be responsible for all the monitoring activities. All the findings and results in the form of monitoring report will be finally shared with Punjab-EPA. The monitoring program has been designed carefully considering the identified impacts mentioned in Chapter-6. Table 7.2 provides environmental monitoring schedule for construction and operations stages of the proposed Project.

7.5.2 Budget Estimate for Environmental Monitoring and Compliance

Budget Estimate for Environmental Monitoring and Compliance during the Construction and Operation Phase has been summarized in Table 7.3.

Table 7.2: Environmental Monitoring Schedule

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility	Duration
1.	Water Resources/ Water Quality	Monitoring of Physical, Chemical and Biological parameters and its compliance with PEQS, 2016 for surface water and drinking water.	• Major receptors are Drains, distributaries and commercial / residential areas within the AOI of the proposed project. • Other proposed effluent discharge points are: ▪ Contractors camps; ▪ Concrete preparation plants; ▪ Fuel (Petrol. Oil and Grease) products storages; and ▪ Vehicle and machines repairing and servicing yards.	• Visual checks of laboratory activities; and • Discrete grab sampling and laboratory testing of water samples by EPA-Punjab Certified Laboratory for monitoring.	• Once before the start of construction activities; • On quarterly basis during the construction phase; • Bi-annually for at least one year during O&M phase; and • Visual inspection daily.	• RUDA • Contractor • RUDA	• As per PEQS, 2016.
2.	Soil Contamination	Soil contamination due to effluent / surface runoff and uncontrolled solid waste disposal activities at sites.	• Along access Roads (proposed project); and • Other proposed sampling sites are: ▪ Construction camps; ▪ Equipment washing yards; ▪ Spillage points of fuel, chemicals and lubricants.	• Visual observations and checking of laboratory activities; • Sampling and laboratory testing for soil samples.	• Once before the start of construction activities; • On quarterly basis during the construction phase; • Bi-annually for at least one year during O&M phase; and • Visual inspection daily.	• RUDA • Contractor • RUDA	

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility	Duration
3.	Dust Emissions	Monitoring of PM_{10} and $PM_{2.5}$ and its compliance with PEQS, 2016 for Ambient Air.	Sensitive receptors (residential area and construction camps) within the AOI of the proposed project.	• Visual checks of laboratory activities; • Onsite Ambient Air Monitoring Equipment; and • Daily visual monitoring of dust emissions at construction route.	• Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase.	• RUDA • Contractor • RUDA	
4.	Noise Pollution	Monitoring of Noise Level and its compliance with PEQS 2016 for Noise.	Sensitive receptors (residential area and construction camps) within the AOI of the proposed project.	• Visual checks of laboratory activities; and • Onsite Noise Monitoring using Sound Meter.	• Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase.	• RUDA • Contractor • RUDA	
5.	Fumes and gases	Monitoring of CO, CO_2, SOx, NO_x, Lead and $PM_{2.5}$ PM_{10}, Vehicular emissions and its compliance with PEQS 2016.	Sensitive receptors (residential area and construction camps) within the AOI of the proposed project.	• Visual checks of laboratory activities; • Onsite Ambient Air Monitoring Equipment; and • Daily visual monitoring of dust emissions at construction route.	• Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase.	• RUDA • Contractor • RUDA	
6.	Ecological Resources	Disturbance to natural habitat and uncontrolled	Natural habitats within the AOI of the proposed	• Visual checks to ensure that only marked trees	• Once before the start of construction	• RUDA	

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility	Duration
		floral cutting which can be avoidable.	project.	are cut within the Project corridor; and • Monitoring of Wildlife / birds hunting.	activities; and • Visual inspection daily / weekly during construction and O&M phase.	• Contractor • RUDA	
7.	Safety of workers	Medical record of workers	Construction site.	• Checking of accident/ near miss records. • Medical surveillance of Construction workers	• On quarterly basis during the construction phase.	• Contractor	
8.	Restoration of work sites	Site cleared and no solid and construction waste in the study area	Construction site and camp sites	• Visual inspection	• After completion of construction work	• Contractor	

7.5.3 Responsibilities for Environmental Testing and Reporting

The Construction Contractor (CC) will be responsible for environmental monitoring and reporting throughout the construction phase under the supervision of Environmental Engineer of Supervision Consultant (SC); in coordination with Project Director, RUDA. During construction phase, environmental testing reports will be prepared on quarterly basis and one comprehensive report will be prepared at the end of the construction phase and will be submitted to each of the following authorities and institutions: (i) RUDA and (ii) EPA-Punjab.

During the first year of the project operation, concessionaire will be responsible to conduct environmental testing and monitoring along with its cost through a third party contractor and EPA-Punjab certified lab. The reports will be prepared biannually and one comprehensive report will be prepared annually and submitted to the EPA-Punjab. Contents of the final report will include results of environmental monitoring in comparison to the standards for the various parameters, location and sampling time along with recommendations for the future environmental testing and monitoring.

7.5.4 Budget Estimate for Environmental Monitoring and Compliance

Budget Estimate for Environmental Monitoring and Compliance during the Construction and Operation Phase has been summarized in Table 7.3.

Table 7.3: Budget Estimate for Environmental Monitoring and Compliance during the Construction and Operation Phase

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
A) Construction Phase (12 Months)						
Ambient Air Quality	Visual checks and monitoring of SO_2, NO, NO_2, CO, Suspended Particulate Matter, PM_{10}, $PM_{2.5}$ according to PEQS, 2016.	1x2x4= 8	Quarterly @ Rs. 30,000 per sample	CC and SC	24 hours	240,000/-
Noise Level	Noise level monitoring (Day and Night) as per PEQS, 2016.	1x2x4= 8	Quarterly @ Rs. 2,000 per point	CC and SC	24 hours	8,000/-
Drinking Water Quality	Sampling and laboratory testing of water samples by EPA approved Laboratory as per PEQS, 2016.	1x2x4=8	Quarterly @ Rs. 20,000 per sample	CC and SC	-	160,000/-
Surface Water Quality	Sampling and laboratory testing of water samples by EPA approved Laboratory as per PEQS, 2016.	1x1x4=4	Quarterly @ Rs. 20,000 per sample	CC and SC	-	80,000/-
					TOTAL (A) =	***488,000/-***
B) Operation Phase (12 Months)						
Ambient Air Quality	CO, NO_2, SO_2, Lead, SPM, $PM_{2.5}$ and PM_{10}	1x1x2 = 2	Biannually @ Rs. 30,000 per sample	RUDA	24 hours	60,000 /-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x1x2 = 2	Biannually @ Rs. 2,000 per point	RUDA	24 hours	4,000/-
Drinking Water Quality	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	1x1x2 = 2	Biannually @ Rs. 20,000 per point	RUDA	-	40,000/-
Surface Water	Discrete grab sampling and laboratory testing of water	1x1x2 = 2	Biannually @ Rs. 20,000	RUDA	-	40,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
Quality	samples by EPA approved Laboratory for monitoring.		per point			
					TOTAL (B) =	***144,000/-***
					GRAND TOTAL (A+B) =	***632,000/-***

KEY

CC Construction Contractor SC Supervision Consultant

RUDA Communication & Works Department

Notes:

- Provision must be given in annual budget of operation phase for environmental monitoring. For this, the cost of operation phase (i.e. Rs. 144,000/-) must be considered with an annual increment of 10%.
- All the environmental parameters will be analyzed as per Punjab Environmental Quality Standards (PEQS), 2016.

7.6 Tree Plantation

To minimize the negative impacts arising due to tree cutting (175 No.), increased vehicular activity and to enhance the landscape of the project area, plantation at available spaces may be carried out especially along sides and at the median.

Plantation Plan shall be carried out by the Client in coordination with PHA, which has the requisite expertise and experience for such tasks.

The tentative cost for the plantation is about Rs. 6.8 Million. Detailed Tree Plantation Plan is attached as **Annex-XII**.

7.7 TRAINING AND CAPACITY BUILDING

An environmental and social training and technical assistance (TA) program is to be carried out before the implementation of the proposed project as it strengthens the institutional capacity required to manage the environmental and social issues. Contractor's environmental awareness and appropriate knowledge of environmental protection is critical to the successful implementation of the EMMP because without appropriate environmental awareness, knowledge, and skills required for the implementation of the mitigation measures, it would be difficult for the Contractor(s) workforce to implement effective environmental protection measures.

RUDA will be responsible to engage TA consultant to conduct environmental and social training programs. The objective of the TA will be as follows:

- To help in establishment of appropriate systems;
- To train senior RUDA staff, Contractor and Sub-Contractor workers and Supervision Consultant employees, responsible for managing environment and social tasks and planning during construction and post construction phase; and
- Training courses on specialized areas such as air, water and noise pollution monitoring.

Table 7.4 provides brief detail of the capacity building and training plan for the proposed project.

Table 7.4: Capacity Building Programs and Technical Assistance Services

Provided by	Contents	Trainees	Duration
TA Individuals, Consultants and Organizations specializing in Environmental Management and Monitoring	Short Seminars and Courses on: • Environmental laws and regulations; • Environmental Sustainability; and • Environmental Management and Monitoring Plan (EMMP)	Members of Environmental Committee, RUDA Staff and Contractor Workers	3 Days
TA Individuals, Consultants	Short Seminars and Courses on:	Members of	3 Days

Provided by	Contents	Trainees	Duration
and Organizations specializing in Social Management and Monitoring, and Occupational Health and Safety	• Occupational Health and Safety Plan (OHS); • Basic First Aid; • Occupational and Community Health and Safety Management; • Labour Camp Management; • Traffic Management; • COVID-19 Protection and Control; • Use and Importance of Personal Protective Equipment's (PPEs); and • Fire Safety and Emergency Response Measures.	Environmental Committee, RUDA Staff and Contractor Workers	
TA Individuals, Consultants and Organizations specializing in Environmental and Social Management and Monitoring	Short Seminars and Courses on: • Environmental Management Plan (EMP); • Environment Health and Safety Management; • Occupational Health and Safety; • Basic First Aid; • Waste Management; • Fire Safety and Emergency Response Measures; • Electrical Safety; and • Use and Importance of Personal Protective Equipment's (PPEs)	Operation and Maintenance Staff of RUDA	3 Days

7.8 COMMUNICATION & DOCUMENTATION

Communication and documentation is an essential feature of EMP. The key features of such mechanism are:

7.8.1 Data Recording and Maintenance

All forms to be used for recording information during the environmental monitoring will follow a standard format which will correspond to the data base in to which all the gathered information will be placed. Check boxes will be used as much as possible to facilitate data entry. Tracking system will be developed for each form.

7.8.2 Database

The database may include the following information:

- Training programs;
- Staff deployment;
- Non-compliances;

- Corrective actions
- List of environmental data; and
- List of environmental data to be maintained:
  - Soil and land pollution;
  - Disposal of waste;
  - Water resources;
  - Fuel oil and chemical spills;
  - Vegetation record;
  - Noise pollution;
  - Air and dust pollution;
  - Socio-economic data; and
  - Ecological sensitivities.

7.8.3 Meetings and Reporting

Monthly meetings will be held at site during the construction phase. The purpose of these meetings will be to discuss the routine activities, non-compliances and their remedial measures. Various reports will also be produced at periodic time intervals, as provided in Table 7.5 along with information regarding persons responsible for report preparation and review process. Additionally, minutes of meeting will also be submitted as part of routine environmental reports.

Table 7.5: Periodic Reporting Mechanism

Sr. No.	Report Category	Prepared by	Reviewed by
1	Monthly	Contractors' environmental staff	RUDA / SC
2	Quarterly	Contractors' environmental staff	RUDA / SC
3	Semi-Annual Environmental Monitoring Report (SAEMR)	Construction Supervision Consultant (CSC)	RUDA / SC
4	Annual Report	Contractors' environmental staff	RUDA / SC
5	Completion Report	Contractors' environmental staff	RUDA / SC

7.8.4 Social Complaint Register

The Contractor will maintain a register of complaints record from local communities and measures taken to mitigate these concerns.

7.8.5 Photographic Records

Contractors will maintain photographic records during the implementation of the proposed Project. As a minimum, the photographic records will include the site photographs, all the roads, camp sites and monitoring activities, etc.

7.8.6 Non-Compliance of the EMP

The implementation of the proposed EMP involves inputs from various functionaries. The Contractor will be primarily responsible for ensuring implementation of the mitigation

measures proposed in the EMP, which will be part of the contract documents. The provision of the environmental mitigation cost will be made in the total cost of Project, for which the Contractor will be paid on the basis of monthly compliance reports. However, if the Contractor fails to comply with the implementation of EMP and submission of the monthly compliance reports, deductions will be made from the payments to the Contractor claimed under the heads of environmental components.

7.8.7 Review of Recorded Data

All the data and communication recorded and maintained by the Contractor will be periodically reviewed and checked by SC and RUDA and necessary action will be recommended to Contractor to improve the recording and documentation.

7.9 MANAGEMENT PLANS

Various site-specific management plans will be prepared by Contractor as a part of EMP for the better management and implementation of EMP during all phases of the proposed Project. However, approval of these site-specific plans from RUDA should be sought before start of construction activities. These site-specific plans are listed below but not limited to these:

- Tree Plantation / Reforestation Plan;
- Health, Safety and Environment (HSE) Management Plan;
- Emergency Preparedness and Response Plan;
- Site Restoration and Rehabilitation Plan;
- Waste Management Plan;
- Disaster Management Plan;
- Drinking Water Supply and Sanitation Plan
- Traffic Management Plan;
- Change Management Plan
- Quarry Management Plan; and
- Resource Conservation Plan.

7.10 PUBLIC DISCLOSURE

RUDA will disclose this EIA to all the stakeholders prior to the start of the construction. This report will be made available to the stakeholders at places as designated by the PEPA. In addition, executive summary of the Report will be translated into Urdu language and made available to the affected communities and locals. The copies will also be kept at construction site for ease in accessibility of the locals. This will ensure the locals to be aware of the Project impacts, its mitigation, responsible staff and mode of implementation. In addition, the executive summary will also be published on RUDA website.

7.11 EMP COST

The contractor will be responsible for implementation of mitigation measures and environmental Monitoring during construction phase, whereas RUDA will be responsible for

implementation of mitigation measures and environmental Monitoring during operation phase. For an effective implementation of environmental mitigation measures during construction and operational phase, it is very important to provide sufficient funds for the implementation of environmental and social mitigation measures, monitoring and training. The estimated cost of environmental and social mitigation measures, monitoring and training is given in the Table 7.6.

The cost for EMP will be part of the contract document with the Contractor. The same may also be included in the total project cost for the implementation of EMP. It must be noted that environmental cost will not be a separate entity because all of its components will be addressed in the bidding document under various heads of account.

Table 7.6: Environmental and Social Testing, Mitigation and Training Cost

Sr. No.	Activity	Description	Cost (Rs.)	Rationale
1.	Medical screening for workers	Rs. 5,000 per person for 100 employees *Pre-Construction Phase:* 100 x 5,000 x 1 = 500,000 *Construction Phase:* 100 x 5,000 x 1 = 500,000	2,250,000/-	Medical screening of the workers before deployment on site and twice a year during whole construction period.
2.	Material Storage, handling and use	Four Number of tarpaulins of Rs. 20,000 each	80,000/-	Four tarpaulins are proposed during the whole construction phase for the protection of material and dust control.
3.	Water Sprinkling	Sprinkling of water to control dust at site on alternate day @ 30,000/Month	540,000/-	Sprinkling of water to control dust emissions at site during whole construction period.
4.	Handling of solid waste	Includes the cost of collection, segregation, transportation, disposal and management of domestic, commercial and construction wastes	600,000/-	Rs. 50,000 per month for 12 months to collect waste at construction camps and construction waste from all the active sites on daily basis.
5.	Health and Safety of Workers	For 100 employees for the provision of dust masks, safety shoes, gloves, first aid box,	1,705,000/-	For detail, please refer to **Annex–XIII**.

Sr. No.	Activity	Description	Cost (Rs.)	Rationale
		ear plugs, safety helmets and safety jackets (Hi Vis) and provision of dust bins, warning tap, safety cones and safety sign boards.		
6.	HSE Expert	HSE Expert to monitor / conduct all HSE related activities e.g. TBTs, PPEs, housekeeping, safety signage, emergency preparedness, etc. during construction and operational phase *Construction Phase:* 1 x 12 x 150,000 = 1,800,000 *Operational Phase:* 1 x 12 x 150,000 = 1,800,000	3,600,000/-	Cost for hiring HSE Experts along with their monthly logistics during construction and operational phase.
7.	Environmental Testing Cost	Ambient air, drinking water, surface water and noise	632,000/-	Refer to Table 8.3 for detailed schedule and cost of environmental testing during construction and operation phase.
8.	Cost of environmental and social training	Short Seminars, Courses, Trainings and Lectures on Environment, Social and Occupational, Health and Safety constituents and components (Rs. 75,000/- per session twice a year during construction phase). *Construction Phase:* 2 x 75,000 = 150,000	150,000/-	Refer to Table 8.4 for details.
9.	Environmental Audit	Environmental Auditing through third party twice a year during construction and operational phase	1,600,000/-	Cost for at least two auditors along with logistics, travels and accommodation charges.

Sr. No.	Activity	Description	Cost (Rs.)	Rationale
		2 x 400,000 = 800,000 *Operational Phase:* 2 x 400,000 = 800,000		
10.	Tree Plantation	Approximately 1750 numbers (based on GIS and field trothing for species identification) of different trees may be cut down during construction phase. Therefore, Compensatory planting trees against each fallen tree of similar floral function should be planned which is approx. 1750 to enhance the landscape of the project area. Plantation at available spaces may be carried out especially at the median.	6,800,000 /-	For detail, please refer to **Annex–XII**.
		Total =	***17,957,000/-***	

The total estimated cost for the environmental management, monitoring and auditing during construction and O&M (annual cost will be updated for next upcoming years accordingly) comes to about **PKR 17.9 Million**.

8 CONCLUSION AND RECOMMENDATIONS

8.1 GENERAL

The EIA report has been prepared in accordance with the requirements of the Punjab Environmental Protection Act, 2012 and 2017 (Amended); Pak-EPA Regulations, 2000 for review of IEE and EIA and Pakistan EIA procedures.

8.2 CONCLUSION

The main objectives of the proposed Interchange/Trumpet is to provide interconnectivity with the Ring Road, Lahore for the Chahar Bagh Society and to provide a safe, congestion free road facility to the commuters of the Project area.

Significant efforts were made to identify the main physical, ecological, social, cultural and environmental issues related to the construction and operation of the proposed road. Various stakeholders including government departments and agencies were also contacted for obtaining salient information in this regard along with that from area residents.

During the pre-construction, construction and operational phases, following are the main issues and concerns:

- Land Acquisition;
- Disturbance to infrastructure and public utilities;
- Disturbance to the public movement and cultural norms during construction;
- Reduction in the daily routine activities of local residents during construction;
- Noise and air pollution due to the working of construction machinery during construction and traffic operation phases of the Project;
- Solid waste and wastewater generation during construction;
- Oil spillages from construction machinery, resulting in soil and groundwater contamination;
- Cutting of trees/bushes/crops falling within the proposed ROW;
- Surface water bodies contamination due to soil erosion and construction activities; and
- Occupational and community health and safety issues.

Results of the EIA Study have shown that there are no critical environmental impacts associated with the project. However, several concerns / impacts with regard to physical, ecological and social environment have been identified in report which needs to be mitigated by strict implementation of Environmental Management Plan. These impacts could also be reduced by proper and judicious compensation to the affectees and well planned meticulous design of the facility and by implementing an appropriate tree plantation plan. In fact, in times of diminishing economic and natural resources, using sustainable approaches in transportation infrastructure

will help us to enhance quality of life and serve the transportation needs of the present leaving provision for future generations to meet their needs.

8.3 RECOMMENDATIONS

An Environmental Monitoring/Management Plan (EMP) for both the phases (construction and operation) has been developed as part of the report which provides a detailed mitigation matrix that covers impacts, mitigation measures, roles and responsibilities and timings to avoid, minimize or mitigate the adverse impacts of the proposed project.

Based on the field visit, environmental monitoring and analysis of primary and secondary data, following recommendations have been conferred so that the Proponent gets the necessary direction and clarity to ensure efficient environment friendly and compliant operation:

- The proposed road should be designed and constructed to withstand high magnitude earthquakes as per Seismic Building Code of Pakistan, 2007;
- Proper location(s) for construction camps should be selected by contractor in close coordination with RUDA that cause minimal/no damage to the prevailing environmental conditions of the project area;
- Formulation and implementation of a comprehensive safety and security plan by contractor before the start of the construction activities for the camps which should be comprised of a training manual, use of safety equipment, emergency preparedness and code of ethics;
- Wearing of Personal Protective Equipment (PPEs) such as helmet, masks, adequate footwear for bituminous pavement works, protective goggles and gloves should be made compulsory during construction activities and formulation and implementation of Health and Safety Plan (HSP) for construction workers;
- Preparation and implementation of Solid Waste Management Plan during construction stage by contractor in close coordination with concerned authorities for collection, reuse, recycling and disposal of waste;
- Employment opportunities should be provided to local people for skilled and unskilled works during construction stage;
- A provision of adequate budget in the overall cost of the Project and on-site space for plantation as per guidelines of the concerned departments should be provided in the design of proposed road to compensate tree cutting and to eradicate air pollution. Moreover, tree plantation must be considered to create a buffer zone for the noise pollution arising from the road traffic;
- Soil contamination should be controlled by proper storage of chemicals;
- Surface runoff and wastewater generated during construction stage should be controlled and collected in septic tanks and soakage pits;
- Dust and fugitive emissions should be controlled by maintenance of equipment, fine tuning of the vehicles and regular sprinkling of water on soil;
- Noise and vibration should be controlled by equipment maintenance, by providing noise barrier and by scheduling the construction activities to avoid peak activity hours in the area;

- Adequate budget should be provided in the project cost for the compensation to the affected people's as per Land Acquisition Act, 1894; and
- For effective implementation of suggested mitigation measures, the environmental mitigation and monitoring cost/EMP must be the part of the bidding document of the Contractor.