



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



INFRASTRUCTURE DEVELOPMENT AT CHAHARBAGH PHASE-II



ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY

VOLUME-I

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Consultant



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Infrastructure Development at Chaharbagh Phase-II

ENVIRONMENTAL IMPACT ASSESMENT STUDY

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LIST OF ABBREVIATIONS

AoI	Area of Influence
BCP	Buildig Code of Pakistan
BOD	Biological Oxygen Demand
CEO	Chief Executive Officer
CDA	Canal and Drainage Act 1873
CDM	Clean Development Mechanisms
CWD	Communication and Works Department
CCMP	Construction Camp Management Plan
COVID-19	Coronavirus disease
Col	Corridor of Impact
CCI	Council of Common Interest
ECO	Economic Cooperation Organization
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMMM	Environmental Mitigation and Management Matrix
EPA	Environmental Protection Agency
EPD	Environment Protection Department
ERP	Emergency Response Plan
FGDs	Focused Group Discussions
GHGs	Greenhouse gases
GoP	Government of Pakistan
GoPb	Government of the Punjab
HCS	Highway Capacity Software
IEE	Initial Environmental Examination
ILO	International Labour Organization
ISO	International Organization for Standardization
KPH	Kilometres Per Hour
LAA	Land Acquisition Act
LESCO	Lahore Electric Supply Company
LOS	Level of Service
LWMC	Lahore Waste Management Company
MSDS	Material Safety Data Sheets
NCS	National Conservation Strategy
NDMA	National Disaster Management Authority
NESPAK	National Engineering Services Pakistan
PAPs	Project Affected Persons
PEQS	Punjab Environmental Quality Standards
PHA	Parks & Horticulture Authority
NOC	No Objection Certificate
NPO	No Project Option
NPZ	Noise Perimeter Zones
NGOs	Non-Governmental Organizations
OSHA	Occupational Safety & Health Administration
PMD	Pakistan Meteorological Department
NCS	Pakistan National Conservation Strategy
PD	Project Director
PGA	Peak Ground Acceleration

PPE	Personnel Protective Equipment
PAPs	Project Affected Persons
PEPA	Punjab Environmental Protection Act
PEQs	Punjab Environmental Quality Standards
R & D	Research and Development
RUDA	Ravi Urban Development Authority
RRUDP	River Ravi Urban Development Project
SDGs	Sustainable Development Goals
STDs	Sexually-Transmitted Diseases
SSEMP	Site Specific EMP
SOP	Standard Operating Procedures
SC	Supervisory Consultant

EXECUTIVE SUMMARY

ES-1 INTRODUCTION

Government of the 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. "Ravi Urban Development Authority (RUDA)" was established to meet the objective of infrastructure development under River Ravi Urban Development Project (RRUDP). The proposed Chaharbagh Phase-II project is part of the RRUDP. Chaharbagh Phase-II is a comprehensive housing project situated in Ravi City's Phase-I on Theri Road. The project's strategic location provides easy access to major transportation networks, educational institutions. Chaharbagh Phase-II incorporates a variety of residential plot sizes and amenities, including parks, educational institutions, healthcare facilities, commercial areas, recreational spaces, and security measures. This document presents the findings of Environmental Impact Assessment (EIA) of Infrastructure Development at Chaharbagh of Ravi Riverfront Urban Development Project (RRUDP).

ES-2 REGULATORY AND POLICY REVIEW

The EIA Study has been conducted for the subject project as a mandatory requirement of Punjab Environmental Protection Act, 1997 (Amended 2012 & 2017). Section 12 (1) of the Act states that "No proponent of a Project shall commence construction or operation unless he has filed with the Provincial Agency an Environmental Impact Assessment or, where the Project is likely to cause an adverse environmental effect, an Environmental Impact Assessment, and has obtained from the Provincial Agency approval in respect thereof." Other relevant laws have also been discussed briefly in Chapter-2.

According to the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations 2022, the proposed project falls under Category 'H' of the Schedule-II. This category requires an EIA study to be conducted for urban development projects to initiate the process of environmental approval.

ES-3 DESCRIPTION OF PROJECT

Chaharbagh Phase-II is a comprehensive housing project, focuses on providing residential units, amenities, and infrastructure to enhance the standard of living for residents. The proposed development is spanned on 168.22 acres of land. The total Area of the proposed Project is mainly distributed into various land-use including residential, roads & parking, commercial, amenities, open spaces and green areas. Tentative cost of the proposed Project is about PKR.7,809.7 Million.

ES-4 DESCRIPTION OF THE ENVIRONMENT

Physical Environment

The proposed Project falls under administrative jurisdiction of District Lahore. Lahore is generally flat and slopes towards south and south-west, city lies on the alluvial plain called Bari Doab. The Project area has moderate to extreme climate conditions, with hot summers and cold winters.

As per Building Code of Pakistan (BCP), 2007 (Seismic Provisions), the proposed Project falls entirely in the Zone-2A with Peak Ground Acceleration (PGA) 0.08 to 0.16 g of the seismic zonation. Major sensitive receptors, i.e.,

health and educational institutions, and religious places (mosques, shrines and graveyard) recorded based on site survey and by using the GIS tool for the proposed Project.

Ecological Environment

The study area has a variety of trees. The major tree species in the Project Area are Shisham (*Dalbergia sissoo*), Eucalyptus (*Eucalyptus camaldulensis*), Neem (*Azadirachta indica*), Pipal (*Ficus religiosa*), Ber (*Ziziphus mauritiana*), Toot (Mulberry) (*Morus alba*), and Kikar (*Acacia modesta*).

Common mammals found in the area are dogs, cats, house rats and bats. House sparrow (*Passer domesticus*), House crow (*Corvus splendens*) and Mynah (*Acredotherestrictis*) are the most common in the area. There are no wetlands in the Project Area. There is no game reserve, wild sanctuaries and National Park present in the Project Area.

Socio-Economic Environment:

The project area falls in District Lahore. Total two (02) main settlements named Nath Kalan and Theri 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. The household surveys, indicated that household size is 7.1 persons. The sample size of seventy-eight (78) households was calculated based on the Standard Statistical Formula. The population of the settlements in Aol is predominantly Muslim followed by Christians. The educational facilities in the Aol comprises Middle schools for boys and girls in village Nath Kalan.

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 Protection Department (EPD), Forest Department, Wildlife Department, Parks & Horticulture Authority (PHA) etc.), potential PAPs, local community and other general public residing in the Study Area. Consultation process included Focused Group Discussions (FGDs), 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 168.22 Acres, which is owned by RUDA, the Government of the Punjab.
- 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 6,600 liters/day¹ for 200 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 Chaharbagh. Install a sewerage treatment plant (STP) will be installed to treat the waste water.
- A total of about 90 kg 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 20-25 trees / saplings may be affected. A tree plantation program has been formulated with the recommendations of compensatory planting of 1,000 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 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

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

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 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. 23.8 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. However, there will be significant impacts on the ecological and social environment. These impacts could be reduced by proper and judicious compensation to the affectees and well-planned meticulous design and by implementing an appropriate tree plantation.

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 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 province of the Punjab 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 the 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.

Chaharbagh Phase-II is a housing project situated in the southwestern section of Phase-I of Ravi City on Theri Road, having an area of approximately 168.22 acres. Chaharbagh Phase-II project aimed at addressing the growing demand for an affordable and sustainable housing in Ravi City.

This document presents the findings of Environmental Impact Assessment (EIA) of Infrastructure Development at Chaharbagh Phase-II (as detailed in sec.3) of Ravi Riverfront Urban Development Project (RRUDP).

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 falls under Category "H" (Urban Development and Tourism, sub-category 'Housing Schemes with more than 300 kanals' of Schedule-II, which requires an EIA before commencement of construction.

1.3 NATURE, SIZE AND LOCATION OF THE PROJECT

Chaharbagh Phase-II is an expansive residential development located in precinct 04 of RUDA Master Plan adjacent to the Theri Road. It is strategically located in a prime area of Ravi City with convenient access to major transportation networks, educational institutions and healthcare facilities. The location ensures connectivity and easy accessibility for residents, contributing to a convenient and well-connected community.

Figure 1-1 shows the location map of the proposed Project.

1.4 SCOPE OF STUDY

The scope of this EIA Study aims at collection and scrutinizing 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.

1.5 PURPOSE OF EIA REPORT

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

1.6 THE PROPONENT AND CONSULTANT

a) Proponent Contact/Address

Chief Executive Officer/ Project Director
River Ravi Urban Development Project
Ravi Urban Development Authority (RUDA)
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b) Consultant Contact/Address

National Engineering Services Pakistan Private Limited (NESPAK)
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Tel: 042-99090000 Ext. 233

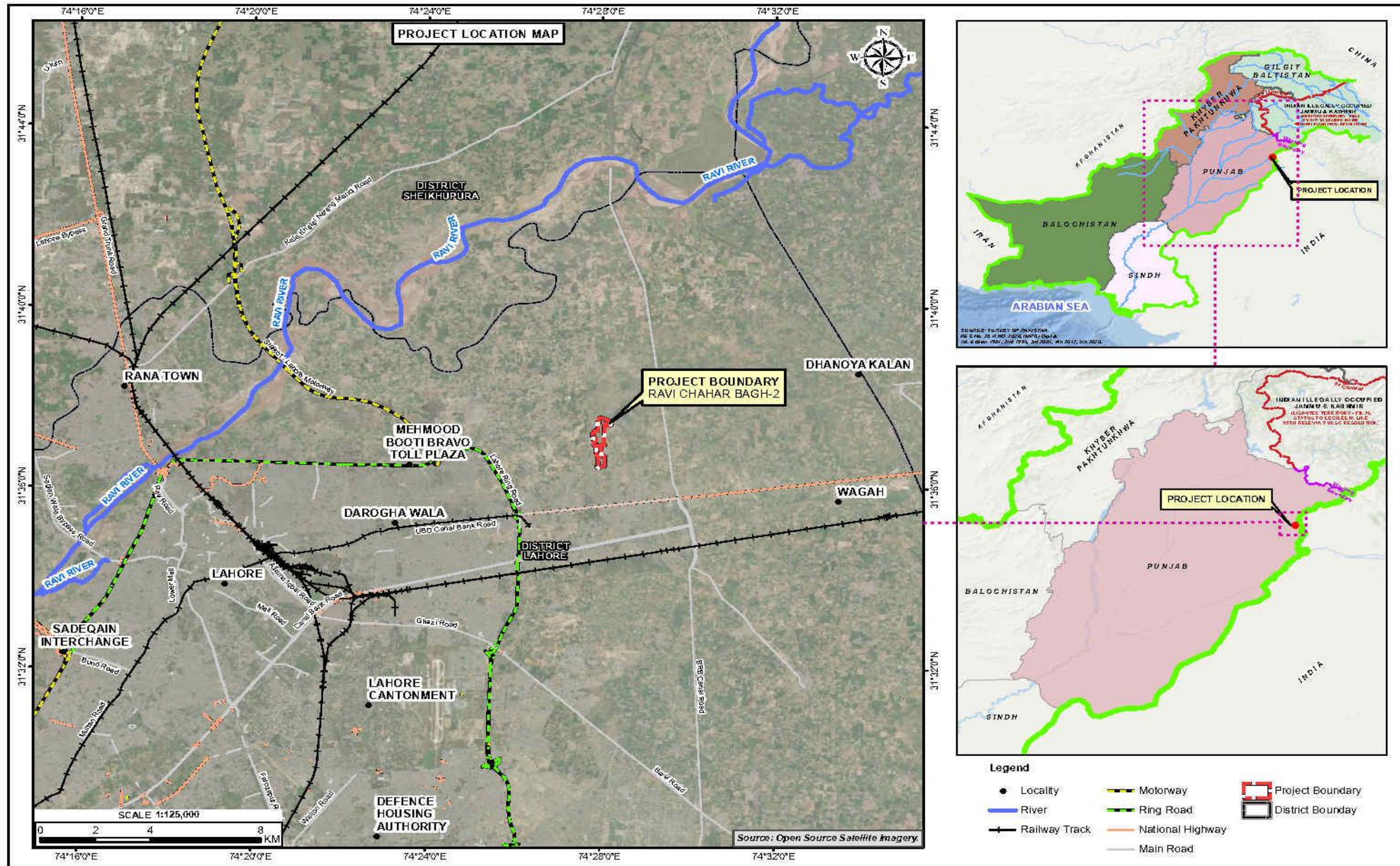


Figure 1.1: Location Map of the Proposed Project

1.7 EIA TEAM COMPOSITION

Based on the requirements of ToR and objectives of the study, NESPAK formed a team of experts comprising a team leader (Environmental Expert) with professional support from the Environmental Engineer, Environmental Scientists, Sociologist and Ecologist. RUDA environment Directorate closely coordinated the collection of data and liaison with departments. The professional staff was involved in analyzing the data, impact assessment and mitigation measures and report compilation. In addition, the EIA team worked in close coordination with the design team and several inputs were provided by the design engineers 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.	Muhammad Shariq Ahmed	Chief Engineer/Head ERSD Section
2.	Ms. Shehnaila Hanif	Senior Environmental Scientist
3.	Mr. Muhammad Sajjad	Senior Sociologist
4.	Mr. Ibadullah Khan	Senior Ecologist
5.	Mr. Muneeb Yousaf	GIS Analyst

1.8 METHODOLOGY

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

1.8.1 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.

1.8.2 Data Collection

In this step, primary and secondary data were 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.

1.8.3 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.

1.8.4 Delineation of Area of Influence (Aol)

Aol includes the area in the surroundings of the proposed alignment receiving direct impact of project activities. The Aol delineated for the proposed project is 25 m from the boundary of the project area. The Aol map is shown as **Figure 1.2**.

1.8.5 Survey of Aol

A team of Environmental Scientists, Ecologist and Sociologist carried out the environmental and social survey of the Aol in September, 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 Aol was observed.

1.8.6 Environmental Baseline Survey of the Project

Detailed environmental and social survey was carried out within the Aol 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 following parameters:

Physical Environment

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

- Land resources (including land use pattern, soil composition, topography, 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.

c) Endangered species

Data related to endangered species (both flora and fauna,) was collected and no endangered species has been found in the project area.

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 impact 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.

1.8.7 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 Protection Department, Parks & Horticulture Authority, Forest & Wildlife Department etc. to discuss the issues/constraints and get their views and feedback to mitigate the potential environmental as well as social impacts associated with the implementation and operation of the Project.

1.8.8 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. To mitigate the significant adverse impacts, adequate mitigation measures and implementation framework were proposed so that the proponent could incorporate them beforehand in the design phase.

1.8.9 Environmental Management Plan (EMP)

An Environmental Management Plan (EMP) 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.

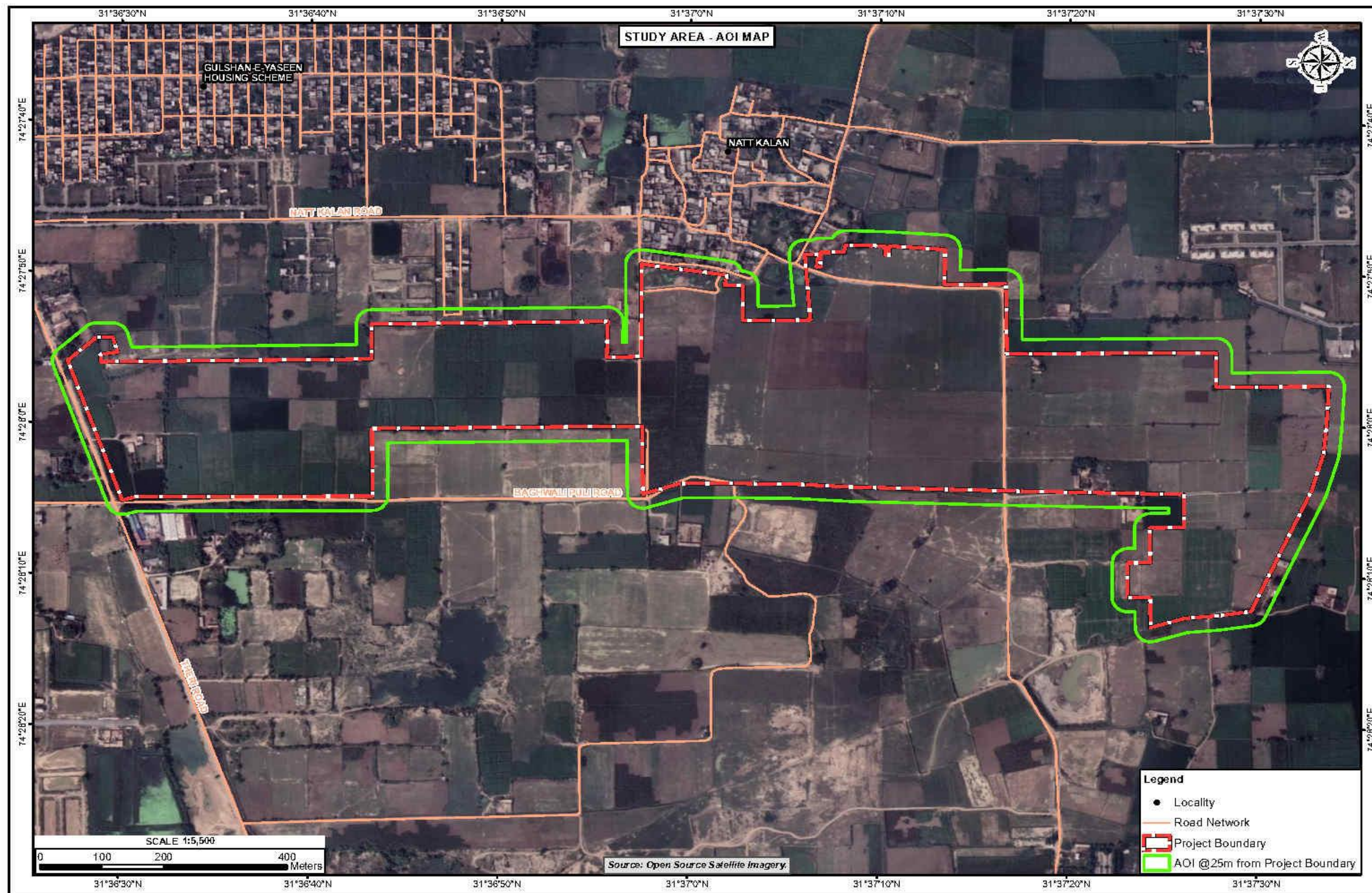


Figure 1.2: Aoi for the Proposed Project

1.9 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 Consultations

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 proposed project.

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

Section 8 “**Conclusion 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 Local Governments to address their environmental concerns and to ensure effective management of their environmental resources.	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.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
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. The policy thus provides a comprehensive framework for the development of Action Plans for national efforts on adaptation and mitigation.	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.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
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.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
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: - Promoting ecological, social and cultural functions of forests through sustainable management and use of forest produce including wood and non-wood forest products; - Implementing a national level mass afforestation programme to expand and maintain optimum forest cover; - Maximizing forest areas by investing in available communal lands/ shamlat, and Guzara forests and urban forestry; - Facilitating and harmonizing inter-provincial movement, trade and commerce of wood and non-wood forest products through the Federal Forestry Board; - Inter-linking natural forests, protected areas, wetlands and wildlife habitats to reduce fragmentation; - Enhancing role and contribution of forests in reducing carbon emissions and enhancing forest carbon pools; - Facilitating implementation of international conventions and agreements related to Forestry, Wetlands, Biodiversity and Climate Change; and - 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;	The labour force will be employed for construction of the proposed Project. The provision of policy will apply to all the employed labourers.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		- Skill development and employment; and - Manpower export.	
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 elicited 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.

Table 2.2: Main Legislation/Acts Related to Environment and their Relevance to the 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 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

Sr. No.	Act	Brief Coverage	Relevance to Project
		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. For the proposed Project, Environmental Protection Department (EPD)/Environmental Protection Agency (EPA), Government of the 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.	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
2.	Pakistan Environmental Protection Agency, (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, which implies that an EIA is required for the proposed 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.
4.	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.

Sr. No.	Act	Brief Coverage	Relevance to Project
5.	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.
6.	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 <i>ibid</i>. 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 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	This Act is directly related to the establishment of proposed project as it falls under jurisdiction of RUDA.

Sr. No.	Act	Brief Coverage	Relevance to Project
		standard facilities.	
7.	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.
8.	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.
9.	Land Acquisition Act (LAA), 1894 Including Later Amendments	The Land Acquisition Act, 1894, is a "law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be paid on account of such acquisition". The exercise of the power of acquisition has been limited to public purposes. The principles laid down for the determination of compensation, as clarified by judicial pronouncements made from time to time, reflect the anxiety of the law-giver to compensate those who have been deprived of property, adequately. The land needed for the construction of development projects will be acquired under normal conditions based on prevailing market prices or negotiated prices between client and the owners of land. Section 17(4) of the LAA will not be used in the absence of an emergency. Instead, the land will be purchased under willing-seller willing-buyer deal at agreed upon market rates and the seller will have the option not to sell the land, in case an acceptable deal for both the parties is not reached.	This Act will anticipate if proposed project involves acquisition of land under the law in the project area.
10.	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 as green belts will be developed for the proposed project which needs to be maintained during operation phase.
11.	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 may involve cutting of trees which may result in loss of habitat, therefore, the provisions of this

Sr. No.	Act	Brief Coverage	Relevance to Project
			law are applicable.
12.	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.
13.	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.
14.	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.
15.	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 provisions of the Penal Code, 1860 are applicable to the project in terms of penalties for effecting human

Sr. No.	Act	Brief Coverage	Relevance to Project
		The Code also addresses control of noise, noxious emissions and disposal of effluents.	lives and public property. It also addresses the control of noise, air emissions and effluent disposal.
16.	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; - Trade Union and Employers Association Regulation; and - Other Laws.	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
17.	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	This Act will elicit if there is misappropriation of water supply during construction activities.

Sr. No.	Act	Brief Coverage	Relevance to Project
		the Province. This Act is in draft stage.	
18.	The Punjab Water Act, 2019	This act ensures comprehensive management and regulation of water resources in the Punjab in the interest of conservation and sustainability.	This this act will be triggered as Main Canal exists near the Project Area.
19.	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. These include a requirement for updating the plan every three years, the need to provide for management of hazardous waste in a manner that will prevent adverse environmental impacts and to ensure that hazardous and non-hazardous waste are not mixed.	This rule is applicable to the proposed project due to involvement of hazardous waste handling, use and disposal during the construction stage.
20.	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.
21.	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 may guide during construction and operational phase to ensure health and safety of workers associated with the project activities.
22.	The Punjab Occupational Safety And	This Act entails provision of occupational safety and health of the workers at workplace and to protect them against risks	The Act will trigger during construction and operational phase to ensure health and

Sr. No.	Act	Brief Coverage	Relevance to Project
	Health Act, 2019	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.	safety of workers at workplace associated with the project activities.
23.	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.
24.	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.
25.	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.
26.	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 as the cutting of trees may be involved.
27.	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, branches in reserved and protected forests.	The proposed project is urban in nature and no protected forest is situated in the Project area.
28.	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.

Sr. No.	Act	Brief Coverage	Relevance to Project
29.	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.
30.	The Canal and Drainage Act, 1873	The Canal and Drainage Act 1873 (CDA) focuses on construction and maintenance of drainage channels and defines powers to prohibit obstruction or order their removal. It also covers issues related to canal navigation. It briefly addresses issues relating to environmental pollution. Section 70(5) of the CDA clearly states that no one is allowed to “corrupt or foul the water of any canal so as to render it less fit for the purposes for which it is ordinarily used.” In addition, Section 73 of the CDA gives power to arrest without warrant or to be taken before the magistrate a person who has wilfully damaged or obstructed the canal or “rendered it less useful.”	This Act will be applicable as the proposed project is near the main canal.
31.	The Punjab Emergency Service 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. It describes procedures to establish emergency service, emergency board, emergency fund, emergency ambulance and rescue vehicles, offence and punishment, etc.	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.
32.	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.
33.	Seismic Building Code of Pakistan 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	This Code is applicable to the proposed project as it includes the formation of structures.

Sr. No.	Act	Brief Coverage	Relevance to Project
		related components. Construction of buildings shall be considered as violation of professional engineering work specified under clause (XXV) of section 2 of the Act.	

2.3 INTERNATIONAL PROTOCOL / CONVENTIONS

As Pakistan is a 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.	The Rio Declaration, 1992 Web Link: http://www.unesco.org/education/pdf/RIO_E.PDF	Pakistan signed the treaty on 13Jun 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.
2.	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 11 th December, 1997 at the 3 rd Conference of the countries to the treaty when they met in Kyoto, and entered into force on 16 th 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 monitoring and reporting emissions.
3.	Convention on Biological Diversity, 1994	Pakistan signed this treaty in 1992 and it was ratified by cabinet	The Convention on the Biological Diversity (CBD) has three main goals: Conservation of biological diversity

Sr. No	Agreement/Convention	Ratification	Description/Relevance
	Web Link: https://www.cbd.int/	in 1994.	(or biodiversity); sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources.
4.	UN Convention to Combat Desertification (UNCCD), 1994 Web Link: https://www.unccd.int/	Pakistan signed the Convention on 15th October 1994 and ratified it on 24 February, 1997	The UNCCD is a Convention to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements.
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 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 tissue 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 (GHG) due to the construction of the proposed project.
7.	Sustainable Development Goals (SDGs)	At the Sustainable Development Summit on 25 th September 2015, UN Member States adopted the 2030 Agenda for Sustainable Development,	The SDGs that will prevail for the proposed project are as follows: Promote Gender Equality and Empower Women: The contractor during construction phase will be

Sr. No	Agreement/Convention	Ratification	Description/Relevance
		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.	responsible to hire women for construction activities to elude gender discrimination and to promote women empowerment. • 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 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 Ravi Urban Development Authority (RUDA)

The implementing agency of the proposed Project is Ravi Urban Development Authority (RUDA). The management of RUDA will ensure that all the proposed mitigation measures are effectively implemented at the design, construction, and operation stages of the proposed Project.

2.4.2 Environmental Protection Agency, 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 therefore Punjab-EPA will be responsible for reviewing the report, issuing environmental approval and overall/broad based monitoring of the proposed project activities.

3 PROJECT DESCRIPTION

3.1 GENERAL

This Chapter presents the detailed project description along with project cost, land requirement, implementation schedule, workforce and water requirements, etc.

3.2 VISION OF THE PROJECT

Chaharbagh Phase-II aims to create a sustainable, inclusive and vibrant community within Ravi City's Phase-I by adhering to strong design principles, incorporating innovative technologies and prioritizing community well-being, the Project seeks to set new standards for urban excellence.

The Proposed phase of Chaharbagh will provide a modern, well planned and facilitated healthy living environment for every walk of life. The project will offer modern and feasible living standards within the Metropolitan city of Lahore, along with recreational facilities in the location. As it will be a planned development, so all the utilities and facilities will be integrated during design phase.

3.3 OBJECTIVES OF THE PROJECT

The overall objectives of the Project include sustainability, community integration, accessibility and universal design, roads and transportation, water and sewerage supply system, electricity and waste management system along with environmental advantages and economic benefits.

3.4 PROJECT ADMINISTRATIVE JURISDICTION

The proposed Project lies in District Lahore, Punjab.

3.5 PROJECT IMPLEMENTATION SCHEDULE

The tentative implementation period for proposed Project is twenty four (24) months.

3.6 COST OF THE PROJECT

Tentative cost of the proposed Project (RUDA – Infrastructure Development at Chaharbagh) is about PKR 7,809.7 Million.

3.7 PROPOSED MASTER PLANNING

The Chaharbagh Phase-II offers an extensive residential development in a strategic location, with proposed road infrastructure, proximity to essential amenities, and accessibility to public transportation, this phase offers a desirable living environment for potential residents.

The Proposed site is intended to provide locations for regional-serving retail, office and residential uses that will provide vibrant mixed-use setting that fosters positive day and night-time activity. Mixed-use development may feature dynamic taller buildings and building complexes with maximum FAR, over four or five storeys in height (G+4), (G+5) that are scaled appropriately to create a comfortable pedestrian environment and be compatible & accessible with adjacent neighborhoods to promote the regional-economic development. The proposed master plan of the Ravi Chaharbagh Project is provided as **Figure 3.1**.

3.7.1 Land-Use Plan

The proposed development of Ravi Chahar Bagh-II Project on 168 acres of land. The total Area of the proposed Project is mainly distributed into various land uses including residential (42%), roads/ streets/ parking (44%), commercial (5%), amenities for public use (1.59%), open spaces/green areas (7%).

The categorization of the land use with respect to the area of the proposed development is provided in the **Table 3.1**

Table 3.1: Land Use with respect to the Area

Sr. No.	Category	Area (Acers)	%age
1	Developable Area	83.62	49.70%
	Residential	70.05	
	Commercial	8.43	
	Apartments	2.46	
	Amenities	2.68	
2	Open/ Green Area	11.15	6.62%
3	Roads/ Streets/Parking	73.45	43.68%
Total		168.22	100.00%

MASTER PLAN CHAHAR BAGH PHASE II

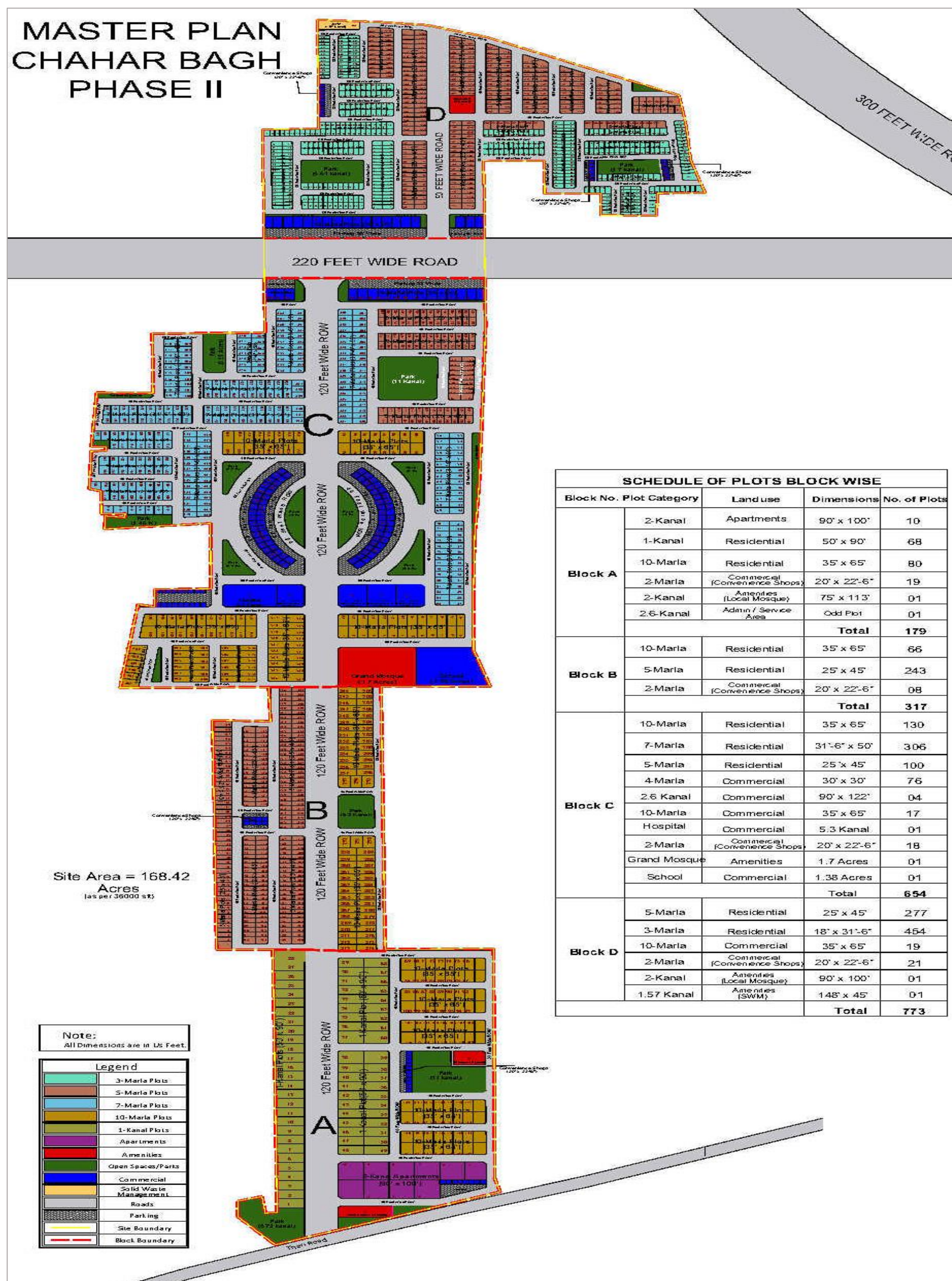


Figure 3.1: Master Plan of the Proposed Project

3.7.2 Salient Features of the Project

Chaharbagh Phase-II is a comprehensive housing project, focuses on providing residential units, amenities, and infrastructure to enhance the standard of living for residents. Chaharbagh Phase-II aims to accommodate a diverse range of residents, including all income level groups. The Salient features of the proposed Project are provided below:

- Residential Units
- Parks and Green Spaces
- Educational Institutions
- Healthcare Facilities
- Commercial Areas
- Recreational Facilities
- Security Measures

A. Residential Units

The largest land use category is residential, comprising 662.80 Kanal, which accounts for 43.21% of the total area. Chaharbagh Phase-II has been organized into three distinct blocks i.e., Block A, Block B, and Block C, each offering a range of residential and community amenities.

B. Commercial Use

Retail outlets, supermarkets, restaurants, and other commercial establishments are planned to meet the daily needs of residents. The schedule of commercial plots consists of a total of 116 plots categorized into three types. Overall, these plots offer a range of options for individuals or businesses looking to invest or establish commercial ventures. Commercial and Public Use Map of Chaharbagh Phase-II is shown in **Figure 3.2**.

C. Public Use

Public buildings occupy 42.85 Kanal, representing 3.29% of the area that includes a school, hospital & pharmacies and other public infrastructure. A graveyard is also planned for the residents of Chaharbagh phase-II that occupies 17.07 Kanal, representing 1.32% of the area.

D. Parks And Green Spaces

Ample green spaces, landscaped parks, and recreational areas are developed to promote a healthy and active lifestyle. Total area of 95.76 Kanal has been allocated for open and green spaces. These areas could include parks, gardens, or recreational spaces, providing greenery and leisure opportunities for residents. **Figure 3.3** shows the Parks and Green Spaces Map of Chaharbagh Phase-II.

E. Recreational Facilities

Sports facilities, including playgrounds, gyms, swimming pools, and sports courts, are incorporated in the project design to promote an active and healthy lifestyle. The proposed community center will also play a vital role in improving the social lives of the residents.

F. Security Measures

Chaharbagh Phase-II will ensure the safety and security of residents through measures such as gated entrances, CCTV surveillance, and trained security personnel.





3.7.3 Infrastructure Facilities for the Proposed Project

The project also focuses on providing robust infrastructure and utilities that include:

- Roads Works;
- Water Supply Network;
- Drainage Network;
- Sewerage System;
- Boundary Wall;
- Entry Gate.

3.8 DESIGN FEATURES

1. Road Works (14.48 km)

Well-planned internal road networks, pedestrian-friendly pathways, and convenient access to public transportation are developed for smooth mobility within and outside the scheme.

Figure 3.4 showing the connectivity plan inside Chaharbagh Phase-II. The central artery (red line), designated as the Primary Road, boasts a generous width of 120 feet, ensuring seamless flow and accommodating various modes of transportation. Complementing the Primary Road are the Secondary (80 feet & 60 feet width) and Tertiary Roads (40 feet & 50 feet width) that contribute to the overall accessibility and circulation within different sections of the Phase-II area. Summary of technical parameters of connectivity plan is given in Table 3.2.

Table 3.2: Technical Parameters of proposed Road Works

RoW (Feet)	No. of Lanes	Carriageway	Lane Width (Feet)	Metaled Portion (Feet)	Length (m)
220	3	Dual	12	70	239
120	3	Dual	11	70	1596
80	2	Dual	11	44	335
60	2	Dual	11	44	264
50	1	Dual	12	24	436
40	1	Dual	12	24	6890
30	1	Dual	11	22	4724

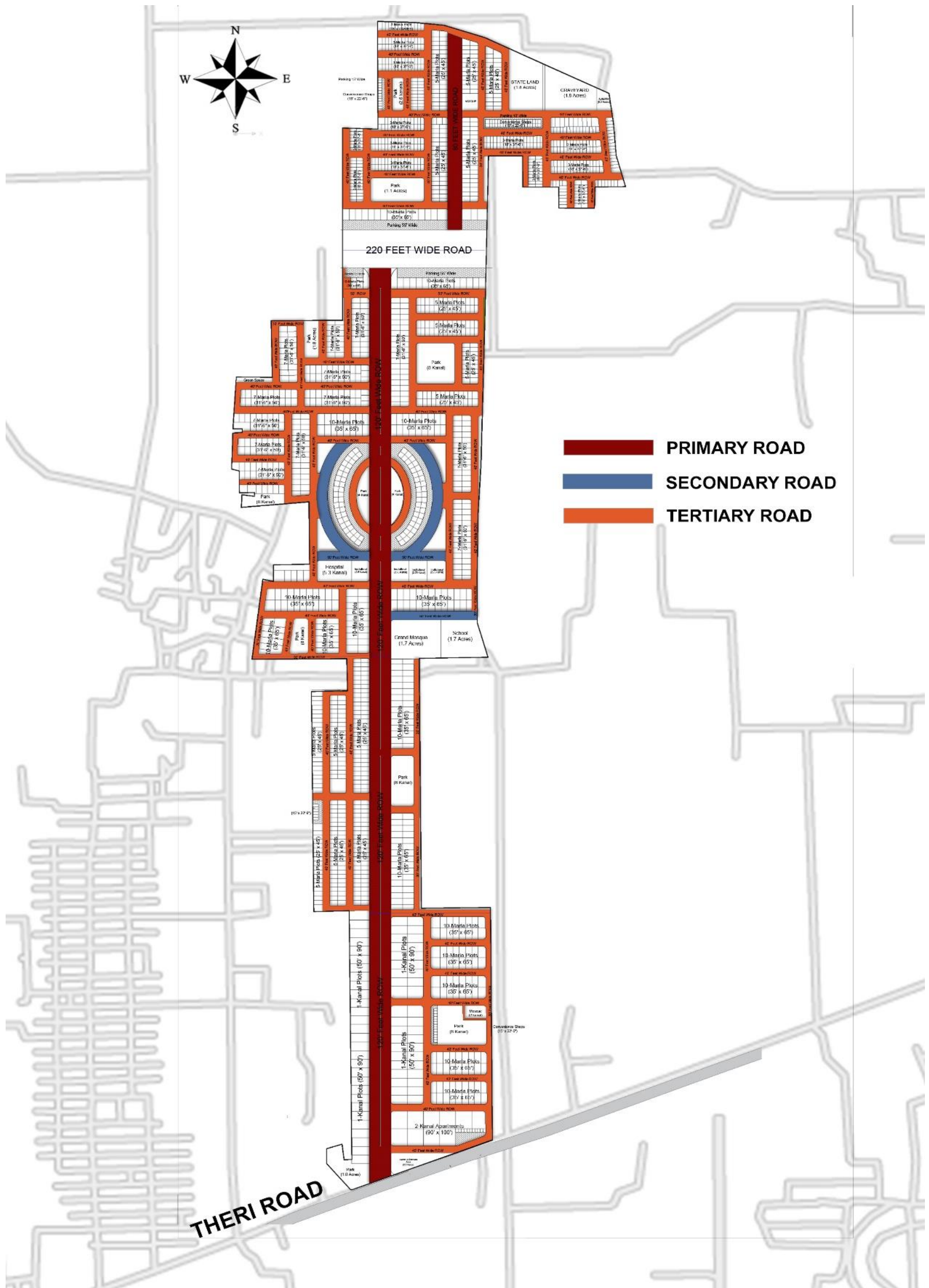


Figure 3.4: Roads & Connectivity Map of the Chaharbagh Phase-II

2. Water Supply Network

Adequate water supply, water treatment plants, and efficient distribution systems will also be implemented to meet the future needs of the residents. Design features of the proposed Water Supply Network are given below:

- Total Length : 19,740 m (approx.)
- Diameters (mm) : 32, 75, 110, 160, 200, 260
- Average Daily Demand : 2.228 Cusecs
- Max. Daily Demand : 3.342 Cusecs
- Pumping hours of Tubewell : 16 hrs
- Pumping capacity per day : 5.013 Cusecs
- No. of T/W having capacity of 1.5 cusecs each : 03 No.
- No. of OHR : 03 No.
- Proposed OHR capacity : 150,000 gallons

3. Sewerage Works

Proper sewage and waste management systems will be established to ensure cleanliness and sanitation within the housing scheme. Technical parameters of proposed sewerage & drainage work are given below:

- Total Length : 18,200 m (approx.)
- Diameters : 9", 12", 15", 18", 21", 24", 30", 36"
- Sewage Demand : 2.2282 Cusecs
- Design Sewage Demand : 11.7 Cusecs
- Tentative Depth of Trunk Sewer : 17 feet

4. Drainage Works

- Total Length : 2,170 m
- Size : 3 ft, 4 ft, 5 ft
- Depth : 2.5 - 5 ft
- Width : 3 - 5 ft
- RCC : 4000 psi

5. Entry Gates

Chaharbagh Phase-II ensures the safety and security of residents through measures such as gated entrances and boundary wall around the whole society.

- No. of Entry Gates : 02 No.
- Boundary Wall Length : 6500 ft

Figure 3.6 provides the concept plan of the proposed project.

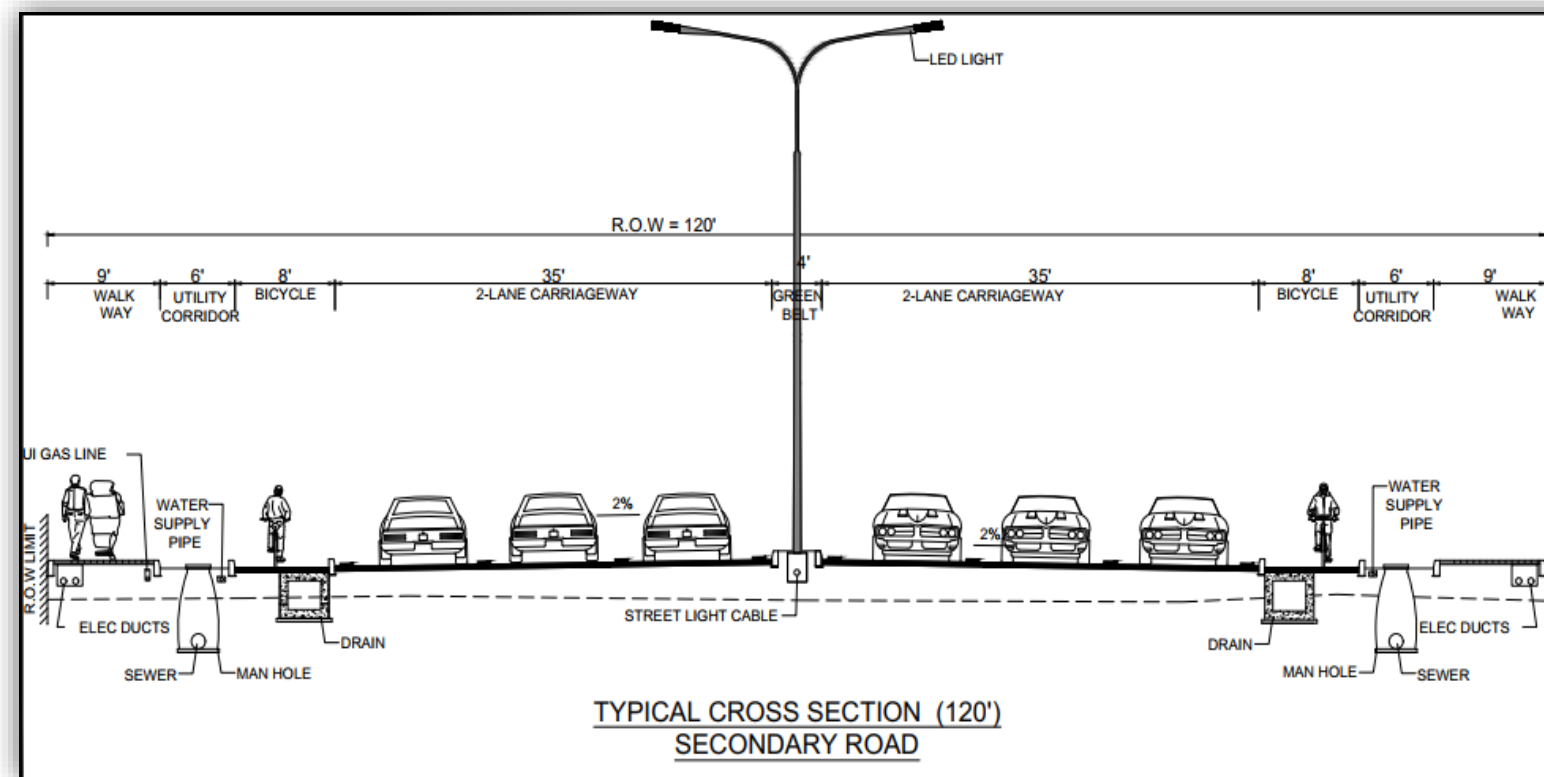
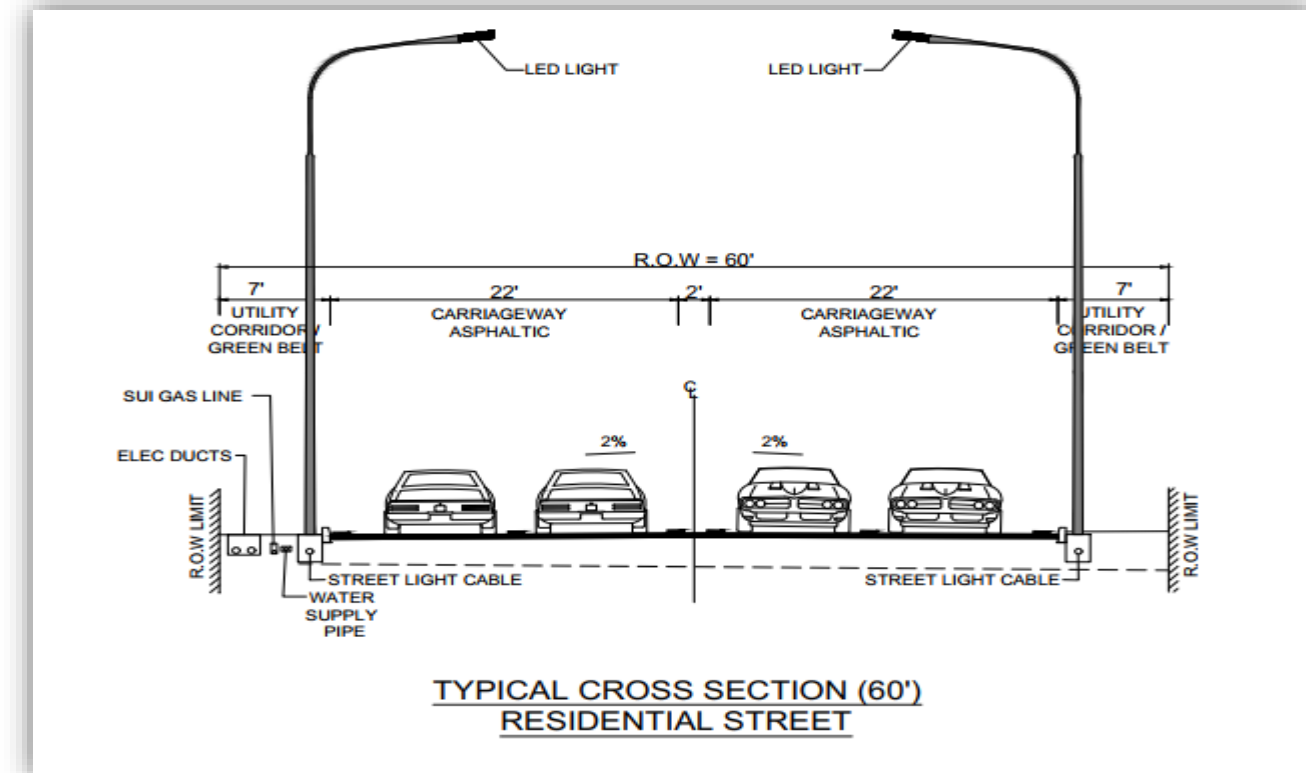
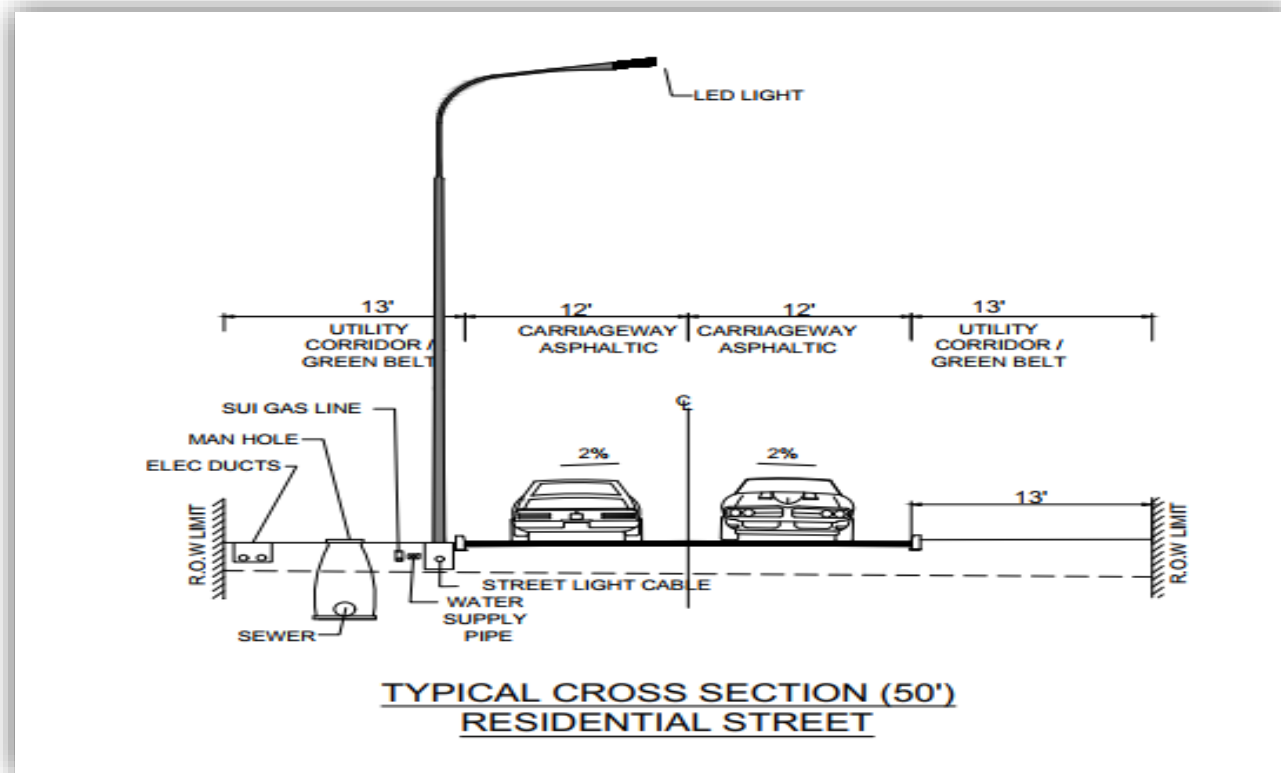


Figure 3.5: Typical Cross Section of Proposed Roads



Figure 3.6: Concept Plan of Proposed Project

3.9 CONSTRUCTION MATERIAL

The materials used in construction of the proposed project would include following but not limited to: cement, sand, aggregates, stones, reinforced cement concrete frame (RCC Frame), brick infill, brick cladding coarse aggregates (crush), fine aggregates (sand), water, asphalt, reinforcement cement and steel.

- Crushed Aggregate of required specifications will be utilized by the contractor from available sources nearby the project area.
- Good quality natural fine aggregate or sand of acceptable gradation will be obtained from nearby licensed or approved entities dealing with fine aggregates.
- Asphalt, reinforcement and cement material will be transported from the nearby factories or approved dealers for construction purposes.

3.10 EXPECTED EQUIPMENT'S FOR CONSTRUCTION

The list of the machinery and the equipment expected to be used for the proposed Project are provided in **Table 3.3**.

Table 3.3: Machinery and Equipment Requirement for the Proposed Project

Sr. No.	Machinery Name	Sr. No.	Machinery Name
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	Aggregate Spreader	18	Water Pumps
8	Three Wheel Rollers	19	Cranes
9	Tandem Roller	20	Vibrators
10	Asphalt Plant	21	Generators
11	Paver		

3.11 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.

3.12 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 200 workers/employees. Unskilled labor should be hired locally.

3.13 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.

3.14 WATER REQUIREMENT

The water consumption for construction phase is estimated to be 8,000 liters/day for 200 workers during construction phase of the proposed Project.

3.15 WASTEWATER GENERATION AND TREATMENT MECHANISM

The wastewater generation is estimated to be 6,600 liters/day for 200 construction workers during construction phase of the proposed Project². Temporary toilets with cesspit will be adequately installed and treated periodically, and after the completion of work, the ground will be restored.

3.16 SOLID WASTE

The solid waste generation is estimated to be 90 kg/day for 200 construction workers during construction phase of the proposed Project³.

3.17 POWER REQUIREMENT / POWER SOURCE

² Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/day)

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.

The main source of electricity/electric power during construction phase will be diesel generators for construction camps. The source of power for operation phase will be Lahore Electric Supply Company (LESCO).

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 Aol 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.



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 part 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.

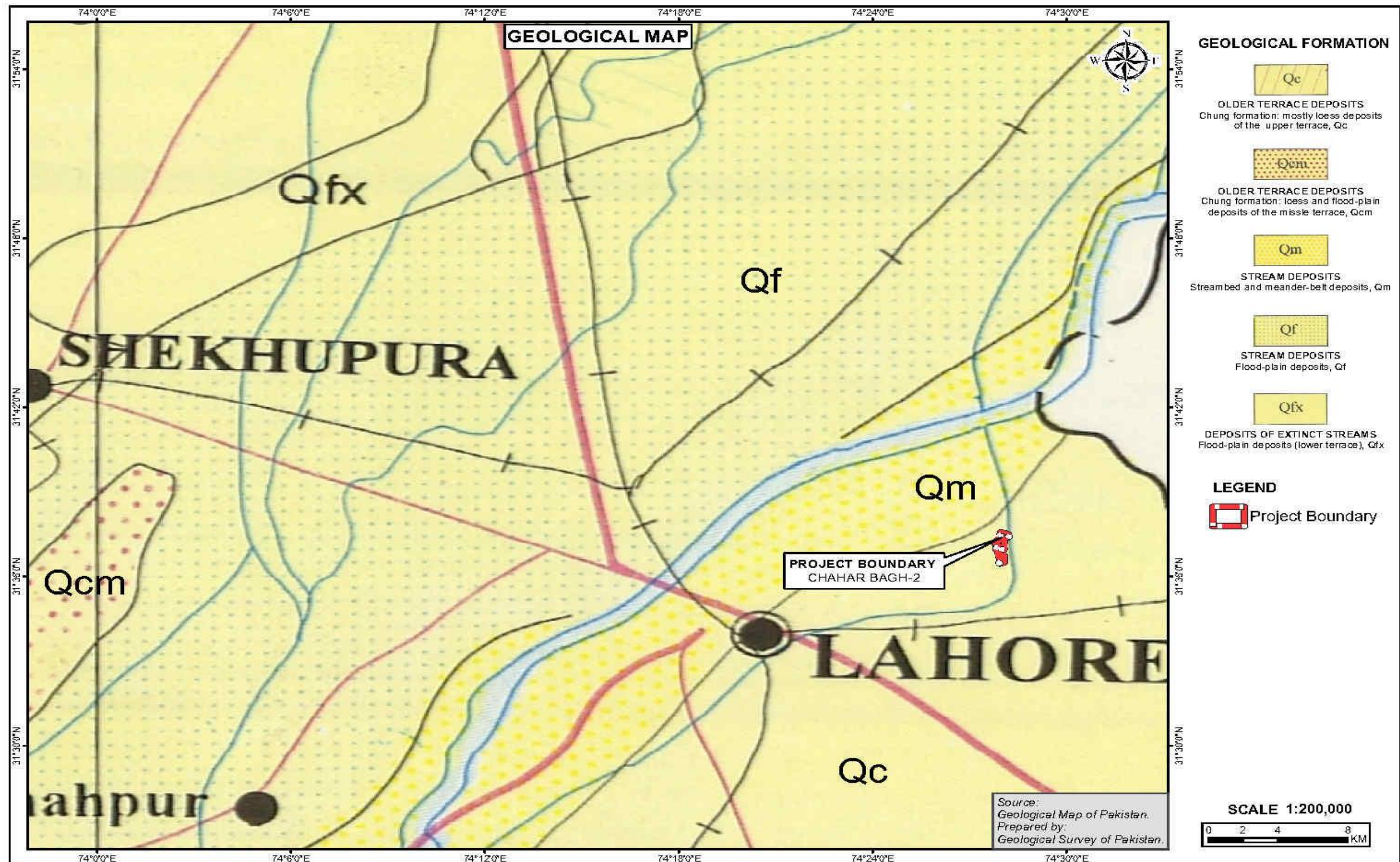


Figure 4.2: Regional Geological Map of the Study Area



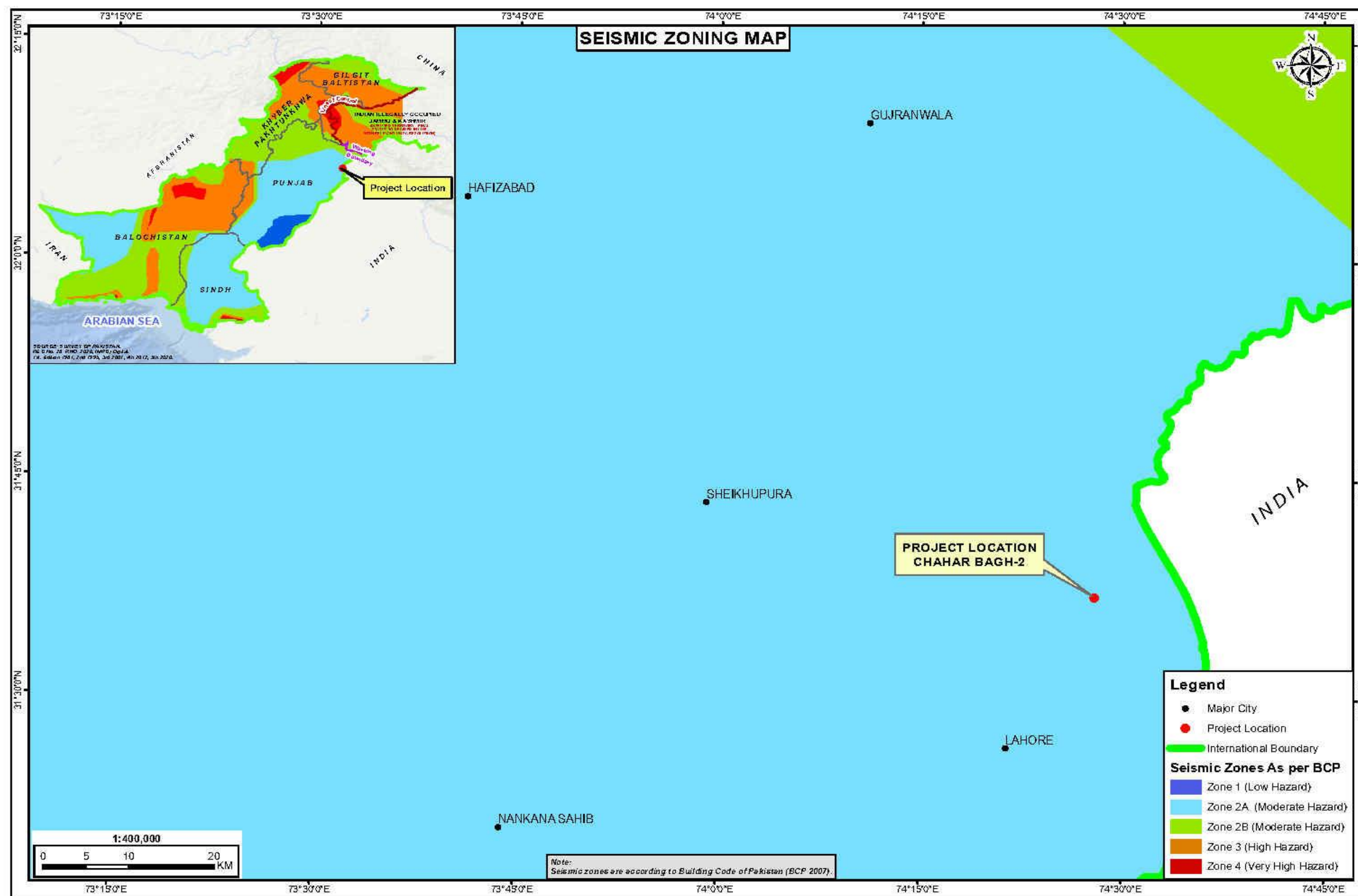


Figure 4.4: Seismic Zoning Map of the Study Area

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 Lahore district 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°C to 47°C. The winter seasons lasts from November to March, with mean minimum and mean maximum temperature ranges from 2°C to 18 °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.

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

Temperature

Table 4.1 and 4.2 shows mean minimal and maximal temperatures observed for each month between year 2011 to 2022 in the study area. The highest temperature measured is 47°C in June, 2014, and the lowest temperature was observed in December, 2021 i.e., 7°C. Moreover, Figure 4.5 shows the graphical presentation of mean temperatures in the Study Area for the year 2011-2022.

Table 4.1: Mean Maximum Temperatures (°C) between 2011 and 2022⁶

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2011	22	23	31	37	44	44	40	36	35	34	30	25
2012	19	20	29	35	42	46	45	38	37	36	30	24
2013	22	22	31	37	44	46	43	38	40	36	29	25
2014	22	23	28	36	41	47	44	42	36	35	29	22
2015	22	26	28	6	43	42	39	39	38	36	30	24
2016	24	28	31	37	43	45	41	40	40	39	32	28
2017	21	27	31	40	44	43	41	41	41	39	30	26
2018	25	27	33	38	43	44	40	40	39	36	30	24
2019	20	22	27	38	41	45	41	39	39	36	28	22
2020	18	25	27	36	41	45	44	40	41	38	28	23
2021	22	27	31	41	44	43	42	42	40	39	31	26
2022	18	22	34	42	43	42	35	35	36	34	28	23

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

⁶ Meteorological Data for Lahore (2011-2022)

Table 4.2: Mean Minimal Temperatures (°C) between 2011 and 2022

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2011	8	10	15	20	29	32	31	27	26	23	19	13
2012	7	8	14	22	28	33	33	29	26	23	18	13
2013	9	11	15	22	30	34	33	28	27	25	17	13
2014	9	9	14	22	28	34	32	3	26	23	17	10
2015	9	12	15	23	30	33	31	30	26	25	18	13
2016	10	12	16	23	31	34	32	30	28	24	18	14
2017	9	11	15	24	30	32	32	31	29	26	20	16
2018	13	14	19	25	31	35	32	31	28	25	20	14
2019	11	12	16	26	30	34	31	29	27	24	19	13
2020	10	13	16	24	30	35	34	31	30	26	18	14
2021	8	11	16	24	30	33	33	30	29	27	20	15
2022	9	9	17	23	28	29	28	27	26	21	15	10

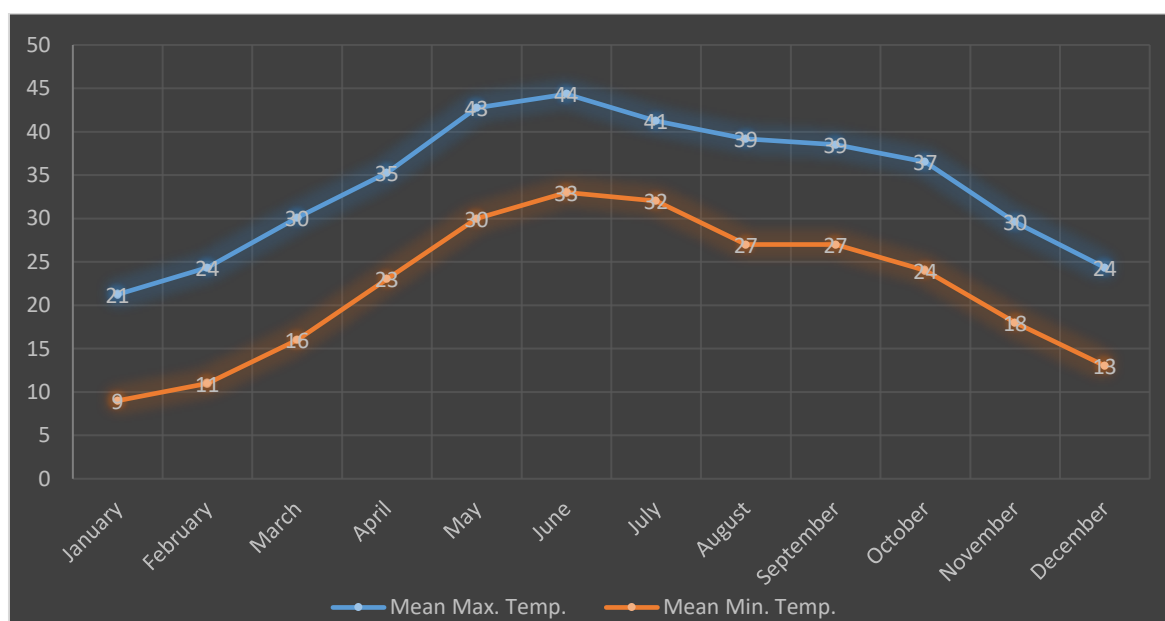


Figure 4-5: Mean Maximum and Minimum Temperature in the Study Area (2011-2021)

Precipitation (Rainfall)

Table 4.3 shows mean monthly precipitation observed in the study area from 2011 to 2022 with an annual average rainfall of 409.2 mm. Figure 4.6 shows the mean monthly precipitation in the study area for the year 2011-2022.

Table 4.3: Mean Monthly Precipitation (2011-2022)⁷

Month	Precipitation (millimeters)
January	19.7
February	31.2
March	28.3
April	18.5
May	21.6
June	42.7
July	70.2
August	83.2
September	77.9
October	3.8
November	5.2
December	6.9
Annual	409.2

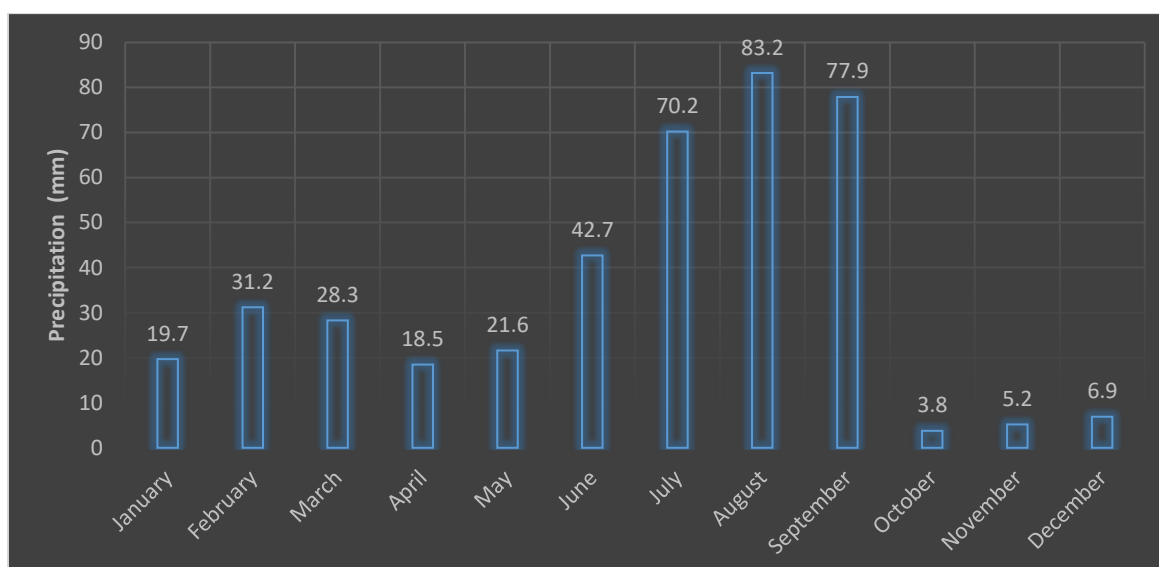


Figure 4-6: Average Precipitation in the Study Area (2011-2022)

Relative Humidity

A mean daily data of humidity on a monthly basis from 2011 to 2022 is shown in Table 4.4 and Figure 4.7.

⁷ Meteorological Data for Lahore (2011-2022)

Table 4.4: Mean Relative Humidity (%) in the Study Area (2011-2022)⁸

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2011	50	64	49	34	25	34	47	68	68	41	36	32
2012	59	59	51	39	20	17	35	58	54	32	27	40
2013	47	68	52	26	16	25	38	59	45	39	27	36
2014	51	61	52	31	24	20	34	40	58	38	27	33
2015	48	47	53	33	16	24	44	49	39	30	26	29
2016	43	37	42	23	21	25	42	44	35	21	19	27
2017	53	45	36	21	20	29	40	39	30	18	24	27
2018	32	38	30	25	17	28	43	47	45	25	25	27
2019	45	63	51	27	19	20	46	54	51	34	41	39
2020	59	47	57	33	24	22	34	53	38	16	24	35
2021	59	47	56	34	20	21	34	52	36	15	24	32
2022	62	56	29	12	14	23	57	62	56	40	32	27

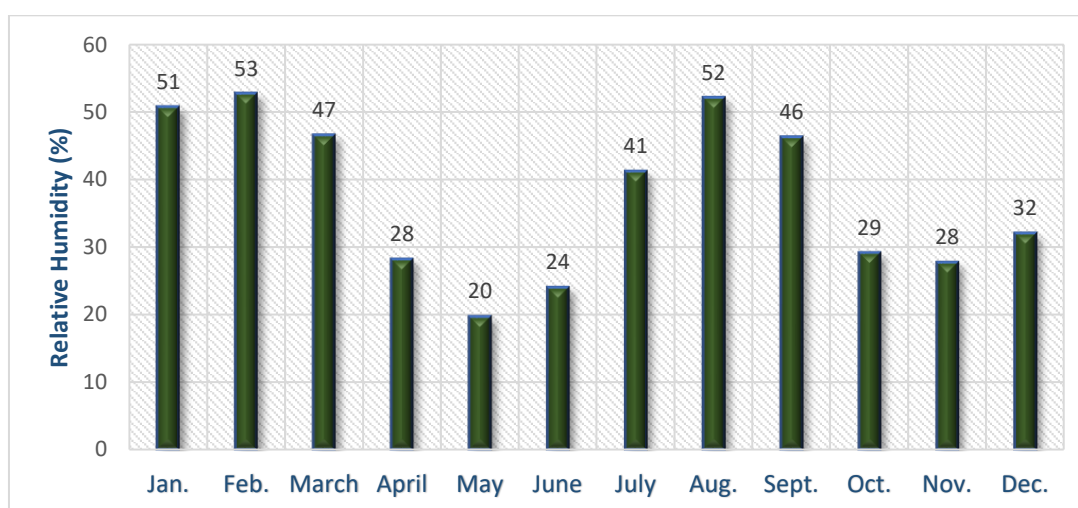


Figure 4-7: Mean Relative Humidity in the Study Area (2011-2022)

Wind Speed and Wind Gust

Table 4.5 and Figure 4.8 depicts average wind speed on a monthly basis in the study area from year 2011 to 2022.

Table 4.5: Mean Wind Speed (Km/h) in the Study Area (2011-2022)⁹

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2011	7.2	8.3	8.2	8.3	8.2	8.4	6.8	6.9	5.1	5.6	6.1	6.3
2012	7.3	9.5	8.9	8	8.6	7.2	6.8	6.4	5.4	5.5	7	8.4
2013	7.4	9.2	8	8.4	8.6	7	7.3	6.6	5.4	5.1	7.4	7.4
2014	7.4	7.3	8.8	8.9	7.8	7.5	6.6	5.8	5.6	5.8	7.6	7
2015	7.3	9.5	8.7	9.7	9.2	8.9	9.8	8.2	7.3	6.7	7.6	7.4
2016	6.5	8.2	9.9	10.9	10.3	9.4	7.7	6.8	7	5.6	6.9	6.3
2017	7.4	8.1	8.1	10.3	8.6	8.7	7.9	7.4	5.3	5	4.7	6.2

⁸ Meteorological Data for Lahore (2011-2022)

⁹ Meteorological Data for Lahore (2011-2021)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2018	5.9	6.9	7.9	9.2	10	9.4	8.3	8.5	7.5	5.8	6.9	5.2
2019	6.6	7.2	8.1	9.3	9.2	10.3	11.9	9.9	11.4	7.5	6.9	4.9
2020	6.7	7.7	9.8	9.8	11.8	10.6	9.9	10.3	7.4	6.1	7	7.1
2021	6.5	7.5	9.4	9.2	11.5	10.2	6.7	10.1	7.5	5.8	6.9	7.0
2022	7.1	8.4	9.6	8.9	10.4	10.1	9.6	8.7	8.1	7.8	8	6.4

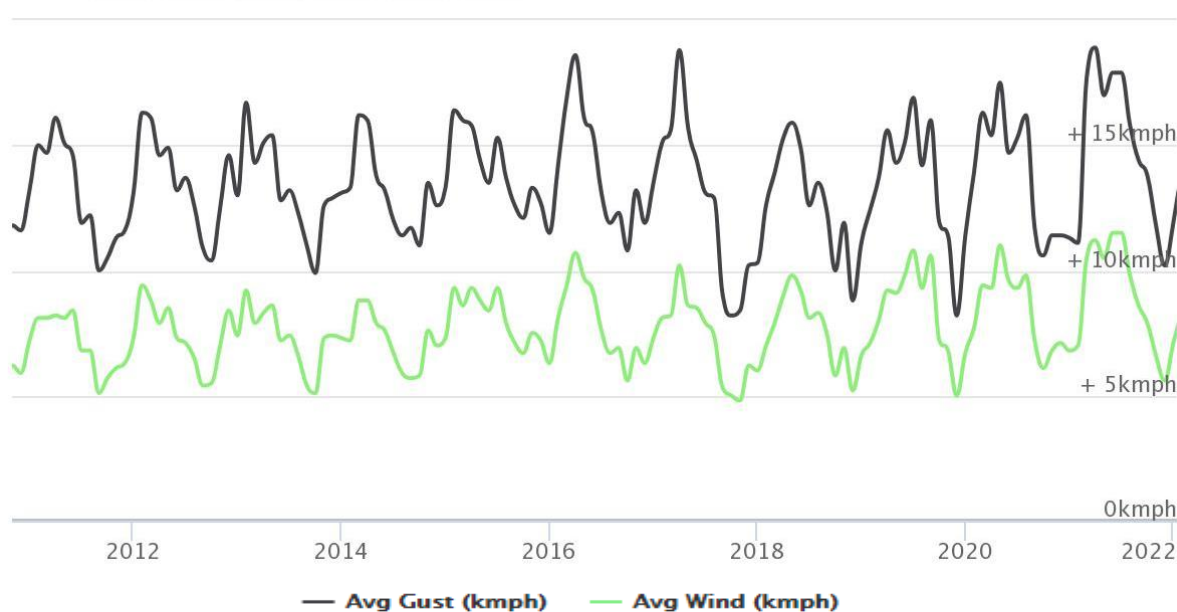


Figure 4-8: Average Wind Speed and Gust in the Study Area from 2011 to 2022

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.¹⁰

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.

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 325¹¹ 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

¹⁰ https://wasa.punjab.gov.pk/infodesk_watersupply

¹¹ Final Feasibility Study Report on Lahore Water and Wastewater Management Project-February, 2019

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.

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 Booti Disposal 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/day¹².

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.

¹² <https://www.lwmc.com.pk/uc-plan.php>

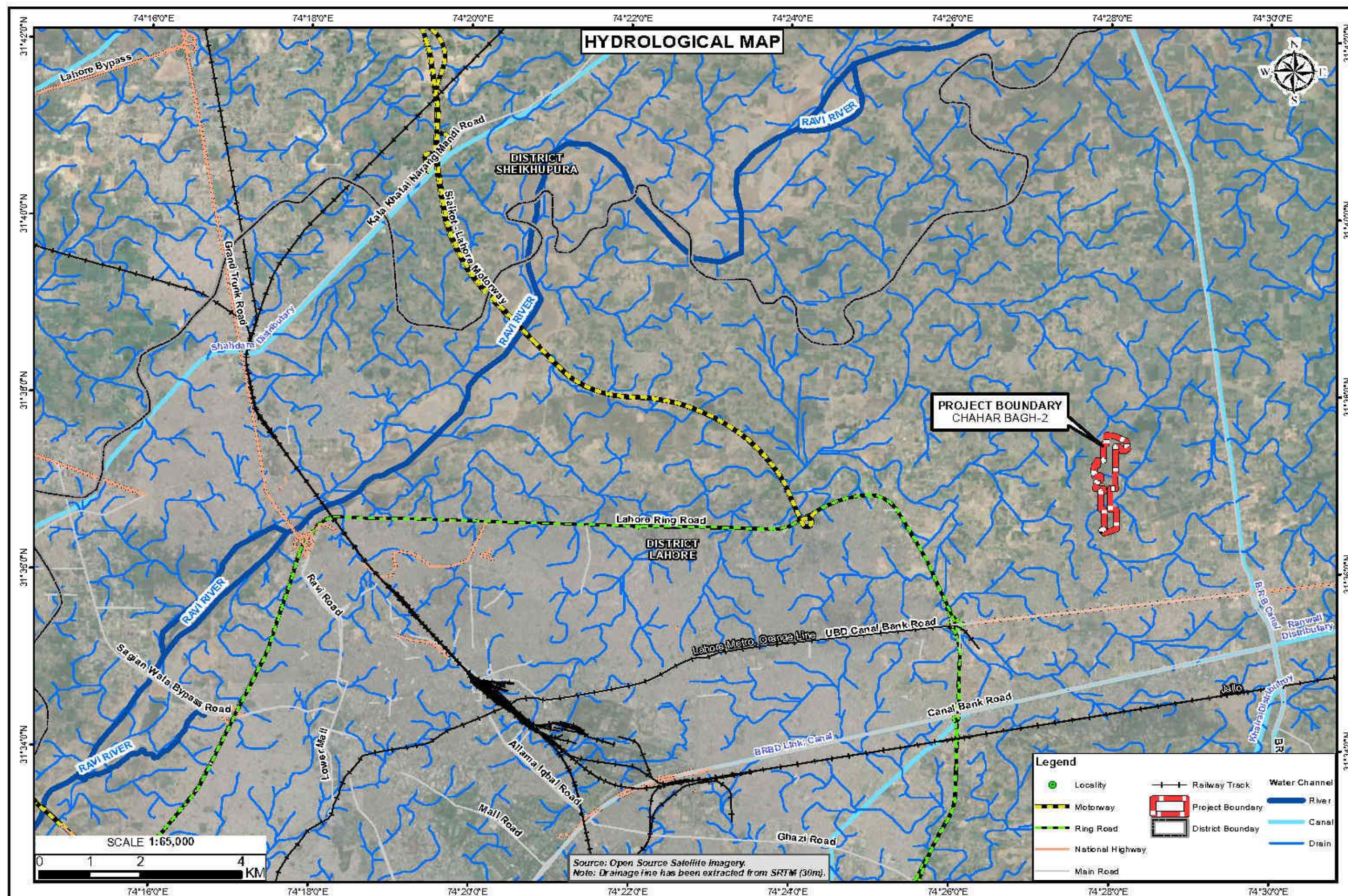


Figure 4.9: Surface Water Resources Map of the Study Area

4.3 ENVIRONMENTAL MONITORING

The environmental parameters for ambient air, noise level and groundwater were monitored in November, 2023 and these results were used for establishing the baseline profile of the Study Area. Environmental monitoring reports of are attached as **Annex-II**. An Environmental Monitoring Map is shown in **Figure 4.10**.

4.3.1 Air Quality

The ambient air quality monitoring for Nitrogen Dioxide (NO₂), Nitrogen Oxide (NO), Sulfur Dioxide (SO₂), Carbon Monoxide (CO), Ozone (O₃), Particulate Matter (PM_{2.5}), Particulate Matter (PM₁₀) and Suspended Particulate Matter (SPM) was carried out in the Project Area. The sampling was conducted for 24 hours duration for NO₂, NO, SO₂, PM_{2.5}, PM₁₀ and SPM, 1 hour for O₃ 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**. A pictorial view of environmental monitoring is shown in **Plate 4.1**.

Table 4.6: Average Concentration of Ambient Air Pollutants

Parameter	Unit	Monitoring Duration	Average Concentration of Pollutants at Natt Kallan Road	Average Concentration of Pollutants at Village Natt Kallan	Limits as Per PEQS, 2016
Nitrogen Dioxide (NO ₂)	µg/m ³	24 Hours	22.33	22.34	80 µg/m ³ for 24 Hours
Nitrogen Oxide (NO)	µg/m ³	24 Hours	14.17	14.35	40 µg/m ³ for 24 Hours
Sulfur Dioxide (SO ₂)	µg/m ³	24 Hours	19.32	19.34	120 µg/m ³ for 24 Hours
Carbon Monoxide (CO)	mg/m ³	08 Hours	1.11	1.12	5.0 µg/m ³ for 8 Hours
Ozone (O ₃)	µg/m ³	01 Hours	18.85	18.99	130 µg/m ³ for 01 Hours
Particulate Matter (PM ₁₀)	µg/m ³	24 Hours	133.22	133.46	150 µg/m ³ for 24 Hours
Particulate Matter (PM _{2.5})	µg/m ³	24 Hours	30.44	30.70	35 µg/m ³ for 24 Hours
Suspended Particulates Matter (SPM)	µg/m ³	24 Hours	198.66	199.16	500 µg/m ³ for 24 Hours
Lead	µg/m ³	24 Hours	0.19	0.18	1.5 µg/m ³ for 24 Hours

µg/m³: micrograms per cubic meter

PEQS: Punjab Environmental Quality Standards

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



Plate 4.1: A view of Air & Noise Monitoring at Project Site

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 4.7: Average Concentration of Noise Level

Averaging Time	PEQS, 2016	NL-01 Average Value in dB (A)	NL-02 Average Value in dB (A)
	Category A (Residential Area)		
Day-time	55	53.08	52.80
Night-time	45	44.61	44.93

The above results show that the average noise values at day and night time are within the permissible limits of PEQS in the Study Area.

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 4.8: Results of Ground Water Analysis

Sr. No.	Parameter	Unit	Test Results (Ground Water) GW-01	Punjab Standards for Drinking Water Quality, 2016
A. Physical and Chemical Analysis				
1.	pH	-	6.91	6.5-8.5
2.	Odor	-	Odorless	Non-Objectionable
3.	Taste	-	Sweet	Non-Objectionable
4.	Color	Pt-Co	<1.0	≤ 15 TCU
5.	Turbidity	NTU	<0.1	< 5 NTU
6.	Total Hardness	mg/l	344.0	< 500 mg/l
7.	Total Dissolved Solids	mg/l	619.0	< 1000
8.	Chloride	mg/l	9.78	< 250
9.	Cyanide (Cn)	mg/l	<0.01	≤ 0.05
10.	Fluoride (F)	mg/l	<0.01	≤ 1.5
11.	Nitrite	mg/l	<0.01	≤ 3
12.	Nitrate	mg/l	4.8	≤ 50
13.	Phenolic Compound	mg/l	<0.01	-
14.	Residual Chlorine	mg/l	<0.1	0.2-0.5
15.	Aluminum (Al)	mg/l	<0.028	≤ 0.2
16.	Cadmium	mg/l	<0.0028	0.01
17.	Copper	mg/l	<0.0045	2
18.	Chromium	mg/l	<0.0054	≤ 0.05
19.	Mercury	mg/l	<0.0008	≤ 0.001
20.	Antimony (Sb)	mg/l	ND	≤ 0.005
21.	Nickel	mg/l	<0.008	≤ 0.02
22.	Zinc	mg/l	<0.0033	5.0
23.	Arsenic	mg/l	<0.01	≤ 0.05
24.	Barium	mg/l	<0.031	0.7
25.	Boron	mg/l	<0.1	0.3
26.	Manganese	mg/l	<0.0016	≤ 0.5
27.	Lead	mg/l	<0.013	≤ 0.05
28.	Selenium	mg/l	ND	0.01
B. Microbiological Analysis				
1.	Total Coliforms	CFU/100ml	Absent	Must not be detectable in any 100ml Sample
2.	Faecal Coliforms	CFU/100ml	Absent	

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.

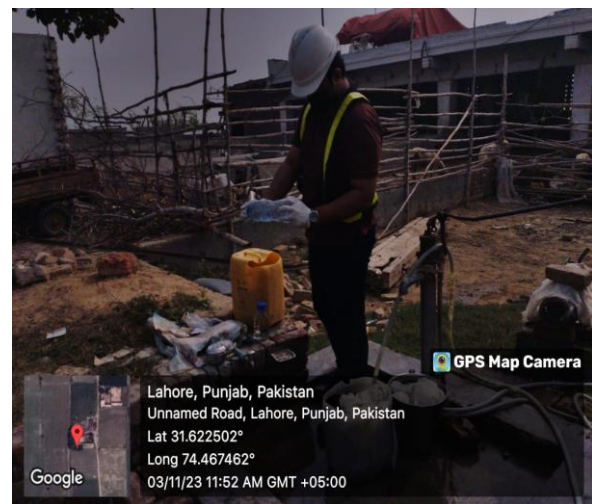


Plate 4.2: A view of Drinking Water Sampling at Project Site

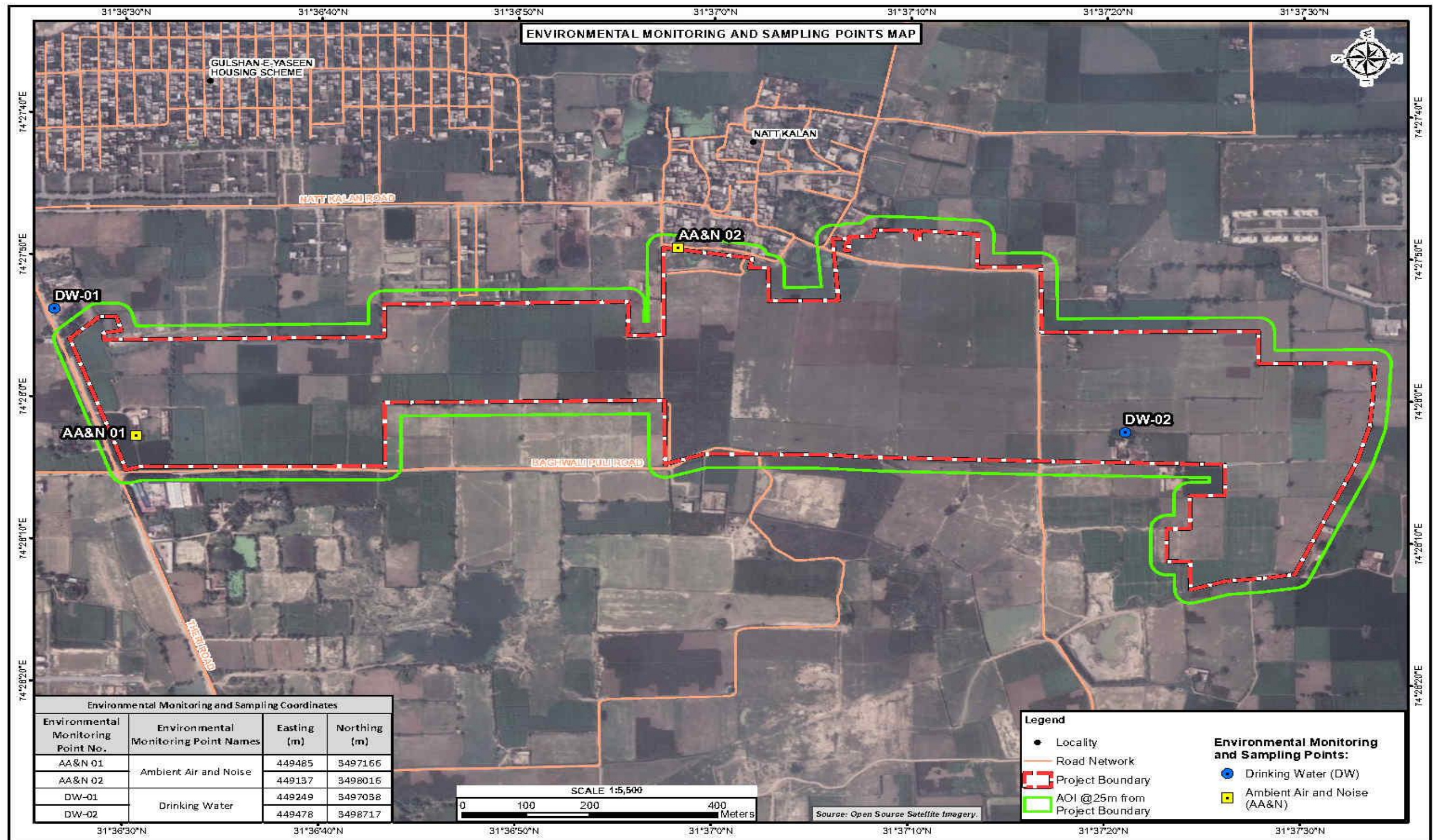


Figure 4.10: Environmental Monitoring Map of the Study Area

4.4 LAND USE PATTERN

The land use of the study area is mainly of barren/open area and cultivated land. The built-up area primarily includes the small quarter and store room. **Table 4.9** depicts land use cover of the Project area. Pictorial views of current land use are provided in **Plate 4.3**. The land use map of the proposed Project site is shown in **Figure 4.11**.

Table 4.9: Land Use Type

Landuse Type	Area (acres)
Barren / Open Area	3.06
Builtup Area	0.47
Cultivated Land	133.50
Road / Track	2.11
Stream / Nullah	0.31



Plate 4.3: Current Land use of the Project Area

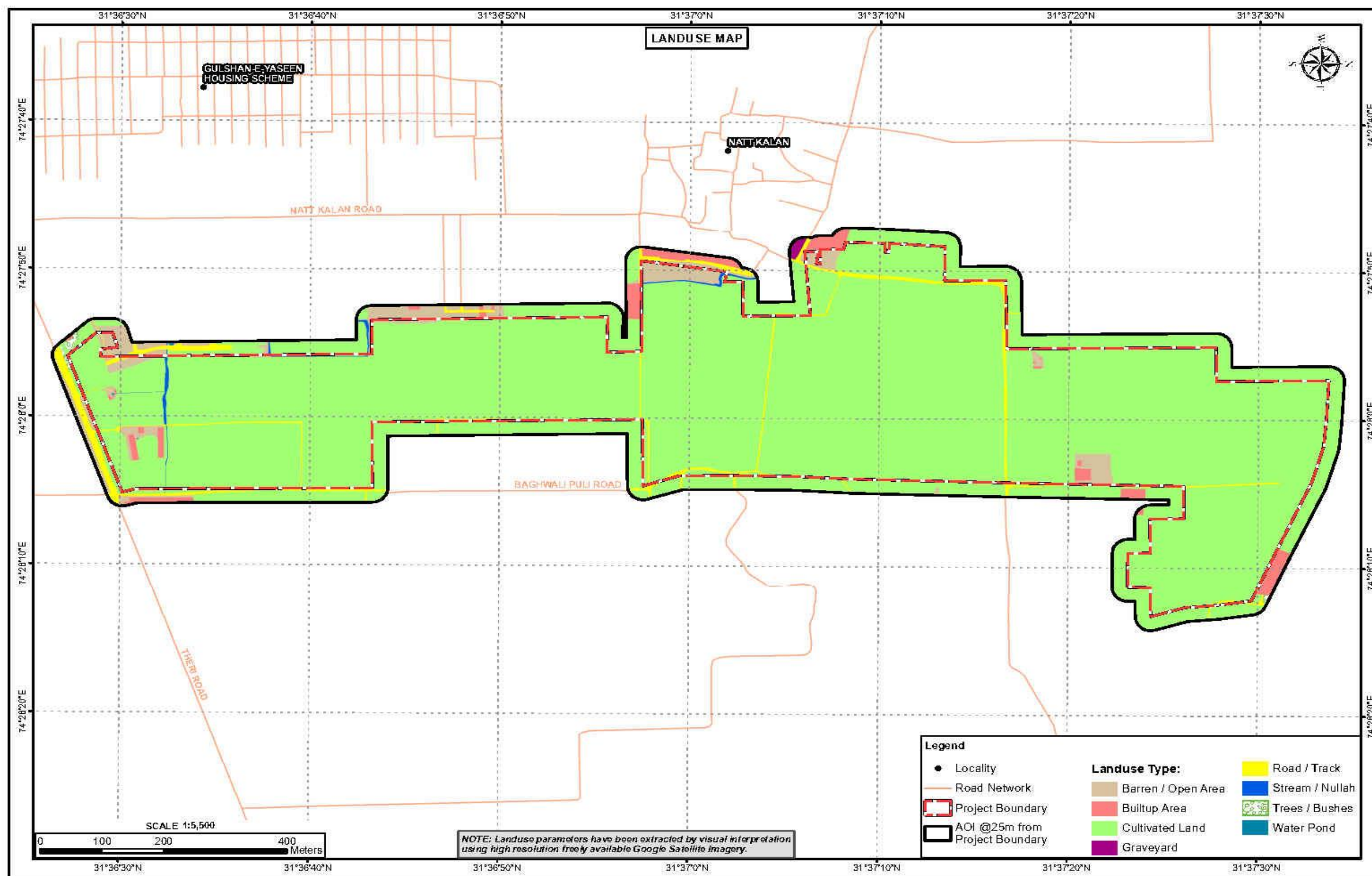


Figure 4.11: Land Use Map of the Study Area

4.5 ECOLOGICAL RESOURCES

Ecological study of the area has been conducted using standard ecological assessment technique based on primary and secondary information and inclusion of additional information collected during site visit, discussion and meetings with groups of communities/public living in and around Project area coupled with expert visual observations. Following is the description of the baseline ecological environment of the area.

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. Due to rapid increase in the population and anthropogenic activities the land has been degraded and the project area is barren except 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 4.10: Inventory of Trees Present in Study Area

Sr. No.	Common Name	Scientific Name
1	Kikar	<i>Acacia Nilotica</i>
2	Eucalyptus	<i>Eucalyptus camaldulensis</i>
4	Shisham	<i>Dalbergia sissoo</i>
5	Bakain	<i>Melia azedarach</i>
6	Toot	<i>Morus alba</i>
7	Neem	<i>Azadirachta indica</i>
8	Jaman	<i>Syzygium cumini</i>
9	Pipal (Sacred Fig)	<i>Ficus religiosa</i>
10	Ber	<i>Ziziphus mauritiana</i>

These trees are mostly of medium size with a girth between 2' to 4'.

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.

Some of the pictorial views of flora of the project area are provided in **Plate 4.4**.



Plate 4.4: Pictorial Views of Flora in the Project Area

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 (*Corvus splendens*) and Mynah (*Acridotheres tristis*) are the most common in the area. In addition, following birds have also been observed in the area.

Table 4.11: Birds in the Project Area

Sr.No.	Common Name	Scientific Name
1	Nightingale	<i>Pycnonotus cafer</i>
2	Parrot	<i>Psittacula krameri</i>
3	Pigeon	<i>Columba livia</i>
4	Hoopoe	<i>Upupa epops</i>

4.5.2.5 Endangered species

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

4.5.2.6 Wildlife Sanctuaries and Game Reserves

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

4.5.2.7 Critical Habitats

No critical habitats exist near the project area or the study area 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

4.6.1 General

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 September, 2023 was the calculation of sample size. Total two (02) main settlements named Natt Kalan and Theri fall near the project alignment. Besides, numerous settlements i.e., Dera Jaat were also present in 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.

4.6.2 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.

- Natt Kalan;
- Theri;

4.7 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.

The sample size of seventy eight (78) households was calculated based on the Standard Statistical Formula using a confidence level of 95% (which is frequently used in social research) and confidence interval of 10%. The calculated sample size was distributed proportionately among the nearby settlements. The households were selected by using random sampling technique, a type of probability sampling. 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.

4.7.1 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.

4.7.2 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.

4.7.3 Reconnaissance Field visit

A reconnaissance visit to the project, before conducting detailed survey was conducted in start of September, 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.

4.7.4 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.

4.7.5 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.

4.8 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 Gunj Bakhsh 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 comprise UCs consisting of members directly elected by people through an open competition, which is also from the Electoral College for the selection of the members for the next higher tier.

4.9 DEMOGRAPHY

4.9.1 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.

4.9.2 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., 87%) were married and 11% were unmarried. Table: 4.12 shows the marital status of the respondents.

Table 4.12: Marital Status of the Respondents

Sr. No.	Marital Status	Number	Percentage
1	Married	68	87
2	Un-Married	10	13
Total		78	100

4.9.3 Literacy

Educational distribution of the respondents shows that Fifteen (15%) of the respondents were illiterate. 23% were educated up to primary level. However, 21% and 17% were educated up to middle and matric level respectively. Moreover, 14% respondents were educated up to intermediate and 10% respondents described their education level up to graduation and above. Educational level of the respondents is shown in Table 4.13.

Table 4.13: Educational Level of the Respondents

Sr. No.	Education of the Respondents	Number	Percentage
1	Illiterate	12	15
2	Primary	19	23
3	Middle	16	21
4	Matric	13	17
5	Intermediate	11	14
6	Graduation and above	7	10
Total		78	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. 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.

4.9.4 Languages Spoken

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

4.9.5 Housing

A mix housing pattern was observed among the project DPs where 19% of the respondents were living in semi pacca houses, while 68% respondents had pacca houses. Only 13% of the respondents mentioned that they were living in kutcha houses, made with mud and inferior construction material. Table 4.14 shows construction pattern of houses of the respondents.

Table 4.14: Housing Conditions

Sr. No.	Type of House	Number	Percentage
1	Semi Pacca ¹³	15	19
2	Pacca ¹⁴	53	68
3	kutcha ¹⁵	10	13
	Total	78	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.

4.10 ECONOMIC ASPECTS

4.10.1 Occupations

Occupation of the respondents were also asked during the field survey. Majority (41%) of the respondents were associated with farming. Thirteen (08%) of the respondents were running their shops while 3% 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 15% were engaged with private jobs to earn their livelihood. Rest of the respondents were associated with their own business and government jobs as reflected in Table 4.15.

¹³ Constructed using a combination of pacca (strong, high-quality) and kutcha (inferior) materials.

¹⁴ 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.

¹⁵ Constructed of mud and kutcha (inferior) materials

Table 4.15: Occupation of the Respondents

Sr. No.	Profession	Number of Respondent	Percentage
1	Farmers	32	41
2	Shopkeepers	6	8
3	Mechanic	2	3
4	Laborers	17	22
5	Private Service	12	15
6	Business	7	9
7	Govt. Service	2	2
Total		78	100

4.10.2 Income Levels

Socioeconomic findings of the survey revealed that 3% of the respondents were falling in the low income group of up to rupees 30,000. On the other hand, 38% were earning in the range of 30,001 to 40,000 rupees, and 22% of the respondents were earning their monthly income between the ranges of 40,001 to 50,000 rupees per month. Whereas, 23% of the respondents were earning between 50,001 to 60,000 and 14% were earning above 50,000 per month. Table 4.16 shows the average monthly income of the respondents.

Table 4.16: Average Monthly Income of the Respondents

Sr. No.	Average Monthly Income (Rs.)	Number of Respondent	Percentage
1	Up to 30,000	2	3
2	30,001 – 40,000	30	38
3	40,001 – 50,000	17	22
4	50,001-60,000	18	23
5	Above 60,000	11	14
Total		78	100

During the field surveys, it was observed that in case of farming households, the major sources of income were from crops and livestock (dairy products). For non-farm or landless households, the main sources of income were activities, such as business, shopkeeper, government employment, private employment, and labor work

4.10.3 Expenditure

Household expenditure depends on the earning of the household members, about 14% of respondents reported their monthly expenditure up to 30,000, and 40% respondents found within the range of 30,000- 40,000 per month. While, 21% were falling between the expenditure range of 40,001 to 50,000 and 15% recorded their monthly expenditures between the ranges of 500,001-60,000 per month. However, 10% of the respondents were

having their expenses more than 60,000 per month. Table 4. 17 shows the average monthly expenditures of the respondents.

Table 4.17: Range of Monthly Expenditures of the Respondents

Sr. No.	Average Monthly Expenditures	Number of Respondent	Percentage
1	Up to 30,000	11	14
2	30,001 – 40,000	31	40
3	40,001 – 50,000	16	21
4	50,001-60,000	12	15
5	Above 60,000	8	10
Total		78	100

The monthly expenditure and pattern of the expenditure provides an indication for assessing the standard of living of a household. The expenditure on food items includes cereals, pulses, flour, sugar, cooking oil/ ghee, and milk while the expenditure on non-food items are education, medical treatment, clothes, shoes, and toiletries.

4.10.4 Money Borrowed

Table 4.18 shows that significant majority i.e., 86% of respondents did not borrow money during the fiscal year 2023-2024. While only 11% borrowed money during this time.

Table 4.18: Money Borrowed

Sr. No.	Last Year Borrow Money	Number	Percentage
1	No	67	86
2	Yes	11	14
Total		78	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, education, and livestock. 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).

4.10.5 Agriculture Practice

In the proposed Project Area, groundwater is being supplied through tube wells for agriculture purposes which is the main source of irrigation water. Local farmers use traditional methods for farming (i.e., ploughing, tilling etc.) coupled with use of tractors and modern machinery for cultivation and harvesting. They grow almost all types of vegetables and fodder crops for their domestic animals. Milk selling is one of the major sources of livelihood for the local people, hence, they are used to grow fodder crops on major portion of their agricultural land. There were no fruit orchards in proposed Project's Aol.

The major agricultural machinery being used was tractors. There has been a consistent increase in the number of privately-owned agricultural machines. The farmers seem to consider increased mechanization of agriculture as they are buying more agricultural machinery, especially tractors. Scythes, sickle-type western hand tools are also being used for cutting of Barseem and other fodder crops. Fertilizers such as urea and ammonium phosphate are used by farmers to increase the crop productivity.

4.11 RELIGIOUS AND CULTURAL ASPECTS

4.11.1 Religion, Ethnic and Minority Groups

The population of the settlements in AOI is Muslim. The core unit of social organization is the caste system (“baraderi” in local language) in which groups are either defined on the basis of specific occupation or lineage. Jatt and Rajppoot are major casts in the project area. The social life of the local population is traditionally on rural.

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 Aol, local councilors, chairman and deputy chairman are the influential persons.

4.11.2 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 Aol, 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 Aol, 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).

4.11.3 Family System

Joint family system is the dominant culture in the Aol. 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 Aol 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.

4.11.4 Decision-making Methods and Conflict Resolutions System

The methods for decision-making about social conflicts in the Aol are “Panchayat” (an assembly of wise and respected elders), court and caste groups.

People prefer “Panchayat” in the Aol compared to court or other legal system because this method is more effective. “Panchayat” provide timely justice while other methods are complex and require time as well as money.

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.

4.12 INFRASTRUCTURE FACILITIES

4.12.1 Educational Facilities

The educational facilities in the Aol comprises 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.

4.12.2 Health Facilities

Health facilities are generally inadequate in the AoI. 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 Lahore. As per findings of the socioeconomic survey and community consultations, there were no proper health facility for the local people of village Natt Kalan and Theri. Local people are forced to risk their lives in the hands of the traditional practitioners.

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.

4.12.3 Civic Facilities

Electricity is available in both villages and its surrounding, while the proper drainage system is not available even the road network is also poor.

4.12.4 Sources of Drinking Water and quality.

Groundwater is being used for drinking purpose in Natt Kalan, and Their adjacent settlements. Quality of ground water is poor due to sewage of wastewater from drains and factories.

4.13 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, few women doing jobs in different professions like 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 because such services are not available close to home in the Aol.

Women in the Aol 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 rural 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., preparation of fodder for animals, 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 a small loan scheme through the Punjab Rural Support Program (PRSP).

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. Other problems include laborious work such as helping male members in preparation of fodder and managing livestock. These tasks not only affect their health but also take up major portion of their time

5 PUBLIC CONSULTATIONS

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 IEE 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 AoI; 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, Agriculture Department, Forest Department, Wildlife Department, Parks & Horticulture Authority (PHA) and other 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.
Forest Department	- Implementing strategies and policies to conserve and protect forests. - Ensuring the preservation of diverse plant and animal species in forests and natural ecosystems to maintain ecological balance. - Implementing government policies, laws, and regulations related to forests, wildlife, and environmental conservation. - Contributing to global efforts in mitigating climate change by preserving forests, which act as carbon sinks, and promoting sustainable practices to reduce carbon emissions.
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, Agriculture Department, Forest Department, Wildlife Department, 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
- Community level

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	Date
1.	Punjab-EPA	Mr. Noor Ahmed DD EIA	28-9-2022
2.	Forest Department	Syed Nadeem Abbas Sherazi DD	28-9-2022
3.	Wildlife Department	Mr. Tanvir Ahmad Janjua DD	28-9-2022
4.	Parks & Horticulture Authority (PHA)	Mr. Muneeb ur Rehman ADG	27-9-2022
5.	Government Riaz Primary School Nath Kalan	Head Mistress	27-9-2022

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, 2017 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; - Efforts should be made for installation of wastewater treatment plants for proposed projects of RUDA; - 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 of wildlife were recommended; - Loss of trees will be discouraged to keep the ecosystem balance and to protect habitat of wildlife of the region; - There is no protected area in and around the project area; - Required details of the faunal species of the region were also provided.
3.	Forest Department	- No development on green land is allowed as per Lahore Master Plan; - Wastewater Treatment Plants should be installed for proposed project. - Minimum disturbance to the local flora and green cover of the project area; - Urban Forest should be developed in the Lahore.

4.	Parks and Horticulture Authority (PHA)	• Tree cutting should be avoided up to maximum level; • 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.
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Consultation with Deputy Director Forest Department



Consultation with Deputy Director Wildlife Department



Consultation with Additional Director General, Pakistan Horticulture Authority



Consultation with Deputy Director EIA, EPA

Plate 5.1: Pictorial View of the Departmental Consultations

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. 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. People of surrounding communities (males and females) were also consulted along with general public) who were residing or working in the surroundings of the proposed project.

- Community/Public Consultations
- Individual meetings with Locals

5.5.2 Locations of the Public Consultations

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

- Natt Kalan;
- Theri;

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	People of the surrounding communities
2	Local Residents
3	Local Farmers
4	Business/ shop owners
5	Government and private Servants

5.6 CONSULTATIONS WITH LOCAL COMMUNITIES

Extensive consultations were conducted with the local communities 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 and landowners.

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 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 of Findings of the Consultations

Sr. No.	Concerns Raised by Participants	Mitigation Proposed by Participants	Action to be taken by Project Executors
1	Due to construction of the boundary wall of the proposed residential colony, local people will face access problem to their farmland and resident.	Local people should not be restricted to their settlement and their farm land.	Proper access should be provided to the local people to reach surrounding area easily.
4	During the construction period, mobility of the local community will be disturbed. Especially, local community of Village Hando requested to provide proper access road for their village from rear boundary.	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.
5	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.
6	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.
7	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.
8	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.



A View of Socioeconomic Survey



A View of Consultation with Business Men and farmers



A View of Socioeconomic Survey



A View of Socioeconomic Survey

Plate 5.2: Pictorial View of the Community Consultations

5.7 PROPOSED CONSULTATIONS PROGRAM

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 Study Area / Aol 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
Duration	-	Long or Short Term
Effect	-	Direct or Indirect
Extent	-	Wide or Local

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 is 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.

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.

6.3.1 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 (construction and operational phases). A Project Impact Evaluation Matrix is given as **Table 6.1**.

6.3.2 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 characteristic (for example, land acquisition). Information for an array of variables such as land use, infrastructure, vegetation etc. was collected for the standard geographical units within the project's AoI, 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 for the quantification of the land use categories is given in Chapter 4: Description of Environment.

6.4 DELINEATION OF STUDY AREA / AoI

For an EIA Study, a clear delineation of the Study Area / AoI is required. Study Area / AoI is the area within which the potentially significant impacts of the proposed Project activities (direct or indirect) are envisaged. In this report, the Study Area / AoI of the proposed project is considered as 25m from project boundary where the impacts on the environment due to the proposed Project activities are assessed. Based on the available Google Earth Imagery and ARC GIS software, Project footprints were overlaid on the existing Project Area Imagery. Utilizing the information collected through the detailed site visit, consultations with the locals and concerned departments and foreseen impacts of the proposed Project, a tentative AoI was delineated. Map of the Study Area / AoI is shown as **Figure 1.2**.

Table 6.1: Environmental Impacts Matrix for Construction Phase

Project Impact 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	Wastewater Generation	Emission of GHGs	Traffic Issues	Aquatic Ecosystem	Terrestrial Ecosystem	Endangered Species	Loss of Trees	Loss of Crops/Orchards	Conflict over Resources	Public Utilities	Accessibility	Community Stability	Gender Issues	Cultural & Social Issues	Health& Safety	Aesthetic	Security Situation	Living Standards	Employment Opportunities
A. Planning & Design Phase																								
Topographic Survey of Project	2	2	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Geotechnical Investigation	0	0	2	0	0		0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0
Socio-Economic Surveys	2	2	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B. Construction Phase																								
Site Clearance	9	9	9	2	8	4	2	2	0	12	0	10	0	6	10	3	0	2	2	9	4	2	0	6
Earthwork and Excavation	9	9	9	2	8	8	4	4	0	12	0	8	0	6	2	3	2	0	2	9	4	2	0	6
Establishment of Construction Camps & Workshop	2	2	4	0	8	8	0	2	0	4	0	4	0	8	0	0	4	4	4	8	4	2	0	6
Transportation & Storage of Construction Materials	4	6	6	4	4	2	0	4	0	2	0	0	0	0	0	0	4	0	2	6	4	0	0	4
Use of Construction Material and Heavy Machinery	3	8	9	0	4	0	0	2	0	4	0	0	0	0	2	2	0	0	2	8	0	4	0	4
Installation and operation of Batching and Asphalt Plants	4	8	8	2	4	2	2	0	0	2	0	0	0	2	0	0	0	0	0	6	4	0	4	4
Spoil Disposal	3	3	0	2	6	0	0	0	0	6	0	4	0	0	0	0	2	0	4	4	6	0	0	2
Structural & Civil Work	8	8	8	2	7	2	2	2	0	6	0	0	0	2	2	0	2	4	4	9	4	3	0	8
Drainage, Water Supply & sewerage works	4	6	6	2	6	4	2	2	0	6	0	0	0	2	2	0	2	4	4	9	4	4	0	8
Construction of residential/commercial units	0	2	4	4	6	4	2	2	0	2	0	0	0	0	0	0	0	2	0	4	0	0	0	8
C. Operational Phase																								
Movement of Residents, Employees & Visitors	2	4	4	4	9	10	4	4	0	4	0	6	0	0	0	0	4	0	0	2	6	6	6	6
Consumption of water	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal solid waste and wastewater generation	0	0	0	0	6	0	6	6	0	0	0	0	0	0	0	0	0	0	2	6	4	0	0	2
Maintenance of Area Facilities	0	2	2	2	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	2
Landscaping/ Maintenance of Green areas	0	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0	2
										Positive Impact Score					act Significa									
										0					Negligible									
										2 to 4					Low									
										5 to 8					Medium									
										9 to 12					High									
										>12					Very High									

6.5 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

There are some potential significant adverse environmental 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 Phase (i.e., site investigation work i.e., topographical, seismic studies etc.); Construction Phase includes all stages from mobilization of Contractor to the completion of Project; and Operation Phase starts after the Construction Phase which includes the inspection and repair works.

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

6.5.1 Potential Environmental Impacts during Pre-Construction / Design Phase

Following is the brief description of impacts envisaged and the recommended mitigation measures during Pre-construction / Design phase.

6.5.1.1 Land Acquisition

The land associated with the proposed Project is about 166.22 Acres, which is owned by the RUDA. The land is mostly agricultural/barren land. There is no impact related to land acquisition in case of proposed project.

6.5.1.2 Environmentally Responsive Design Considerations

Designing of the project components without considering the prospective and futuristic needs can result in structures with low social acceptability and functionality. Improper designed infrastructure may lead to technical, environmental and financial problems. This includes sewerage lines, pumping station, storm water drainage, water supply, solid waste management system, etc. If not properly planned and designed, it may lead to both social and environmental concerns. Moreover, utilization of the available spaces and designing the layout without considering the prospective and futuristic needs may result in design with low social acceptability and functionality.

This impact is permanent and moderate negative in nature.

Mitigation Measures:

- The infrastructure of proposed Project should be designed keeping in view the future population and projected flows; and
- All structural, layout and engineering designing should be in strict considerations with the applicable national and international by-laws and engineering parameters.

6.5.1.3 Topography

The topography of the project area is flat. The topography of the project areas will be changed due to excavation, tree cutting and establishment of housing scheme. Visual changes to the topography will be of permanent and moderate negative in nature.

Mitigation Measures:

- The project design would consider aesthetic concerns such as the tree plantation which is already recommended in the EIA Report;
- Best engineering design measures should be adopted keeping in view the aesthetics of the project area; and
- Ground disturbances should be limited to only the areas necessary for project related construction activities.

6.5.1.4 Land use

There will be change of land-use due to construction of proposed Project. Currently, the predominant land-use in the project area is barren with few agriculture patches at places. The project site will be converted into residential and commercial area that will have a negative impact on land use.

Mitigation Measures:

- The master plan (as described in Section-3) of the proposed Project shows that a more than 100 kanal of land is being allocated as green area which will help in minimizing the negative impact; and
- The project site may be surrounded by thick tree plantation to minimize the impact and improve the aesthetics. Therefore, a tree plantation plan should be composed in coordination with the Forrest Department with allocation of adequate budget.

6.5.1.5 Seismic Hazard

As per Building Code of Pakistan, Seismic Provisions, 2007, the project area is located in Seismic Zone 2A (low to moderate hazard), where 2A represents peak horizontal ground acceleration from 0.08g to 0.16g. In this Zone, designing of various types of structures should be done on the basis of PGA. A high intensity earthquake impacting the project site can adversely impact the development. This factor requires special consideration of the designers keeping in view of the recent earthquake of October 08, 2005. This will be a local and high adverse impact.

Mitigation Measures:

- The proposed structures should be designed and constructed to withstand high intensity earthquakes. For seismic hazard analysis, updated structural, geotechnical and seismic studies should be conducted; and
- To mitigate the seismic hazard, 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.

6.5.1.6 Emergency Management

Emergency management in case of natural and man-made disaster is a major concern. Increased incidents of disasters especially act of terror, fire, earthquakes etc. demand proper planning. The impact is considered to be high negative, and long-term. An inefficient firefighting system and insufficient storage of fire water may pose a severe threat to human life and to the proposed Project.

Mitigation Measure:

- A separate building for fire brigade, emergency response equipment and staff may be considered in the design;
- Emergency Response Plan is attached as **Annex-III**.

6.5.1.7 Site Selection of Construction Camps

Improper site selection and location of construction camp(s) may lead to various social and environmental impacts which include loss of vegetation due to setting up construction camps, indiscriminate generation of solid waste, and discharge of sanitary effluent, water pollution and health & safety issues in the surrounding settlements. This impact is low negative and short term.

Mitigation Measures:

- Construction camps should be designed to be self-contained to reduce demand on infrastructure and services of nearby communities and to minimize the removal of existing macro-plants;
- There should be no resettlement issue 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.

6.5.1.8 Flora

During the pre-construction phase, activities such as installation of construction camps, construction of temporary facilities & mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space due to which available vegetation is expected to be removed. This impact is site-specific, permanent, 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 facilities 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 should be selected so, as to have limited environmental impact during construction phase and to reduce the cost and land requirement.

6.5.1.9 Fauna

As movement and installations of machinery and vehicles will take place, 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. This impact is site-specific, temporary and low significant.

Mitigation Measures

- The standard measures must be adopted to minimize noise due to machinery movements and installations;
- Wildlife movements and routes must be considered during activities and should be avoided to their maximum level;
- The alternate routes and points are recommended to avoid any damage to locally available fauna;
- The camps shall be designed as properly fenced and gated to check the entry of animals in search of eatable goods; and
- A waste management plan so that the wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them.

6.5.1.10 Public Utilities

Due to the proposed project, public utilities (electric poles, water pipes, power/ telephone lines, etc.) may 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:

- The provision in the design and budget for the relocation of the existing utility infrastructure wherever required and 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 shall be relocated well ahead of time before the actual commencement of the construction work.

6.5.2 Potential Environmental Impacts during Construction Phase

Following is the brief description of impacts envisaged and the recommended mitigation measures during construction phase.

6.5.2.1 Topography

Construction activities are not expected to impact the topography of the area significantly except for those areas where physical activities including digging and excavation areas, storing or dumping sites for excessive material, storing areas and movement of heavy construction machinery will be carried out. The excavated material will be generated due to the construction of various infrastructure components of the project like Roads & Walkways and paved areas, water supply network, storm water drainage network, sewerage system, external electrification system, sui gas layouts and parking facilities. The area where excavated material is to be dumped will also be negatively impacted. This impact is Site-specific, Temporary and medium significant in nature.

Mitigation Measures:

The excavated material will require safe disposal by the Contractor. Most of the excavated material could be used in back filling process and concrete aggregate to be used in construction. A detailed development and operation plan for borrow areas must be prepared by the contractor at the pre development phase (before the starts of extraction of material from each borrow area). Contractor should strictly follow the provisions of approved plan in order to minimize any adverse impact associated with the borrow areas. Likewise, excavated material should be dumped at suitable and approved disposal sites.

6.5.2.2 Soil Erosion and Contamination

Impact on topsoil and soil stability is mainly expected during the preparatory and construction works, which will be caused by the arrangement of the construction camp, construction site, replacement of the equipment, earthworks, arrangement of temporary and permanent infrastructures, etc.

The soil would be exposed to erosion due to removal of vegetation, establishing construction camps / workshops and excavation etc. The most significant aspects in the construction phase of are excavation works and construction of roads. These will expose soils in the affected project area leaving them vulnerable to erosion by surface run-off and wind. The overall threat could exist for the durations of construction works in the monsoon season.

Besides, there is high possibility for soil pollution with substances due to leakages of fuels and oils from the heavy vehicles and machinery used for construction and due to applied chemicals during this phase.

Mitigation Measures:

- In order to prevent the damage and contamination of soil at the project site, surface layer of the soil should be removed and stored temporarily in pre-selected locations. The soil should be stockpiled separately. Stockpiles should be protected

- from wind and atmospheric precipitation and should be at least 50 meters away from surface water body;
- Stored excavated material shall be covered and preferably reused, e.g. in construction of dykes etc.;
 - Sprinkling of water may help in reducing the erosion soil;
 - Use of heavy machinery should be restricted as far as possible to work sites only to avoid the destruction of soil structure;
 - Vehicles and equipment should be checked regularly. In case of damage and fuel / oil leakage, it should be repaired immediately. Damaged Vehicles should not be allowed on the construction sites;
 - In case of spillage of pollutants, spilled material should be localized and contaminated site should be immediately cleaned; Staff should be provided with appropriate means (adsorbents, shovels, etc.) and with personal protective equipment as well;
 - All spoils should be disposed of at site designated by LWMC and the site should be restored back to its original conditions;
 - Non-bituminous wastes from construction activities will be dumped in approved sites, in line with the guidelines for dump sites, and shall be covered;
 - Washing yards shall be paved to avoid seepage of runoff from the yard;
 - After completion of construction works, all kind of waste (including hazardous waste) will be collected and removed from the area. Hazardous waste should be removed for further management by the licensed contractor; and
 - Perennial grasses and shrubs trees should be planted to control the runoff on the site.

6.5.2.3 Water Quality

The potential sources of water pollution associated with the construction of proposed Project are runoff from the construction works area that may contain increased loads of sediments, suspended solids and other contaminants. Potential sources of pollution from the site include:

- Runoff and erosion from exposed soil surfaces, earth work areas and stockpiles e.g., grouting and cement material with the rain;
- Wash water from dust suppression sprays;
- Fuel and lubricants from maintenance of construction vehicles and mechanical equipment;
- Spillage of liquids stored on-site such as oil, diesel, and solvents etc. are likely to result in water pollution; and
- Uncontrolled discharge of debris and rubbish such as packaging, construction material and refuse.

The groundwater may get contaminated from the wastewater generation from the construction camps, leachate from improper dumping of solid waste. The impact is medium adverse in nature.

Mitigation Measures:

As a mandatory step, all the effluents will be disposed as per the requirements of PEQS. 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 camp will be established in area with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met;
- The proponent will ensure that the construction work is confined within the project boundary and water bodies are prevented from pollution during construction;
- The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements;
- Regular water quality monitoring according to determined sampling schedule;
- Water required for construction shall be obtained in such a way that the water availability and supply to nearby communities remain unaffected;
- The contractor will ensure that construction debris do not find their way into the drainage which may get clogged;
- To maintain the surface water flow/drainage, proper mitigation measures will be taken for the proposed project, like drainage structures;
- Wastes will be collected, stored and taken to approved disposal site;
- 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 into the land it will meet the requirements of the PEQS for disposal of wastewater.

6.5.2.4 Deterioration of Ambient 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. Besides, multifarious construction activities and increased vehicular traffic (construction vehicles) would also contribute to the localized airborne dust. The larger sized particles, under influence of gravity, tend to settle down in the immediate vicinity of the source. The Suspended Particulate Matter (SPM) tends to remain suspended in the environment for much longer and persistent time and is an environmental hazard. The objectionable impacts of settling of the suspended dust would be its dry deposition on vegetation, motor vehicles, structures, and other exposed surfaces. Exhausts from fossil fuel burning in the construction machinery will also deteriorate local air quality. Similarly, exhausts from generators can also have impacts on air quality in the vicinity. The deteriorated ambient air quality may cause health hazards to the residents of nearby localities.

The overall impact on the quality of air during the construction phase will be high adverse, however, it will be temporary and limited to the project's implementation phase only.

Mitigation Measures:

The construction phase impacts 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 through trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS for carbon emissions and noise;
- Regular water sprinkling of the site 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 preset 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;
- Service roads (used for earthmoving equipment and general transport) should be regularly sprayed with water during dry weather;
- All excavation work should be sprinkled with water;
- 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 should be taken up; e.g., providing them as applicable, with protection canvasses and dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards; and
- Regular monitoring of air quality in accordance with the formulated environmental monitoring plan (given in EMP).

6.5.2.5 Noise and Vibration

The noise and vibration will be produced due to the operation of construction machinery equipment. 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. Noise and vibration are perceived as one of the most undesirable consequences of construction activity. The above machinery is expected to generate noise levels that would be severe in the Project Area. The noise and vibration may cause health hazards to the residents of nearby villages such as Nath Kalan, Their, etc.

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;
- 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;
- Potential impact from vibration during the construction period consists of damage to buildings from heavy earthmoving equipment; and
- Moreover, vibrations from machinery and equipment such as hand held compactors and concrete vibrators can produce easy fatigability and generalized aches in the persons operating these machines.

This impact is medium negative, local and short term.

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 (NPZs): The NPZs are another administrative control to limit exposure to noisy processes or equipment to as few workers as possible. NPZs 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. NPZs can be set up using a sound level meter to find the safe distance from the source (90 dB (A)) and the NPZs 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.

6.5.2.6 Borrow Areas/ Open Pits

Borrow / open pits and its excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments.

Borrow/ open pits may also result in potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the Project Area. This impact is permanent and high adverse in nature.

Mitigation Measures:

- Necessary permits will be obtained for any borrow pits from the competent authorities;
- In borrow pits, the depth of the pit shall be restricted upto 5' and the sides of the excavation will have a slope not steeper than 1:4;
- Soil erosion along the borrow pit shall be regularly checked to prevent/mitigate impacts on adjacent lands;
- In case borrow pits fill with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and
- The Guideline Quarry Management Plan is attached as **Annex-IV**.

6.5.2.7 Operation of Construction Camps / Camp Sites

Mismanagement of construction camp activities can lead to various social and environmental impacts which include health and safety, traffic problems, soil degradation, loss of vegetation and assets on the selected land, solid waste and water pollution in the vicinity settlements. Furthermore, cultural differences, behavior of construction workers, potential disregard for local cultural norms can lead to increased tension between local communities and workers residing in the construction camps. This impact is temporary and moderate negative in nature.

Mitigation Measures:

- The project will seek to avoid sitting camps where their presence might contribute to any conflicts with locals;
- Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different socio-cultural values;
- Camps will be designed to be self-contained to reduce demand on infrastructure and services of nearby communities;
- A comprehensive safety and security plan for the camp will be prepared which will comprise of a training manual, use of safety equipment and emergency preparedness;
- Training will be provided to all staff on camp management rules and overall discipline and cultural awareness;
- Waste Management Plan (**Annex-V**) will be implemented to ensure safe handling, storage, collection and disposal of construction wastes and the training of employees who handle waste;
- Site for construction camp will be selected to minimize the removal of existing macro-plants at camp sites;
- Photographical and botanical inventory of vegetation before clearing the site;
- Compensatory plantation to be done when construction work near ends; and
- The contractor(s) shall ensure removal and rehabilitation of site upon completion.

6.5.2.8 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 nullahs, drains, water channels etc. apart from soil contamination. The wastewater generation is estimated to be 6,600 liters/day¹⁶ for 200 construction workers during construction phase of the proposed Project. This impact can be categorized as moderate adverse, site-specific and temporary.

Mitigation Measures:

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

¹⁶ Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/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;
- Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit; and
- 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.

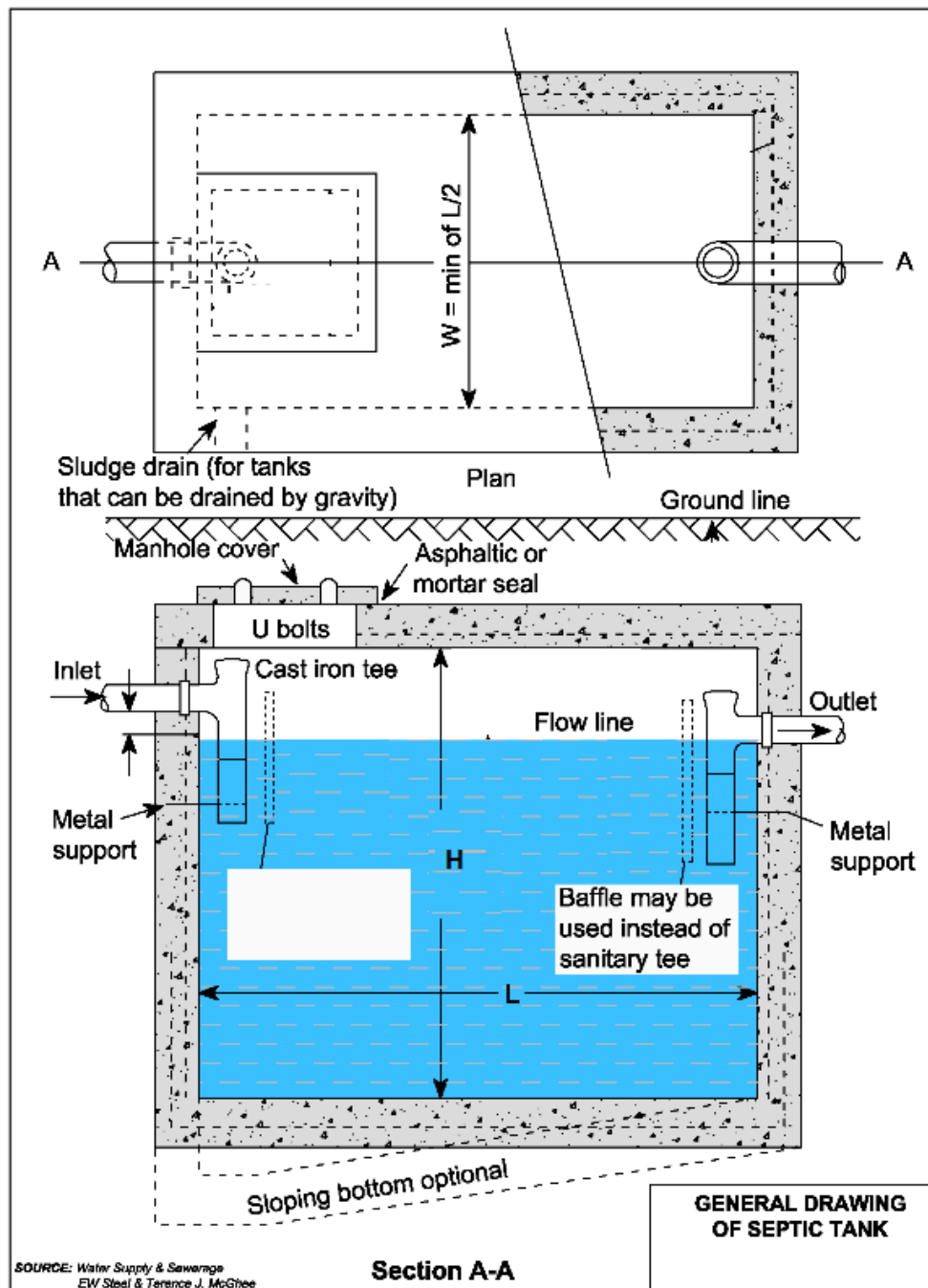


Figure 6.1: General Drawing of Septic Tank

6.5.2.9 Solid Waste Generation at Construction Camps

The solid waste generation is estimated to be 90 kg/day¹⁷ for 200 construction workers during construction phase of the proposed Project. Different type of waste is likely to be generated during the construction phase of the proposed Project. The municipal waste will be in the form of food, cans, paper and wastewater from construction camps toilets and washing yards. Construction waste will include excavated soil, sand, gravel, rocks, asphalt, pieces of concrete, bricks, wood, metal pieces and electrical wires. Whereas, hazardous waste can be comprised of paints and construction chemicals. All these, if left unattended, can become a source of nuisance and environmental pollution in the Project Area.

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 minor negative in nature.

Mitigation Measures:

- Solid Waste generated during construction and camp sites will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan;
- Training of work force in the storage and handling of hazardous materials and chemicals Construction workers and supervisory staff should be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste; proper labeling of containers, including the identification and quantity of the contents, hazard contact information, etc.;
- Waste disposal plan must be reviewed during the entire construction phase in the light of changing weather conditions;
- Emergency response plan shall be prepared to address the accidental spillage of fuels and hazardous goods;
- Immediate collection of spilled oils/fuels/lubricants by collection of contaminated soils and skipping oils from surface water by applying appropriate technologies;
- Reusing bitumen spillage; and disposing non-usable bitumen spills in a deep trench providing clay linings at bottom and filled with soil at the top (for at-least 0.5 m);
- Used oil shall be collected in separate containers stored on impervious platform with restricted access and shall be sold to licensed contractor and the burning of waste oil shall be strictly restricted;
- Segregating and stockpiling scarified/ milled bituminous material and reusing this material in sub grade/shoulders;
- Construction waste such as waste wood can be recovered and recycled into wood for new building projects, and cement, bricks, and plaster can be crushed and reused in other construction and building projects; and

¹⁷ 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 contractor should ensure implementation of proposed Construction Waste Management Plan and it must be reviewed during the entire construction phase in the light of changing weather conditions.

6.5.2.10 Traffic Management

Due to the proposed project construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling especially through Ring Road and other Project Area access roads. 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, dust emissions, noise related impacts, etc. Considering these consequences, this impact can be categorized as site-specific, medium negative and temporary.

Mitigation Measures:

To minimize traffic problems in the proposed 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;
- 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;
- Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays; and
- In the light of Guideline Traffic Management Plan (**Annex-VI**) a site specific TMP will be prepared by the contractor and implemented to avoid traffic accidents, jams/public inconvenience.

6.5.2.11 Climate Change and Green House Gas Abatement

The main sources of greenhouse gases (CO₂, CH₄, 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 landslides and debris flows, 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:

- Regular motioning of the vehicles for engine efficiency;
- All stakeholders (RUDA, consultants, contractors, concessionaires) need to become aware that their actions at all stages of a project can contribute to reducing the CO₂ burden;
- Elimination of unnecessary idling can save fuel, prolong engine life, and reduce emissions. It can also help reduce the noise levels associated with construction. Unnecessary idling occurs when trucks wait for extended periods of time to load or unload materials or supplies, or when equipment is left on when it is not being used. Construction workers may take breaks and leave equipment running unnecessarily or may idle equipment because it is an ingrained habit;
- Managing equipment operations and training workers to reduce unnecessary idling is a relatively easy way to lower operating costs and help reduce the environmental impact of construction;
- A preventive maintenance program by the contractor seeks to maintain engines at their original level of performance and eliminate the high cost of catastrophic engine failure. Preventive maintenance is the systematic inspection, detection, and correction of potential construction equipment failures. It significantly reduces fuel consumption and emissions; and
- Use of low sulfur and good quality fuel in the construction vehicles or operating equipments that will reduce maintenance costs and harmful emissions.
- Alternative energy resources shall be considered where possible; and
- PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.

6.5.2.12 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 Supervision Consultant and

- RUDA and should be 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 active construction sites; and
 - Minor incidents and near misses should be reported by the contractor, and preventive measures should be formulated accordingly by the RUDA management.

6.5.2.13 Occupational Health and Safety

Occupational Health and Safety (OHS) related impacts will arise during construction phase activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. 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 OHS related 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 direct, moderate, site-specific, medium term, temporary, medium probability and irreversible.

Mitigation Measures:

Following mitigation is given to avoid the accidental risks:

- Providing basic medical training to specified work staff and basic medical service and supplies to workers;
- Complying 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 contractor in close coordination with the provincial emergency services.

The Occupational Health and Safety Plan is attached as **Annex-VII**.

6.5.2.14 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, 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;
- 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 health 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.

6.5.2.15 Communicable Diseases

The laborers in the Contractor Camp, truck drivers and like personnel who interact with each other have the potential for the spread of communicable diseases like COVID-19 and HIV/AIDS. Majority of the people living in the surrounding of the Project, and potential labor are not aware of the source, mode of communication or consequences of HIV/AIDS. Although their religious and cultural value system, to a large extent excludes the outbreak or rapid communication of COVID-19 and HIV/AIDS, yet its occurrence in such a situation cannot be precluded. It is necessary that awareness and preventive campaigns are run from time to time in the labor camps and the field offices of the Project to prevent the communicable diseases.

There is a chance of spreading of an epidemic of Coronavirus disease (COVID-19) due to close interaction of the labor force during construction not only among the workers but also in the area. This impact can be categorized as direct, medium, site-specific, short term, temporary, medium to high probability and reversible.

Mitigation Measures:

The Contractor shall:

- Arrange to run an active campaign, in the labor camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS;
- SOPs related to the construction industry advised by National Action Plan for COVID-19 Pakistan to control spreading of COVID-19, shall be implemented by the contractor and should be strictly monitored. Guideline for COVID-19 are attached as **Annex-VIII**;
- Strengthen the existing local health and medical services for the benefit of labor as well as the surrounding villages;
- Ensure cleanliness and hygienic conditions at the labor camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by the Health Department;
- Locating a labor camp at least away from the villages (local settlement), and
- Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents.

6.5.2.16 Resource Conservation

The materials used in construction of proposed project would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement and cement. Almost all the materials to be used in the construction of proposed Project are non-renewable and therefore their sustainable use is necessary for the future use.

Fuel will be used to operate construction machinery and asphalt and batching plants. Sustainable use of energy resources is very important not only to continue future use but also to help to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is very important. The impact is negative and long term in nature.

Mitigation Measures:

Following practices shall be adopted to conserve these natural resources:

- Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment's;
- The efficient and well-maintained equipment's and machinery should be used;
- The equipment and machinery should be turned off when not in use;
- Regular maintenance of machinery to avoid fuel leakages;
- Reduction of wastage of water through training of workers involved in water use should be planned;
- Plan for reuse of construction waste materials may be formulated;
- A good camp design and an efficient worksite management plan should be prepared that may help the contractor to reduce the water demand, and wastewater and solid waste volumes to the lowest levels; and
- Use of solar panels at camp sites to conserve energy.

The Resources Conservation Plan is attached as **Annex-IX**.

6.5.2.17 Discovery of Heritage Sites/ 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 to Directorate General (DG) of Archeology, Government of Punjab to take further suitable action to preserve those antiques or sensitive remains. Chance finds procedure (given in **Annex-X**) shall be adopted in case of any accidental discovery of cultural heritage.

6.5.2.18 Flora

The project will involve destruction of vegetation cover on construction areas particularly along proposed project construction. It is initially examined that approximately 97 mature, sub-mature, of different tree/plants species may be disturbed (as per data from GIS) and physical verification by ground trothing.

Moreover, exhaust of noxious gases from movement of heavy machinery and dust will pollute air which will adversely affect health and vigor of plants. During construction activities

the Contractor's workers may damage the vegetation and trees (for use as fire-wood to fulfill the camps requirements). Overall, it can be stated that the large number of trees may be damaged in the proposed project activities.

This impact is site-specific, medium negative and high significant.

Mitigation Measures:

- Cutting of trees and disturbance of trees shall be avoided as far as possible and select the alternate site for the proposed project as the impact on local ecosystem (especially trees) is expected as high. So, that negative effects on the process of natural regeneration of species are minimized and if possible an alternate area may be considered for proposed project, in which minimum ecological and environmental losses are expected;
- Trees should be replanted or transplanted wherever possible, instead of cutting;
- Tree plantation plan should be implemented preferably in the project area or nearby blank spaces (along the roads, parks & green areas etc. where suitable) within 500m radius possibly;
- A tree plantation program shall be formulated with the recommendations and technical support of PHA and Forest Department;
- NOC for tree cutting from the concerned authority is mandatory;
- As a principal of 1:10, ten trees shall be planted in place of felling of one tree in consideration of mortality i.e. 1,000 new trees will be planted to compensate the losses;
- The proponent shall implement the program with the help of PHA and Forest Department and in consultation with concerned consultant ecologist;
- Open fires should be banned in the area to avoid hazards of fire in the area;
- 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 green land;
- However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation is carried out and minimum damage is 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; and
- Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed.

6.5.2.19 Fauna

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

Birds as well will 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 machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Uncontrolled blasting may even disturb the fauna of the Project Area. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers. This impact is indirect, site-specific, temporary, reversible and medium significant.

Mitigation Measures:

- Care shall be taken during construction activities for avoiding purposely or chance killing of animals;
- If any wild species and habitat is found during construction, it must be dealt carefully and local wildlife department officials should be informed;
- Hunting, poaching and harassing of animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor 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;
- 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;
- Wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and
- Noise produced due to construction activities may be kept to acceptable level.

6.5.2.20 Social/ Cultural Conflicts

During the construction phase of the project, conflicts may arise between labor force and Local communities that exists near the Project Area. 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.

6.5.3 Potential Environmental Impacts during Operational Phase

The anticipated environmental impacts related to the proposed Project have been studied for the operational phase of the project as discussed hereunder.

6.5.3.1 Waste Generation

Municipal solid waste will be generated during operation phase of the proposed Project. Improper storage and dumping of waste may pollute soil and groundwater and may also choke sewerage pipes and storm water drains of Chaharbagh. It may also affect the aesthetics and can cause health problems to the residents and especially workers who are handling waste. Therefore, this impact will be high negative, long term and definite.

Mitigation Measures:

- A comprehensive solid waste management system should be formulated for the operation phase; Waste storage containers with color coding should be placed at designated locations;
- The management of Chaharbagh should employ sanitary workers or hire contractor for waste collection and allocate budget for it;
- Waste segregation should be done at source and requisite planning needs to be done to implement the segregation techniques through residents and commercial building users;
- The biodegradable waste may be processed, treated and disposed of through composting or bio-methanation within the premises of Chaharbagh as far as possible. The residual waste should be given to waste collectors or a certified third-party contractor for final disposal at the designated landfill site;
- Construction waste including sand, concrete, clay, subsoil and rubble is to be stored by the society in their premises until it is handed over to the collector;
- Fines may be imposed for strict implementation of waste disposal from households; and
- Daily housekeeping of roads and parks should be carried out to minimize the generation of waste.

6.5.3.2 Wastewater Generation

Wastewater will be generated in the form of sewage from washrooms and other sources of the residential and commercial buildings of Chaharbagh. If disposed untreated, will not only create nuisance to the residents in nearby villages (in the shape of odor and health issues) but also to environment. The impact is high negative and permanent in nature.

Mitigation measures:

- Install a sewerage treatment plant (STP) to treat the waste water of Chaharbagh phase-II;
- Treated waste water may be used for watering the green areas;
- Timely maintenance of STP for its proper functionality; and
- Monthly treated effluent quality monitoring shall be done from an EPA certified laboratory for compliance with PEQS.

6.5.3.3 Traffic Management

During operation phase, the project will experience an upsurge in vehicles of residents and visitors. This means an increased number of vehicles accessing the facility. This in turn may have undesirable effect on traffic flow within the area.

Mitigation Measures

- A traffic assessment study needs to be conducted to get traffic projections during operation phase of the proposed Project;
- The management of the project should prepare, implement and monitor traffic management to avoid traffic congestions in and around the project area; and
- Liaison with the Lahore Traffic Police Department on the roads, surrounding the project for continuous flow of traffic.

6.5.3.4 Impact on Flora

During the operational phase of the proposed project, no significant impacts are envisaged or release of any significant pressure detrimental to flora. The presence of adequate flora at available spaces in the project area 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.

Mitigations Measures:

- The landscape plan provided in the master plan must be completely implemented;
- The implementation of plantation plan recommend in compensation for cutting of trees should start during operational stage, to ensure the ecological balance and to avoid any impact on local Environment;
- Large scale plantation of seedlings/ saplings of suitable indigenous tree species, shrubs and ornamental plants in the form of tree groves, should be carried out in accordance with the tree plantation plan to improve aesthetic value and offset the effect of removal of vegetation;
- Proper check and balance of above-mentioned activities is highly recommended. Plantations raised must be maintained according to the Silvicultural practices which include proper irrigation, cleaning, pruning and thinning at prescribed intensity, silt clearance and trench-opening; and
- Maintenance and security of the plantation should be done for at-least five years.

6.5.3.5 Emergency Preparedness and Response

During the operation phase, emergencies like fire and disasters such as earthquakes and flooding may occur. This impact is negative, temporary and moderate in nature.

Mitigation Measures

- An Emergency Response Plans for storm flooding, earthquakes, and manmade disasters must be developed by the RUDA, in close consultation with Fire Fighting Department (FFD), Rescue 1122 Services and Provincial Disaster Management Authority (PDMA);

- Training of management staff and employees regarding the emergency procedures and plans should be regularly conducted;
- Responsible person to implement the Emergency Response Plan should be clearly designated;
- Emergency numbers should be clearly posted, so that a quick action is taken when an emergency arises;
- Firefighting machinery and vehicles should be maintained regularly; and
- Regular drills for fire emergencies should be carried out.

6.5.3.6 Socio-economic Impacts

Improved Economy

Better communication and building infrastructure will facilitate the locals and will provide better business, trade and development opportunities to the locals resulting in uplift in economy. The proposed Project will also generate new job opportunities in different sectors. This is positive impact.

Improved life style

With improved economy, trade and development, the locals will be benefitted and will bring a positive change and uplift in their lifestyle and development of economic activities that boost the living standards of locals.

7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 GENERAL

Environmental Management Plan (EMP) is a tool for the implementation of all the suggested measures to make the project environmentally sustainable. It provides an overall approach for managing and monitoring the environmental, ecological and socio-economic issues of the proposed Project, and describes the institutional framework and reporting mechanism to implement EMP for the proposed Project.

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 EMP COMPONENTS

The EMP comprises following main components:

- EMP Objectives;
- Scope of the EMP;
- Environmental Policy, Legislation and Framework;
- Institutional Requirements;
- Environmental Mitigation and Management Matrix;
- Environmental Monitoring Plan;
- Planning for EMP Implementation;
- Training and Capacity Building;
- Communication & Documentation;
- Management Plans;
- Chance Find Procedure;
- Public Disclosure;
- EMP Cost; and
- Summary of Environmental Cost.

7.3 OBJECTIVES OF 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.

7.4 INSTITUTIONAL REQUIREMENTS

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

7.4.1 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 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 8.1.

7.4.2 Overall Oversight Arrangements

A Project Steering Committee comprising of CEO 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.

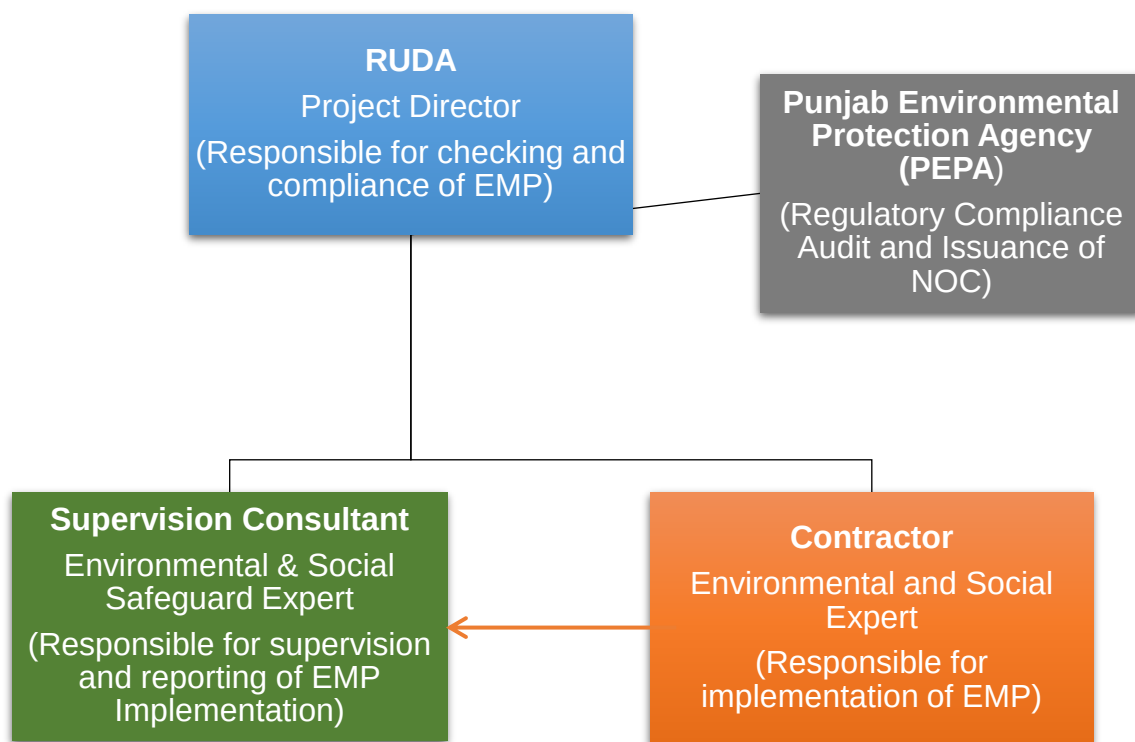


Figure 7.1: Organizational Setup for the Implementation of EMP at Construction Stage

7.4.3 Roles and Responsibilities for EMP Implementation during construction Phase

a. RUDA/ Employer Concerned Staff

The specific responsibilities are as follows:

- Setting up systems for environmental management;
- Ensuring that the Contractor(s) develop and carry out environmental implementation plans that are consistent with the EMP;
- Liaising between the Project staff and the Supervisory Consultant's staff to monitor environmental and social compliance during construction phase;
- Ensuring that the required environmental and social training is provided to the concerned staff;
- Responsible for carrying out random site visits to the construction sites to review the environmental performance of the contractors;
- Monitoring the progress of environment and social related activities;
- Make sure that the contractor is implementing the additional measures, suggested by the Supervisory Consultant in monthly environmental monitoring reports;
- Assessment of the crops, trees, valuation of property (if any), public utilities and negotiation with the affectees for fixation of compensation to be paid for temporary as well as permanent acquisition of the land;
- Assist in checking genuine ownerships of the claimants, in consultation with the Revenue staff for prompt payment to the affectees;

- To assist Contractor for obtaining necessary approvals from the concerned departments;
- Maintaining interface with the other lined departments/stakeholders; and
- Reporting to the EPA-Punjab on status of EMP implementation.

b. Supervision Consultant (SC)

A professional consulting firm will be hired by RUDA and responsible for Contract Administration and Construction Supervision. The firm will be fully empowered as the 'Engineer' in accordance with International Federation of Consulting Engineers (FIDIC) stipulations. The Consultant will administer the civil work's contracts, make engineering decisions, be responsible for quality assurance, provide general guidance and furnish timely responses to the Contractors in all matters relating to the civil works, and ensure that all clauses of the Contract Agreement including environmental and social clauses between the civil works Contractors' and RUDA are respected. The Project Engineer will have a full-time field based environmental and social specialist to ensure the implementation of EMP. Two separate experts, one for environment and one for social aspects, will be hired. The environmental and social specialist of SC will also develop training modules, conduct environmental and social trainings for the contractor's staff, and ensure social issues are properly addressed and mitigated during the project life.

Environmental and Social Experts (ESEs) 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. ESEs 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 ESEs are as follows:

- To oversee the performance of the Contractor to make sure that the Contractor is complying with EMP;
- 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 staff;
- Periodic reporting as mentioned in EMP; and
- Suggest any additional mitigation measures (if required).

c. Responsibilities of Contractor

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

- 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.
- ESE of contractor will be responsible for the implementation of 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;
- ESE will conduct the environmental, health and safety trainings for the staff and labors; 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)

PEPA 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.

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

The proposed Project will be administrated by RUDA during the O&M phase. RUDA has established District Support & Monitoring Department to monitor the development works of every district and for technical support for District Government. 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.

7.5 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 during Design Phase

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
Preconstruction / Design Phase					
1.	Environmentally Responsive Design Consideration Designing of the project components without considering the prospective and futuristic needs can result in structures with low social acceptability and functionality. Improper designed infrastructure may lead to technical, environmental and financial problems. This includes sewerage lines, pumping station, storm water drainage, water supply, solid waste management system, etc. If not properly planned and designed, it may lead to both social and environmental concerns.	• The infrastructure of proposed Project should be designed keeping in view the future population and projected flows; and • All structural, layout and engineering designing should be in strict accordance with the applicable national and international by-laws and engineering parameters;	• Audits and Checks	Design Consultant	Proponent
2.	Topography The topography of the project area is flat. There will be change in topography due to excavation and tree cutting. Visual changes to the topography will be of permanent but moderate negative in nature.	• The project design would consider aesthetic concerns such as the tree plantation which is already recommended in the EIA Report; • Best engineering design measures should be adopted keeping in view the aesthetics of the project area; and • Ground disturbances should be limited to only the areas necessary for project related construction activities.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent
3.	Landuse/ Land value		• Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	There will be change of land-use due to construction of proposed Project. Currently, the predominant land-use in the project area is barren with few agriculture patches at places. The project site will be converted into residential and commercial area that will have a negative impact on land use.	- The master plan (as described in Section-3) of the proposed Project shows that more than 100 kanal of land is being allocated as green area which will help in minimizing the negative impact; and - The project site may be surrounded by thick tree plantation to minimize the impact and improve the aesthetics. Therefore, a tree plantation plan should be composed in coordination with the Forest Department with allocation of adequate budget.			
4.	Seismic Hazard As per Building Code of Pakistan, Seismic Provisions, 2007, the project area is located in Seismic Zone 2A (low to moderate hazard), A high intensity earthquake impacting the project site can adversely impact the development.	- The proposed structure should be designed and constructed to withstand high earthquakes. For seismic hazard analysis, updated structural, geotechnical and seismic studies should be conducted; - To mitigate the seismic hazard, 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.	- Confirmation of design incorporation. - Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
5.	Emergency Management Emergency management in case of natural and man-made disaster is a major concern. Increased incidents of disasters especially act of terror, fire, earthquakes etc. demand proper planning. An inefficient firefighting system and insufficient storage of fire water may pose a severe threat to human life and to the proposed Project.	- A separate building for fire brigade, emergency response equipment and staff may be considered in the design; - Emergency Response Plan is attached as Annex-III.	- Confirmation of design incorporation. - Audits and Checks	Design Consultant	Proponent
6.	Construction Camps Improper site selection and location of construction camp(s) may lead to various social and environmental impacts which include loss of vegetation due to setting up construction camps, indiscriminate generation of solid waste, and discharge of sanitary effluent, water pollution and health & safety issues in the surrounding settlements. This impact is negative, local, low, short term and definite.	- Construction camps should be designed to be self-contained to reduce demand on infrastructure and services of nearby communities and to minimize the removal of existing macro-plants; - There should be no resettlement issue 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	- Confirmation of design incorporation. - Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		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.			
7.	Flora During the pre-construction phase, activities such as installation of construction camps, construction of temporary facilities & mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space due to which available vegetation is expected to be removed. This impact is site-specific, permanent, irreversible, possible, medium significant and needs to be encountered prior to the start of construction stage.	- The camps, mobility of machinery and construction of temporary facilities should be proper 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 should be selected so, as to have limited environmental impact during construction phase and to reduce the cost and land requirement.	Audits and Checks	Design Consultant	Proponent
8.	Fauna	The standard measures must be adopted to minimize noise due to machinery movements and	Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	As movement and installations of machinery and vehicles will take place, 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, irreversible and low significant.	installations; - Wildlife movements and routes must be considered during activities and should be avoided to their maximum level; - The alternate routes and points are recommended to avoid any damage to locally available fauna; - The camps shall be designed as properly fenced and gated to check the entry of animals in search of eatable goods; and - A waste management plan so that the wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them.			
9.	Public Utilities Due to the proposed project, public utilities (electric poles) may 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 infrastructure wherever required and 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 shall be relocated well ahead of time before the actual commencement of the construction work.	Audits and Checks	Design Consultant	Proponent
Construction Phase					
10.	Topography Construction activities are not expected	The excavated material will require safe disposal by the Contractor. Most of the excavated material could be used in back	Visual observation and photographic record	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	to impact the topography of the area significantly except for those areas where physical activities including digging and excavation areas, storing or dumping sites for excessive material, storing areas and movement of heavy construction machinery will be carried out. The excavated material will be generated due to the construction of various infrastructure components of the project like Roads & Walkways and paved areas, Water supply network, Water supply network, Storm water drainage network, Sanitary sewerage system, External Electrification system, Sui Gas layouts and Parking facilities. The area where excavated material is to be dumped will also be negatively impacted. This impact is Site-specific, Temporary, Irreversible, Possible and Low Significant.	filling process and concrete aggregate to be used in construction. A detailed development and operation plan for borrow areas must be prepared by the contractor at the pre development phase (before the starts of extraction of material from each borrow area). Contractor should strictly follow the provisions of approved plan in order to minimize any adverse impact associated with the borrow areas. Likewise, excavated material should be dumped at suitable and approved disposal sites.	Site restoration and rehabilitation plan implementation		
11.	Soil Erosion and Contamination Impact on topsoil and soil stability is mainly expected during the preparatory and construction works, which will be caused by the arrangement of the construction camp, construction site, replacement of the equipment,	In order to prevent the damage and contamination of soil at the project site, surface layer of the soil should be removed and stored temporarily in pre-selected locations. The soil should be stockpiled separately. Stockpiles should be protected from wind and atmospheric precipitation and should be at least 50 meters away from	- 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
	earthworks, arrangement of temporary and permanent infrastructures, etc. The soil would be exposed to erosion due to removal of vegetation, establishing construction camps / workshops and excavation etc. The most significant aspects in the construction phase of are excavation works and construction of roads. These will expose soils in the affected project area leaving them vulnerable to erosion by surface run-off and wind. The overall threat could exist for the durations of construction works in the monsoon season. Besides, there is high possibility for soil pollution with substances due to leakages of fuels and oils from the heavy vehicles and machinery used for construction and due to applied chemicals during this phase.	surface water body; • Stored excavated material shall be covered and preferably reused, e.g., in construction of dykes etc.; • Sprinkling of water may help in reducing the erosion soil; • Use of heavy machinery should be restricted as far as possible to work sites only to avoid the destruction of soil structure; • Vehicles and equipment should be checked regularly. In case of damage and fuel / oil leakage, it should be repaired immediately. Damaged Vehicles should not be allowed on the construction sites; • In case of spillage of pollutants, spilled material should be localized and contaminated site should be immediately cleaned; Staff should be provided with appropriate means (adsorbents, shovels, etc.) and with personal protective equipment as well; • All spoils should be disposed of at site designated by LWMC and the site should be restored back to its original conditions; • Non-bituminous wastes from construction activities will be dumped in approved sites, in line with the guidelines for dump sites, and shall be covered; • Washing yards shall be paved to avoid seepage of runoff from the yard;			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		- After completion of construction works, all kind of waste (including hazardous waste) will be collected and removed from the area. Hazardous waste should be removed for further management by the licensed contractor; and - Perennial grasses and shrubs trees should be planted to control the runoff on the site.			
12.	Water Quality The potential sources of water pollution associated with the construction of proposed Project are runoff from the construction works area that may contain increased loads of sediments, suspended solids and other contaminants. Potential sources of pollution from the site include: - Runoff and erosion from exposed soil surfaces, earth work areas and stockpiles e.g. grouting and cement material with the rain; - Wash water from dust suppression sprays; - Fuel and lubricants from maintenance of construction vehicles and mechanical equipment; - Spillage of liquids stored on-site such as oil, diesel, and solvents etc. are likely to result in water pollution; and	- As a mandatory step, all the effluents will be disposed as per the requirements of PEQS. 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 camp will be established in area with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met; - The proponent will ensure that the construction work is confined within the project boundary and water bodies are prevented from pollution during construction; - The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic	- Visual observation and photographic record - Regular environmental monitoring, sampling and testing reports	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Uncontrolled discharge of debris and rubbish such as packaging, construction material and refuse. The groundwater may get contaminated from the wastewater generation from the construction camps, leachate from improper dumping of solid waste. The impact is medium adverse in nature.	- requirements; - Regular water quality monitoring according to determined sampling schedule; - Water required for construction shall be obtained in such a way that the water availability and supply to nearby communities remain unaffected; - The contractor will ensure that construction debris do not find their way into the drainage which may get clogged; - To maintain the surface water flow/drainage, proper mitigation measures will be taken for the proposed project, like drainage structures; - Wastes will be collected, stored and taken to approved disposal site; - 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			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		is to be discharged in to the land it will meet the requirements of the PEQS for disposal of wastewater.			
13.	Deterioration of Ambient 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. Besides, multifarious construction activities and increased vehicular traffic (construction vehicles) would also contribute to the localized airborne dust. The Suspended Particulate Matter (SPM) tends to remain suspended in the environment for much longer and persistent time and is an environmental hazard. The objectionable impacts of settling of the suspended dust would be its dry deposition on vegetation, motor vehicles, structures, and other exposed surfaces. Exhausts from fossil fuel burning in the construction machinery will also deteriorate local air quality. Similarly,	• 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 through trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS for carbon emissions and noise; • Regular water sprinkling of the site 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;	• Visual observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records • Water sprinkling records.	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	exhausts from generators can also have impacts on air quality in the vicinity. The deteriorated ambient air quality may cause health hazards to the residents of nearby localities.	- 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 preset 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; - Service roads (used for earthmoving equipment and general transport) should be regularly sprayed with water during dry weather; - All excavation work should be sprinkled with water;			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		- 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 should be taken up; e.g., providing them as applicable, with protection canvasses and dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards; and - Regular monitoring of air quality in accordance with the formulated environmental monitoring plan (given in EMP).			
14.	Noise and Vibration The noise and vibration will be produced due to the operation of construction machinery equipment. 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. Noise and vibration are perceived as one of the most undesirable consequences of construction activity.	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 reports - Vehicle maintenance records	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	The above machinery is expected to generate noise levels that would be severe in the Project Area. The noise and vibration may cause health hazards to the residents of nearby villages such as Nath Kalan, Their, etc.				
15.	Borrow Areas/ Open Pits Borrow / open pits and its excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments. Borrow/ open pits may also result in potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the Project Area. This impact is permanent and high adverse in nature.	- Necessary permits will be obtained for any borrow pits from the competent authorities; - In borrow pits, the depth of the pit shall be restricted upto 5' and the sides of the excavation will have a slope not steeper than 1:4; - Soil erosion along the borrow pit shall be regularly checked to prevent/mitigate impacts on adjacent lands; and - In case borrow pits fill with water, measures have to be taken to prevent the creation of mosquito-breeding sites. - The Guideline Quarry/Borrow Management Plan is attached as Annex-IV.	- Visual observation and photographic record - NOC record of permits - Check and audits	Construction Contractor	Proponent
16.	Operation of Construction Camps/Camp Sites Mismanagement of construction camp activities can lead to various social and environmental impacts which include health and safety, traffic problems, soil	- The project will seek to avoid sitting camps where their presence might contribute to any conflicts with locals; - Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different socio-cultural values;	- Visual observation and photographic record. - Waste Management plan implementation	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	degradation, loss of vegetation and assets on the selected land, solid waste and water pollution in the vicinity settlements. Furthermore, cultural differences, behavior of construction workers, potential disregard for local cultural norms can lead to increased tension between local communities and workers residing in the construction camps. This impact is temporary and moderate negative in nature.	- Camps will be designed to be self-contained to reduce demand on infrastructure and services of nearby communities; - A comprehensive safety and security plan for the camp will be prepared which will comprise of a training manual, use of safety equipment and emergency preparedness; - Training will be provided to all staff on camp management rules and overall discipline and cultural awareness; - Waste Management Plan (refer Annex-V) will be implemented to ensure safe handling, storage, collection and disposal of construction wastes and the training of employees who handle waste; - Site for construction camp will be selected to minimize the removal of existing macro-plants at camp sites; - Photographical and botanical inventory of vegetation before clearing the site; - Compensatory plantation to be done when construction work near ends; and - The contractor(s) shall ensure removal and rehabilitation of site upon completion.			
17.	Wastewater Generation at Construction Camps	To dispose the liquid waste generated from the construction activities, the following steps will be taken by the	- Visual observation and photographic record. - Waste Management	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	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 nullahs, drains, water channels etc. apart from soil contamination. The wastewater generation is estimated to be 6,600 liters/day ¹⁸ for 200 construction workers during construction phase of the proposed Project. This impact can be categorized as direct, moderate, site-specific, short term, temporary, high probability and reversible.	Contractor: - 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; - Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit; and - 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.	plan implementation		
18.	Solid Waste Generation at Construction Camps The solid waste generation is estimated to be 90 kg/day¹⁹ for 200 construction workers during construction phase of the proposed Project. Different type of waste is likely to be generated during the construction phase of the proposed Project. The municipal waste will be in	- Solid Waste generated during construction and camp sites will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan; - Training of work force in the storage and handling of hazardous materials and chemicals Construction workers and supervisory staff should be encouraged and educated to practice	- Visual observation and photographic record. - Waste Management plan implementation	Construction Contractor	Proponent

¹⁸ Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/day)

¹⁹ 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.

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	the form of food, cans, paper and wastewater from construction camps toilets and washing yards. Construction waste will include excavated soil, sand, gravel, rocks, asphalt, pieces of concrete, bricks, wood, metal pieces and electrical wires. Whereas, hazardous waste can be comprised of paints and construction chemicals. All these, if left unattended, can become a source of nuisance and environmental pollution in the Project Area. 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 minor negative in nature.	waste minimization, reuse and recycling to reduce quantity of the waste; proper labeling of containers, including the identification and quantity of the contents, hazard contact information, etc; - Waste disposal plan must be reviewed during the entire construction phase in the light of changing weather conditions; - Emergency response plan shall be prepared to address the accidental spillage of fuels and hazardous goods; - Immediate collection of spilled oils/fuels/lubricants by collection of contaminated soils and skipping oils from surface water by applying appropriate technologies; - Reusing bitumen spillage; and disposing non-usable bitumen spills in a deep trench providing clay linings at bottom and filled with soil at the top (for at-least 0.5 m); - Used oil shall be collected in separate containers stored on impervious platform with restricted access and shall be sold to licensed contractor and the burning of waste oil shall be strictly restricted; - Segregating and stockpiling scarified/ milled bituminous material and reusing this material in sub grade/shoulders;			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		- Construction waste such as waste wood can be recovered and recycled into wood for new building projects, and cement, bricks, and plaster can be crushed and reused in other construction and building projects; and - The contractor should ensure implementation of proposed Construction Waste Management Plan and it must be reviewed during the entire construction phase in the light of changing weather conditions.			
19.	Traffic Management Due to the proposed project construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling especially through Ring Road and other Project Area access roads. 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,	To minimize traffic problems in the proposed 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; - 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	- 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
	vibrational impacts, etc. Considering these consequences, this impact can be categorized as site-specific, medium negative, temporary and irreversible.	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; - Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays; and - Traffic Management Plan (Annex-VI) will be prepared by the contractor and implemented to avoid traffic accidents, jams/public inconvenience.			
20.	Green House Gas 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	- Regular motioning of the vehicles for engine efficiency; - All stakeholders (RUDA, consultants, contractors, concessionaires) need to become aware that their actions at all stages of a project can contribute to reducing the CO₂ burden; - Elimination of unnecessary idling can save fuel, prolong engine life, and reduce emissions. It can also help reduce the noise levels associated with construction. Unnecessary idling occurs when trucks wait for extended periods of time to load or unload materials or supplies, or when equipment is left on when it is not being used. Constructions workers may take breaks and leave	- Regular environmental monitoring, sampling and testing reports - Vehicle inspection record - Plantation record	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	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 landslides and debris flows, 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.	equipment running unnecessarily or may idle equipment because it is an ingrained habit; - Managing equipment operations and training workers to reduce unnecessary idling is a relatively easy way to lower operating costs and help reduce the environmental impact of construction; - A preventive maintenance program by the contractor seeks to maintain engines at their original level of performance and eliminate the high cost of catastrophic engine failure. Preventive maintenance is the systematic inspection, detection, and correction of potential construction equipment failures. It significantly reduces fuel consumption and emissions; and - Use of low sulfur and good quality fuel in the construction vehicles or operating equipment that will reduce maintenance costs and harmful emissions. - Alternative energy resources shall be considered where possible; and - PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.			
21.	Natural and Man-Made Disasters	An Emergency Response Plan (ERP)	Trainings, drills, record keeping	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	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.	for earthquakes and manmade disasters should be developed by contractor in coordination with Supervision Consultant and RUDA and should be 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 active construction sites; and • Minor incidents and near misses should be reported by the contractor, and preventive measures should be formulated accordingly by the RUDA management.	• ERP implementation • Visual observation and photographic record.		
22.	Occupational Health and Safety Occupational Health and Safety (OHS) related impacts will arise during construction phase activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. 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	• Providing basic medical training to specified work staff and basic medical service and supplies to workers; • Complying 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	• 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
	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.	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 contractor in close coordination with the provincial emergency services. - The Occupational Health and Safety Plan is attached as Annex-VII.			
23.	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	- 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;	- 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
	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 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.	• 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; • Provision of proper safety and diversion signage at sensitive/accident-prone spots; • Setting up speed limits in close consultation with the local stakeholders; • 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 health workers in disease treatment; immunization program and providing health service; • Reducing the impacts of vector borne diseases will be accomplished			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		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.			
24.	Communicable Diseases The laborers in the Contractor Camp, truck drivers and like personnel who interact with each other have the potential for the spread of communicable diseases like COVID-19 and HIV/AIDS. Majority of the people living in the surrounding of the Project,	The Contractor shall: - Arrange to run an active campaign, in the labor camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS; - SOPs related to the construction industry advised by National Action Plan for COVID-19 Pakistan to control spreading of COVID-19, shall be	- 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
	and potential labor are not aware of the source, mode of communication or consequences of HIV/AIDS. Although their religious and cultural value system, to a large extent excludes the outbreak or rapid communication of COVID-19 and HIV/AIDS, yet its occurrence in such a situation cannot be precluded. It is necessary that awareness and preventive campaigns are run from time to time in the labor camps and the field offices of the Project to prevent the communicable diseases. There is a chance of spreading of an epidemic of Coronavirus disease (COVID-19) due to close interaction of the labor force during construction not only among the workers but also in the area	implemented by the contractor and should be strictly monitored. Guideline for COVID-19 are attached as Annex-VIII; - Strengthen the existing local health and medical services for the benefit of labor as well as the surrounding villages; - Ensure cleanliness and hygienic conditions at the labor camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by the Health Department; - Locating a labor camp at least away from the villages (local settlement), and - Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents.			
25.	Resource Conservation The materials used in construction of proposed project would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement and cement. Almost all the materials to be used in the construction of proposed Project are	- Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment's; - The efficient and well-maintained equipment's and machinery should be used; - The equipment and machinery should be turned off when not in use; - Regular maintenance of machinery to	Audits and Checks	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	non-renewable and therefore their sustainable use is necessary for the future use. Fuel will be used to operate construction machinery and asphalt and batching plants. Sustainable use of energy resources is very important not only to continue future use but also to help to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is very important also to help to reduce air emissions.	avoid fuel leakages; - Reduction of wastage of water through training of workers involved in water use should be planned; - Plan for reuse of construction waste materials may be formulated; - A good camp design and an efficient worksite management plan should be prepared that may help the contractor to reduce the water demand, and wastewater and solid waste volumes to the lowest levels; and - Use of solar panels at camp sites to conserve energy. - The Resources Conservation Plan is attached as Annex-IX.			
26.	Discovery of Heritage Sites/ 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 to Directorate General (DG) of Archeology, Government of Punjab to take further suitable action to preserve those antiques or sensitive remains.	Chance finds procedure (given in Annex-X) shall be adopted in case of any accidental discovery of cultural heritage.	Implementation of chance find procedure	Construction Contractor	Proponent
27.	Flora The project will involve destruction of vegetation cover on construction areas	Cutting of trees and disturbance of trees shall be avoided as far as possible and select the alternate site for the proposed project as the impact on local ecosystem	- Implementation of Tree Plantation Plan - Visual Observations	Construction Contractor in association with PHA or Forest	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	particularly along proposed project construction. It is initially examined that approximately 97 mature, sub-mature, of different tree/plants species may be disturbed (as per data from GIS) and physical verification by ground trothing. Moreover, exhaust of noxious gases from movement of heavy machinery and dust will pollute air which will adversely affect health and vigor of plants. During construction activities the Contractor's workers may damage the vegetation and trees (for use as fire-wood to fulfill the camps requirements). Overall, it can be stated that the large number of trees may be damaged in the proposed project activities.	(especially trees) is expected as high. So, that negative effects on the process of natural regeneration of species are minimized and if possible an alternate area may be considered for proposed project, in which minimum ecological and environmental losses are expected; • Trees should be replanted or transplanted wherever possible, instead of cutting; • Tree plantation plan should be implemented preferably in the project area or nearby blank spaces (along the roads, parks & green areas etc. where suitable) within 500m radius possibly; • A tree plantation program shall be formulated with the recommendations and technical support of concerned PHA and Forest Department; • NOC for tree cutting from the concerned authority is mandatory; • As a principal of 1:10, ten trees shall be planted in place of felling of one tree in consideration of mortality 1,000 new trees will be planted to compensate the losses; • The proponent shall implement the program with the help of PHA and Forest Department and in consultation with concerned consultant ecologist;		Department	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		- Open fires should be banned in the area to avoid hazards of fire in the area; - 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 green land; - However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation is carried out and minimum damage is 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; and - Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed.			
28.	Fauna During construction phase the existing population of birds, mammals and reptiles of the construction areas will be affected due to disturbance arising from	- Care shall be taken during construction activities for avoiding purposely or chance killing of animals; - If any wild species and habitat is found during construction, it must be dealt carefully and local wildlife	Visual Observations	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	construction activities involving excavation, movement of machinery and vehicular traffic, movement of labor, camping, etc. The existing fauna will leave the directly affected areas due to construction activities and human intervention. Some animals particularly reptiles may get killed during the earthwork operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase. Birds as well will 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 machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Uncontrolled blasting may even disturb the fauna of the Project Area. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers	department officials should be informed; - Hunting, poaching and harassing of animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor 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; - 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; - Wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and - Noise produced due to construction activities may be kept to acceptable level.			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
29.	Social/ Cultural Conflicts During the construction phase of the project, conflicts may arise between labor force and Local communities that exists near the Project Area. 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.	- 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.	- Visual observations - Regular monitoring, audit and checks	Construction Contractor	Proponent
O&M Phase					
30.	Waste Generation Municipal solid waste will be generated during operation phase of the proposed Project. Improper storage and dumping of waste may pollute soil and groundwater and may also choke sewerage pipes and storm water drains of Chahar Bagh phase-II. It may also affect the aesthetics and can cause health problems to the residents and especially workers who are handling waste. Therefore, this impact will be negative, local, medium, long term and definite.	- A comprehensive solid waste management system should be formulated for the operation phase; Waste storage containers with color coding should be placed at designated locations; - The management of Chaharbagh should employ sanitary workers or hire contractor for waste collection and allocate budget for it; - Waste segregation should be done at source and requisite planning needs to be done to implement the segregation techniques through residents and commercial building users; - The biodegradable waste may be processed, treated and disposed of	- Implementation of WMP - Regular monitoring, sampling and testing - Regular monitoring, audit and checks	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		through composting or bio-methanation within the premises of Chaharbagh as far as possible. The residual waste should be given to a certified third-party contractor for final disposal at the designated landfill site; • Construction waste including sand, concrete, clay, subsoil and rubble is to be stored by the society in their premises until it is handed over to the collector; • Fines may be imposed for strict implementation of waste disposal from households; and • Daily housekeeping of roads and parks to minimize the generation of waste.			
31.	Wastewater Generation: Wastewater will be generated in the form of sewage from washrooms and other sources of the residential and commercial buildings of Chahar Bagh. If disposed untreated, will not only create nuisance to the residents in nearby villages (in the shape of odor and health issues) but also to environment.	• Install a sewerage treatment plant (STP) to treat the waste water; • Treated waste water may be used for watering the green areas; • Timely maintenance of STP for its proper functionality; and • Monthly treated effluent quality monitoring shall be done from an EPA certified laboratory for compliance with PEQS.	• Regular monitoring, sampling and testing • Regular monitoring, audit and checks	Proponent	
32.	Emergency Preparedness and Response During the operation phase, emergencies like fire and disasters such	• An Emergency Response Plans for storm flooding, earthquakes, and manmade disasters must be developed by the RUDA, in close consultation with Fire Fighting	• Implementation of ERP • Plans for staff Training • Regular audit and	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	as earthquakes and flooding may occur.	Department (FFD), Rescue 1122 Services and Provincial Disaster Management Authority (PDMA); • Training of management staff and employees regarding the emergency procedures and plans should be regularly conducted; • Responsible person to implement the Emergency Response Plan should be clearly designated; • Emergency numbers should be clearly posted, so that a quick action is taken when an emergency arises; • Firefighting machinery and vehicles should be maintained regularly; and • Regular drills for fire emergencies should be carried out.	checks		
33.	Flora During the operational phase of the proposed project, no significant impacts are envisaged or release of any significant pressure detrimental to flora. The presence of adequate flora at available spaces in the project area 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 landscape plan provided in the master plan must be completely implemented; • The implementation of plantation plan recommend in compensation for cutting of trees should start during operational stage, to ensure the ecological balance and to avoid any impact on local Environment; • Large scale plantation of seedlings/ saplings of suitable indigenous tree species, shrubs and ornamental plants in the form of tree groves, should be carried out in accordance with the tree plantation plan to improve aesthetic value and offset the effect of removal of vegetation;	• 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
		• Proper check and balance of above-mentioned activities is highly recommended. Plantations raised must be maintained according to the Silvicultural practices which include proper irrigation, cleaning, pruning and thinning at prescribed intensity, silt clearance and trench-opening; and • Maintenance and security of the plantation should be done for at-least five years.			

KEY

DC

Design Consultant

CC

Construction Contractor

SC

Supervision Consultant

RUDA

Ravi Urban Development Authority

7.6 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 EMMP; 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 EMMP.

7.6.1 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.

7.6.2 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.	- Proposed Project Area; 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, educational and health institutions, religious places 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, educational and health institutions, religious places 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 , SO _x , NO _x , Lead and PM _{2.5} PM ₁₀ , Vehicular emissions and its compliance with PEQS 2016.	Sensitive receptors (concrete plants, construction camps and vehicular emissions) 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	Disturbance to natural	Natural habitats within the	• Visual checks to ensure	• Once before the start	• RUDA	

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility	Duration
	Resources	habitat and uncontrolled floral cutting which can be avoidable.	AOI of the proposed project.	that only marked trees are cut within the Project corridor; and • Monitoring of Wildlife / birds hunting.	of construction 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	

7.6.3 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.

7.6.4 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 (24 Months)						
Ambient Air Quality	CO, NO ₂ , SO ₂ , Lead, SPM, PM _{2.5} and PM ₁₀	1x2x8= 16	Quarterly @ Rs. 30,000 per sample	CC and SC	24 hours	480,000/-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x2x8= 16	Quarterly @ Rs. 2,000 per point	CC and SC	24 hours	32,000/-
Drinking Water Quality	Physical Parameters: Color, pH, Taste, Odour, Turbidity, Total Hardness as Calcium Carbonate and Total Dissolved Solids Biological Parameters: E. Coliform, Fecal Coliform and Total Coliform Chemical Parameters: Aluminum, Antimony, Arsenic, Barium, Cadmium, Chloride, Chromium, Copper, Cyanide, Fluoride, Lead, Manganese, Mercury, Nickel, Nitrate, Nitrite, Selenium, Residual Chlorine, Zinc and Phenolic Compounds	1x2x8= 16	Quarterly @ Rs. 20,000 per sample	CC and SC	-	320,000/-
Surface Water Quality	Physical Parameters: Temperature, pH, Color, Total Dissolved Solids, and Total Suspended Solids	1x1x8= 8	Quarterly @ Rs. 20,000 per sample	CC and SC	-	160,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Biological Parameters: Biochemical Oxygen Demand, Chemical Oxygen Demand, and Fecal Coli Chemical Parameters: Grease and Oil, Lead, Phenolic compounds, Cyanide, Chloride, Fluoride, Anionic Detergents, Sulphate, Sulphide, Ammonia, Calcium, Cadmium, Chromium, Copper, Mercury, Selenium, Nickel, Silver, Zinc, Arsenic, Barium, Iron, Manganese, Boron and Total chloride					
TOTAL (A) =						992,000/-
B) Operation Phase (12 Months)						
Ambient Air Quality	CO, NO ₂ , SO ₂ , Lead, SPM, PM _{2.5} and PM ₁₀	1x2x2 = 4	Biannually @ Rs. 30,000 per sample	RUDA	24 hours	120,000/-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x2x2 = 4	Biannually @ Rs. 2,000 per point	RUDA	24 hours	8,000/-
Drinking Water Quality	Physical Parameters: Color, pH, Taste, Odour, Turbidity, Total Hardness as Calcium Carbonate and Total Dissolved Solids	1x2x2 = 4	Biannually @ Rs. 20,000 per point	RUDA	-	80,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Biological Parameters: E. Coliform, Fecal Coliform and Total Coliform Chemical Parameters: Aluminum, Antimony, Arsenic, Barium, Cadmium, Chloride, Chromium, Copper, Cyanide, Fluoride, Lead, Manganese, Mercury, Nickel, Nitrate, Nitrite, Selenium, Residual Chlorine, Zinc and Phenolic Compounds					
Surface Water Quality	Physical Parameters: Temperature, pH, Color, Total Dissolved Solids, and Total Suspended Solids Biological Parameters: Biochemical Oxygen Demand, Chemical Oxygen Demand, and Fecal Coli Chemical Parameters: Grease and Oil, Lead, Phenolic compounds, Cyanide, Chloride, Fluoride, Anionic Detergents, Sulphate, Sulphide, Ammonia, Calcium, Cadmium, Chromium, Copper, Mercury, Selenium, Nickel, Silver, Zinc, Arsenic, Barium, Iron, Manganese, Boron	1x2x2 = 4	Biannually @ Rs. 20,000 per point	RUDA	-	80,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	and Total chloride					
TOTAL (B) =						288,000/-
GRAND TOTAL (A+B) =						1,280,000/-

KEY

CC Construction Contractor
RUDA Communication & Works Department

SC Supervision Consultant

Notes:

- Provision must be given in annual budget of operation phase for environmental monitoring. For this, the cost of operation phase (i.e. Rs. 288,000/-) must be considered with an annual increment of 10%.
- All the environmental parameters will be analyzed as per Punjab Environmental Quality Standards (PEQS), 2016.

7.7 TREE PLANTATION

To minimize the negative impacts arising due to tree cutting (97 No.), plantation at available spaces may be carried out especially along the boundary and parks of proposed project.

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

Trees recommended for planting are 1,000. The tentative cost for the plantation is about Rs. four Million. Detailed Tree Plantation Plan is attached as Annex-XI.

7.8 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 EMP 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)	Environmental staff of contractor and SC, RUDA Staff and Contractor Workers	3 Days
TA Individuals, Consultants and Organizations specializing in Social	Short Seminars and Courses on: • Occupational Health and Safety Plan (OHS);	Environmental staff of contractor and	3 Days

Provided by	Contents	Trainees	Duration
Management and Monitoring, and Occupational Health and Safety	• 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.	SC, 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

7.9 COMMUNICATION & DOCUMENTATION

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

7.9.1 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.

7.9.2 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.

7.9.3 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

7.9.4 Social Complaint Register

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

7.9.5 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.

7.9.6 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.

7.9.7 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.

7.10 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;
- Drinking Water Supply and Sanitation Plan
- Traffic Management Plan;
- Change Management Plan
- Quarry Management Plan; and
- Resource Conservation Plan.

7.11 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.

7.12 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 200 employees <i>Pre-Construction Phase:</i> $200 \times 5,000 \times 1 = 1,000,000$ <i>Construction Phase:</i> $200 \times 5,000 \times 4 = 4,000,000$	5,000,000 /-	Medical screening of the workers before deployment on site and twice a year during whole construction period.
2.	Material Storage, handling and use	Includes cost of Four Number of tarpaulins (Rs. 20,000 each) and storage at separate area and installment of barrication. $4 \times 20,000 = 80,000$ Lum sum 300,000	380,000/-	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	720,000/-	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	1,200,000/-	Rs. 50,000 per month for 24 months to collect construction waste from all the active sites on daily basis.
5.	Health and Safety of Workers	For 200 employees for the provision of dust masks, safety shoes, gloves, first aid box, ear plugs, safety helmets and safety jackets (Hi Vis) and provision of dust bins, warning tap, safety cones and safety sign boards.	3,161,500/-	For detail, please refer to Annex–XII.
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 <i>Construction Phase:</i> $1 \times 24 \times 150,000 = 3,600,000$	5,400,000/-	Cost for hiring HSE Experts along with their monthly logistics during construction and operational phase.

Sr. No.	Activity	Description	Cost (Rs.)	Rationale
		<i>Operational Phase:</i> $1 \times 12 \times 150,000 = 1,800,000$		
7.	Environmental Testing Cost	Ambient air, drinking water, surface water and noise	1,280,000/-	Refer to Table 7.3 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. 100,000/- per session during construction phase). $3 \times 100,000 = 300,000$	300,000/-	Refer to Table 7.4 for details.
9.	Environmental Audit	Environmental Auditing through third party twice a year during construction and operational phase $4 \times 400,000 = 1,600,000$ <i>Operational Phase:</i> $2 \times 400,000 = 800,000$	2,400,000/-	Cost for at least two auditors along with logistics, travels and accommodation charges.
10.	Tree Plantation	Plantation of different trees may be cut down during construction phase. Therefore, Compensatory planting of ten trees against each fallen tree of similar floral function should be planned which is 200 to enhance the landscape of the project area. Plantation at available spaces may be carried out especially at the median.	4,000,000/-	For detail, please refer to Annex–XI.
Total =			23,841,500/-	

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 23.8 Million**.

8 CONCLUSION AND RECOMMENDATIONS

8.1 GENERAL

The IEE report has been prepared in accordance with the requirements of the Punjab Environmental Protection Act, 2012 and 2017 (Amended); Pak-EPA Regulations, 2022 for review of IEE and EIA and Pakistan EIA procedures.

8.2 CONCLUSION

The main objectives of the Ravi Chaharbagh Phase-II Project is to provide residential units, amenities, and infrastructure to a diverse range of residents, including all income level groups and enhance the standard of living for residents.

Significant efforts were made to identify the main physical, ecological, social, cultural and environmental issues related to the construction and operation of the proposed Project. 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:

- 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;
- Occupational and community health and safety issues; and
- Solid waste handling and disposal and waste water generation and treatment during operation phase.

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 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 an urban infrastructure will help us to enhance quality of life and serve the 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 master planning of the proposed Project should be done in accordance to 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 Personnel 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 project to compensate tree cutting and to eradicate air pollution. Moreover, tree plantation must also be implemented;
- 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;
- Provision of waste water treatment plant to treat the sewerage during the operation phase;
- A comprehensive solid waste management plan to cater the waste during operation phase; 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.