PUNJAB MASS TRANSIT AUTHORITY (PMA)
GOVERNMENT OF THE PUNJAB

YELLOW LINE MASS TRANSIT PROJECT, LAHORE

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY

MAY, 2025

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Yellow Line Mass Transit Project, Lahore

ENVIRONMENTAL IMPACT ASSESMENT STUDY

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LIST OF ABBREVIATONS

AOI	Area of Influence
BCP	Buildig Code of Pakistan
BRBD	Bambawali Ravi Bedian Depalpur
BOD	Biological Oxygen Demand
CC	Construction Contractor
CCMP	Construction Camp Management Plan
COVID-19	Coronavirus disease
CoI	Corridor of Impact
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
DC	Design Consultant
ECO	Economic Cooperation Organization
EIA	Environmental Impact Assessments
EMP	Environmental Management Plan
EMMM	Environmental Mitigation and Management Matrix
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
ESEs	Environmental and Social Experts
FGDs	Focused Group Discussions
FFD	Fire Fighting Department
GoP	Government of Pakistan
GoPb	Government of Punjab
HSE	Health Safety & Environment
IEE	Initial Environmental Examination
ILO	International Labour Organization
KPH	Kilometres Per Hour
LAA	Land Acquisition Act
LOS	Level of Service
LWMC	Lahore Waste Management Company
MSDS	Material Safety Data Sheets
NESPAK	National Engineering Services Pakistan
NO	Nitrogen Oxide
NESPAK	National Engineering Services Pakistan
NL	Noise Level
NOC	No Objection Certificate
NPO	No Project Option
NPZ	Noise Perimeter Zones
NGO's	Non-Governmental Organizations
NCS	Pakistan National Conservation Strategy
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
O3	Ozone
PMA	Punjab Mass Transit Authority
PMD	Pakistan meteorological department
PGA	Peak Ground Acceleration
PHA	Parks & Horticulture Authority
PPE	Personnel Protective Equipment

PAPs	Project Affected Persons
PEPA	Punjab Environmental Protection Agency
PEQs	Punjab Environmental Quality Standards
PM	Particulate Matter
PRSP	Punjab Rural Support Program
QMP	Quarry Management Plan
RE	Resident Engineer
SBC	Seismic Building Code of Pakistan
SC	Supervision Consultant
STP	sewerage treatment plant
STDs	Sexually-Transmitted Disease
SSEMP	Site Specific EMP
SOP	Standard Operating Procedures
SO2	Sulfur Dioxide
SPM	Suspended Particulate Matter
SC	Supervisory Consultant
TA	Technical Assistance
VICS	Vehicle Inspection & Certification System
WASA	Water and Sanitation Agency

EXECUTIVE SUMMARY

ES-1 INTRODUCTION

Lahore, the provincial capital of Punjab is the second largest city in Pakistan with a population of about 13 million (2023). The city's population has been growing at a growth rate of about 3% per annum. The city's rapidly growing population coupled with increasing vehicle ownership has resulted insatiable travel demand. Development of public transport network has not kept pace with this increase, and has caused transport related problems like traffic congestion, accidents, poor environment etc.

The city's current public transport network is fragmented and unable to meet the growing mobility needs of its expanding population. As a result, there is increasing reliance on private vehicles, motorcycles, and informal para-transit modes, contributing to environmental degradation, longer travel times, and higher transport costs. To resolve these issues, Punjab Mass Transit Authority (PMA) intends to undertake a feasibility study for Yellow Line project. This document presents the findings of Environmental Assessment of the proposed Project.

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 'D' 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

The Yellow Line (Canal Line) runs east-west along the canal bank road in Lahore. This line is conceptualized on the basis that the Canal bank road is a major transport corridor for the city and has a relatively straight and clear path while intersecting at several major arterials including Mall Road, Jail Road, Ferozepur Road, Maulana Shokat Ali Road, and Thokar Niaz Baig. The Yellow Line will span 26 kilometers, with 16 stations and is expected to serve approximately 130,000 passengers daily. Tentative cost of the proposed Project is about PKR. 97 Billion.

ES-4 DESCRIPTION OF THE ENVIRONMENT

<u>Physical Environment</u>

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 in the Zone-2A with Peak Ground Acceleration (PGA) from 0.08g to 0.16 g of the seismic zonation. Major sensitive receptors in the project area are health facilities, educational institutions, and religious places (mosques, shrines and graveyard) which has been 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 (Mulbery) *(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 (*Corvussplendens*) and Mynah (*Acredotherestristis*) 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. 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.

ES-5 STAKEHOLDER CONSULTATION

A series of public consultations were conducted to get the feedback/ concerns of the different category of stakeholders including provincial departments i.e. Environment Department, Wildlife Department, Parks and Horticulture Authority (PHA), etc., local community and other general public residing near the Study Area. Consultation process included focus group discussion, semi-structured interviews, one to one meeting and interviews with the government, private and civil society institutions. Basic concerns of the stakeholders were related to 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 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 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/day[1] for 200 construction workers; and sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit.
- A total of about 120 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 corridor. It is initially examined that approximately 600 trees / saplings may be affected. A tree plantation program will be formulated with the recommendations of compensatory planting 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 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. PMA 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. PKR 56.097 Million exclusive of Plantation Cost, which includes cost of environmental monitoring, tree plantation

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

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

Lahore is the second largest urban center in Pakistan. It is the provincial capital of the Punjab Province with a population of 13 million inhabitants in 2023. The transport demand amounts to 15 Million Trips for a typical weekday. Over the past fifteen years the rapid growth in population and vehicle ownership in Lahore has steadily worsened traffic congestion. Several transport studies were conducted to overcome this situation.

To resolve public transport issues in Lahore and to provide safe, efficient, comfortable, and affordable transport to the public, Government of the Punjab (GoP) has successfully completed Green Line, Orange Line and currently planning to introduce a Automated Rapid Transit (ART) system on the Yellow Line (From Harbanspura to Thokar Niaz Baig), Lahore.

The Yellow Line is a key component of Punjab's broader transportation vision aimed at modernizing public transit, reducing urban traffic congestion, and offering safe, affordable, and efficient travel options for daily commuters. Once operational, the Yellow Line will significantly ease the travel burden for residents commuting between eastern Lahore and major city hubs.

This document presents the findings of Environmental Impact Assessment (EIA) of Yellow Line Mass Transit Project.

1.2 NEED FOR ENVIRONEMTNAL 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 "**D**" (*Transport)* of Schedule-II, which requires an EIA before commencement of construction.

1.3 NATURE, SIZE AND LOCATION OF THE PROJECT

GoP has launched the Yellow Line Mass Transit Project, a major public transport initiative aimed at easing urban traffic and enhancing connectivity across the city. This new electric

transit corridor promises to dramatically ease traffic congestion on some of Lahore's busiest routes, offering residents a sustainable alternative to traditional road transport.

The Yellow Line (Canal Line) runs east-west along the canal bank road in Lahore. This line is conceptualized on the basis that the Canal bank road is a major transport corridor for the city and has a relatively straight and clear path while intersecting at several major arterials including Mall Road, Jail Road, Ferozepur Road, Maulana Shokat Ali Road, and Thokar Niaz Baig.

The Yellow Line will span 26 kilometers, is planned to connect Thokar Niaz Baig to Harbanspura. The project will feature an advanced Automated Rapid Transit (ART) system. The line will include 16 modern smart stations and is expected to serve approximately 130,000 passengers daily. **Figure 1-1** shows the location maps 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 intuitional arrangement and to develop cost estimate to implement those mitigation measures.

1.6 THE PROPONENT AND CONSULTANT

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Chairman/ Project Director
Punjab Mass Transit Authority (PMA)
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b) Consultant Contact/Address

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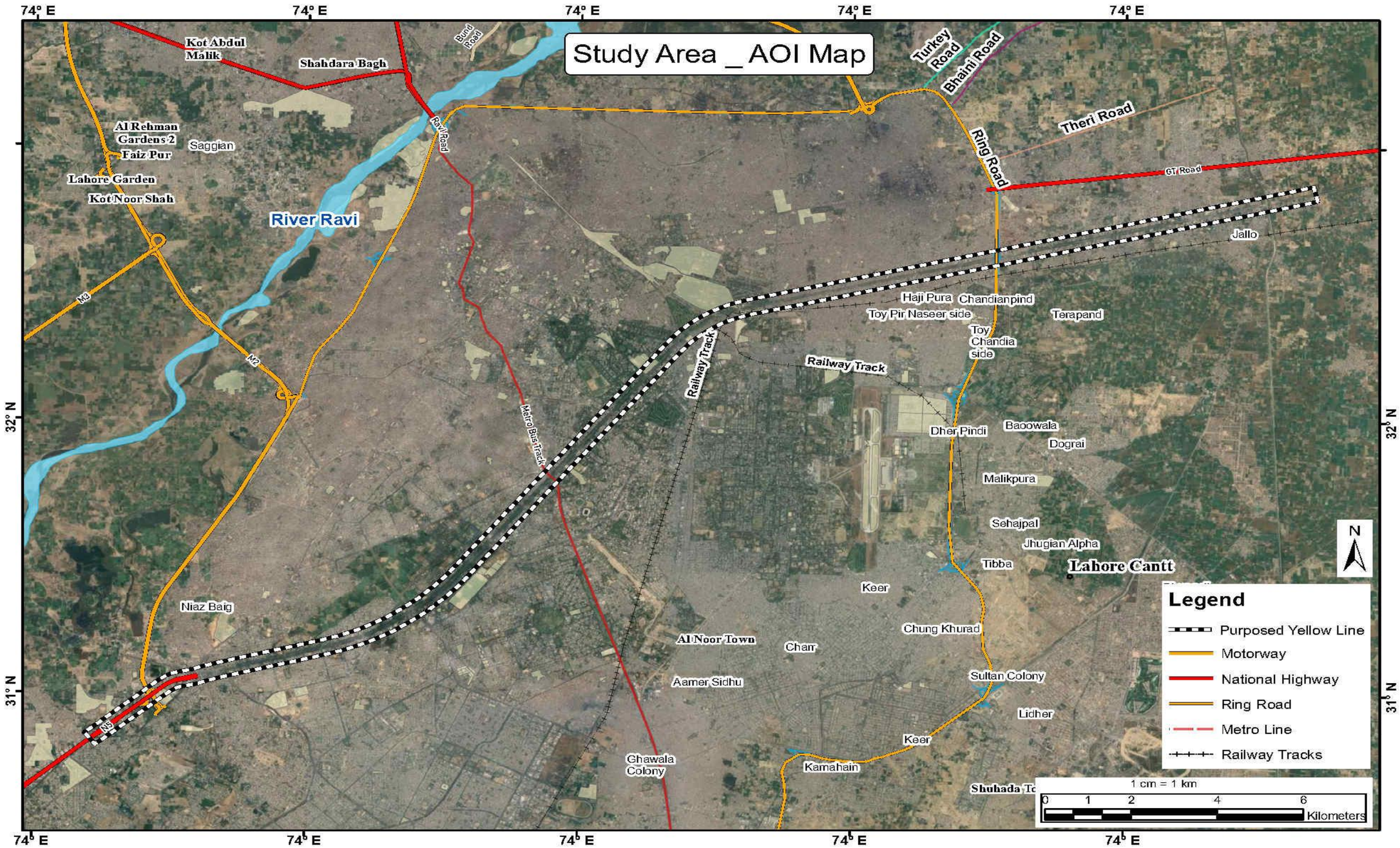


Figure 1.1: Location Map of the Proposed Project

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 Scientists, Sociologist and Ecologist. 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.	Mir Ghnzanfar Afzal	Principal Engineer/Head ERSD Section
2.	Ms. Shehnila 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 Corridor of Impact (COI)

COI includes the area in the surroundings of the proposed alignment receiving direct impact of project activities. The COI delineated for the proposed project is 25 m from the boundary of the project area.

1.8.5 Survey of COI

A team of Environmental Scientists, Ecologist and Sociologist will carry out the environmental and social survey during design stage 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 COI will be observed.

1.8.6 Environmental Baseline Survey of the Project

Prior to the start of field activities comprehensive checklists, proformas and maps will be 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 on the basis of previous studies.

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 meetings will be conducted during the design stage to get feedback on the expected environmental issues related to the Project impacts and suggested mitigation measures. Meetings will also be carried out with the Project affectees, relevant departments including Environment Protection Department Punjab, Parks & Horticulture Department-Punjab, Forest & Wildlife Department Punjab etc. to discuss the issues/constraints and to 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, 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.

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: a) Promoting ecological, social and cultural functions of forests through sustainable management and use of forest produce including wood and non-wood forest products; b) Implementing a national level mass afforestation programme to expand and maintain optimum forest cover; c) Maximizing forest areas by investing in available communal lands/ shamlat, and Guzara forests and urban forestry; d) Facilitating and harmonizing inter-provincial movement, trade and commerce of wood and non-wood forest products through the Federal Forestry Board; e) Inter-linking natural forests, protected areas, wetlands and wildlife habitats to reduce fragmentation; f) Enhancing role and contribution of forests in reducing carbon emissions and enhancing forest carbon pools; g) Facilitating implementation of international conventions and agreements related to Forestry, Wetlands, Biodiversity and Climate Change; and h) 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 elicit if any unforeseen natural and man-made disaster occurs during construction and operation phase.
10	National Action Plan for COVID-19 Pakistan	Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at https://www.nih.org.pk/wp-content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf. The Government of Pakistan has launched the real-time data portal for COVID-19 http://covid.gov.pk/. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf.	This Action Plan for COVID-19 is applicable to the proposed project as it is being launched during this pandemic.

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	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
		as: (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the interrelationships between any of the factors specified in sub-clauses 'a' to 'f'. The notable points of the law are: • No proponent of a project shall commence construction or operation unless he has filed an IEE/EIA with the Provincial Agency designated by the Provincial EPAs an EIA, and has obtained an approval; • Establishment and formation of the Punjab Environmental Protection Council(PEPC); • Prohibition of certain discharges or emissions; • Punjab Environmental Quality Standards (PEQS) for wastewater, air emissions and noise; and • Provincial Government can issue notices and enforce them to protect the environment. In the recent amendment of 2012, legislatives powers related to environment and ecology are given to provincial governments from the Federal government. The provinces are required to enact their own legislation for environmental protection. Other amendments include increasing the penalties for violations. For the proposed Project, Environmental Protection Department (EPD)/Environmental Protection Agency (EPA), Government of Punjab (GoPb) is the concerned authority. The capability of regulatory institutions for environmental management is ultimately responsible for the success of environmental assessments and that development projects are environmentally sound and sustainable.	applicable in term 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 regulation will be useful for PMA 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.	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.
7.	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.
8.	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	This Act will anticipate if proposed project involves permanent acquisition of land in the project area.

Sr. No.	Act	Brief Coverage	Relevance to Project
		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.	
9.	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.
10.	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 law are applicable.
11.	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.
12.	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.

Sr. No.	Act	Brief Coverage	Relevance to Project
13.	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.
14.	Pakistan Penal Code, 1860	The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents.	The provisions of the Penal Code, 1860 are applicable to the project in terms of penalties for effecting human lives and public property. It also addresses the control of noise, air emissions and effluent disposal.
15.	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;	The labour laws will be relevant as it would deal with employment of labour for the construction of propose project. Following are the major labour laws which are applicable to the project: • Bonded Labour System (Abolition) Act, 1992 • Employment of Child Act, 1991 • Minimum Wages Ordinance, 1961 • Industrial Relations Act, 2010 • West Pakistan Minimum Wages for Unskilled Workers' Ordinance, 1969

Sr. No.	Act	Brief Coverage	Relevance to Project
		• 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.	
16.	Punjab Municipal Water Act, 2014	The basic aim of the Act is to recognize, regulate and manage present and future municipal water supply and sanitation services and to establish rights of access to basic water supply and basic sanitation, and to ensure conservation of water resources in the Province. This Act is in draft stage.	This Act will elicit if there is misappropriation of water supply during construction activities.
17.	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.
18.	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.
19.	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	This act will be elicited during construction and operational phase due to use of motor vehicles that produces air pollutants and noise.

Sr. No.	Act	Brief Coverage	Relevance to Project
		standards established under clause (g) of subsection (1) of section 6 of the act.	
20.	ISO 18001 Occupation Health and Safety Assessment Series (OHSAS)	OHSAS 18001 is an Occupation Health and Safety Assessment Series for health and safety management systems to help organizations to control occupational health and safety risks. The OHSAS specifications are applicable to any institute that desires to establish an OH&S management system to eradicate or reduce risk to employees and other interested parties who may be exposed to the risks allied with the project activities. The construction of the proposed project may involve various health and safety issues to construction labour, therefore these ISO 18001 guidelines will be applicable and pertinent.	This series will be elicit during construction and operational phase to ensure health and safety of workers associated with the project activities.
21.	The Punjab Occupational Safety And Health Act, 2019	This Act entails provision of occupational safety and health of the workers at workplace and to protect them against risks arising out of the occupational hazards; to promote safe and healthy working environment catering to the physiological and psychological needs of the employees at workplace.	The Act will trigger during construction and operational phase to ensure health and safety of workers at workplace associated with the project activities.
22.	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.
23.	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.
24.	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	This act will be applicable if any damages occur during construction of the power facilities.

Sr. No.	Act	Brief Coverage	Relevance to Project
		and Maintenance (O&M) of Power distribution facilities.	
25.	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.
26.	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.
27.	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.
28.	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.
29.	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.
30.	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	This act is applicable to the proposed project to provide timely response, rescue and emergency medical treatment to the affected persons during

Sr. No.	Act	Brief Coverage	Relevance to Project
		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.	construction and operation phase of project.
31.	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.
32.	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 related components. Construction of buildings shall be considered as violation of professional engineering work specified under clause (XXV) of section 2 of the Act.	This Code is applicable to the proposed project as it includes the formation of structures.
33.	Punjab Masstransit Authority Act, 2015	It deals with the establishment of Punjab Masstransit Authority for purposes of construction, operation and maintenance of mass transit system in the major cities of the Punjab; for providing safe, efficient and comfortable urban transportation system. It describes powers, budget, functions of authority, development of Masstransit Authority Fund and penalties for contravention.	This act is applicable to the proposed project. The proposed project will require the construction of new transit system.

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 11th December, 1997 at the 3rd Conference of the countries to the treaty when they met in Kyoto, and entered into force on 16th February, 2005. As of November 2007, 175 countries have ratified the protocol. One hundred and thirty-seven (137) developing countries have ratified the protocol, including Brazil, China, India and Pakistan but have no obligation beyond monitoring and reporting emissions.
3.	Convention on Biological Diversity, 1994 Web Link: https://www.cbd.int/	Pakistan signed this treaty in 1992 and it was ratified by cabinet in 1994.	The Convention on the Biological Diversity (CBD) has three main goals: Conservation of biological diversity (or biodiversity); sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources.
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	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.

Sr. No	Agreement/Convention	Ratification	Description/Relevance
		6, 2001	
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 25th September 2015, UN Member States adopted the 2030 Agenda for Sustainable Development, which includes a set of 17 Sustainable Development Goals (SDGs) to end poverty, fight inequality and injustice, and tackle climate change by 2030. Pakistan has displayed commendable commitment to the 2030 Agenda for Sustainable Development as it was one of the first countries to endorse it globally in 2015. On 16th February 2016, the Parliament unanimously approved the Sustainable Development	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 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.

Sr. No	Agreement/Convention	Ratification	Description/Relevance
		Goals (SDGs) as the national development agenda.	

2.4 ADMINISTRATIVE FRAMEWORK

2.4.1 Punjab Mass Transit Authority (PMA)

The implementing agency of the proposed Project is Punjab Mass Transit Authority (PMA). The management of PMA 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 OBJECTIVES OF THE PROJECT

The overall objective of the proposed project is to provide a safe, efficient, comfortable and reliable transport facility to the commuters of the project area. The proposed project will greatly benefit the commuters by providing better quality and environmentally friendly public transport, reducing the number of vehicles on the road, reducing fuel consumption and consequently air emissions from vehicular exhaust especially in case of traffic congestion.

The following objectives have been considered in the implementation of the project:

- Transfer large number of passengers quickly over short distance with little land use;
- Provide the public with environmentally friendly and quality public transport;
- Provide transport safety, transport productivity, travel reliability, travel choices, and social equity;
- Reduce accidents caused by traffic congestions;
- To help save travelling time;
- Reduce the fuel consumption by reducing the demand of private vehicles;
- To create job opportunities for laborers and semi-skilled staff.

3.3 PROJECT ADMINISTRATIVE JURISDICTION

The proposed Project lies in District Lahore, Punjab.

3.4 PROJECT IMPLEMENTATION SCHEDULE

The tentative implementation period for proposed Project is one (01) year.

3.5 COST OF THE PROJECT

Tentative cost of the proposed Project is about PKR 97.99 Billion.

3.6 PROPOSED MASS TRANSIT PLAN

In line with the Government of Punjab's continued commitment and in line with the Chief Minister Punjab's Vision to expand sustainable and integrated mass transit in Lahore, the Punjab Mass Transit Authority (PMA) intends to undertake a feasibility study for three new high-capacity corridors:

- **Yellow Line**
- **Blue Line**
- **Purple Line**

The Yellow Line Mass Transit route will connect Jinnah Terminal to Harbanspura. The Yellow Line will operate using state of the art electric train sets, which will be imported from China.

The initiative aims to offer affordable and eco-friendly transport to the city's growing population. The proposed Yellow Line will span a 26 kilometer stretch from Thokar Niaz Baig to Harbanspura. Once operational, the project is expected to benefit nearly 130,000 passengers daily, easing congestion on major city routes and providing an efficient public transportation alternative.

The Yellow Line, proposed as an Articulated Bus Rapid Transit (ART) corridor, presents a cost-effective and quickly implementable solution to address public transport needs in high-demand areas. The Yellow Line project reflects a crucial shift toward sustainable urban mobility in Pakistan, combining efficiency with environmental responsibility.

The proposed Mass Transit Plan is provided as **Figure 3.1**.

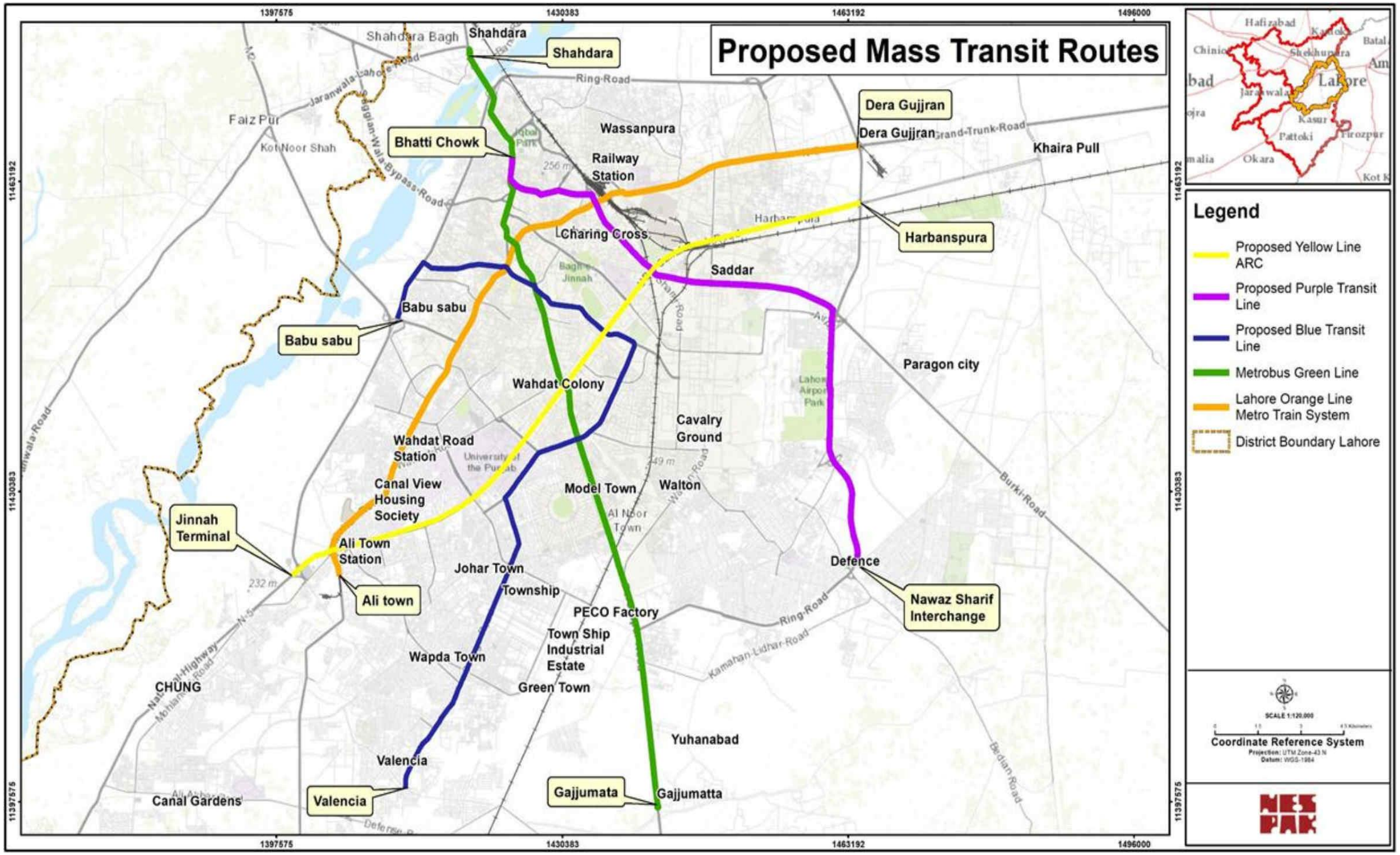


Figure 3.1: Proposed Mass Transit Plan

3.6.1 Salient Features of the Project

- Length : 26km
- Stations : 16 No.
- Ridership : 133,116
- Designated Mode : ART/SRT
- Headway : 2min
- Typical Speed : 70 Km/hr
- Vehicle Type : SRT/Buses
- No. of SRT : 20

Other Components

- Remodelling of Canal Road from Thokar to Jinah Terminal
- Bus Depot at Jinnah Terminal
- Bus Yard at Harbanspura
- Pedestrian Underpass
- Underpass for ART
- Road Widening for ART Track

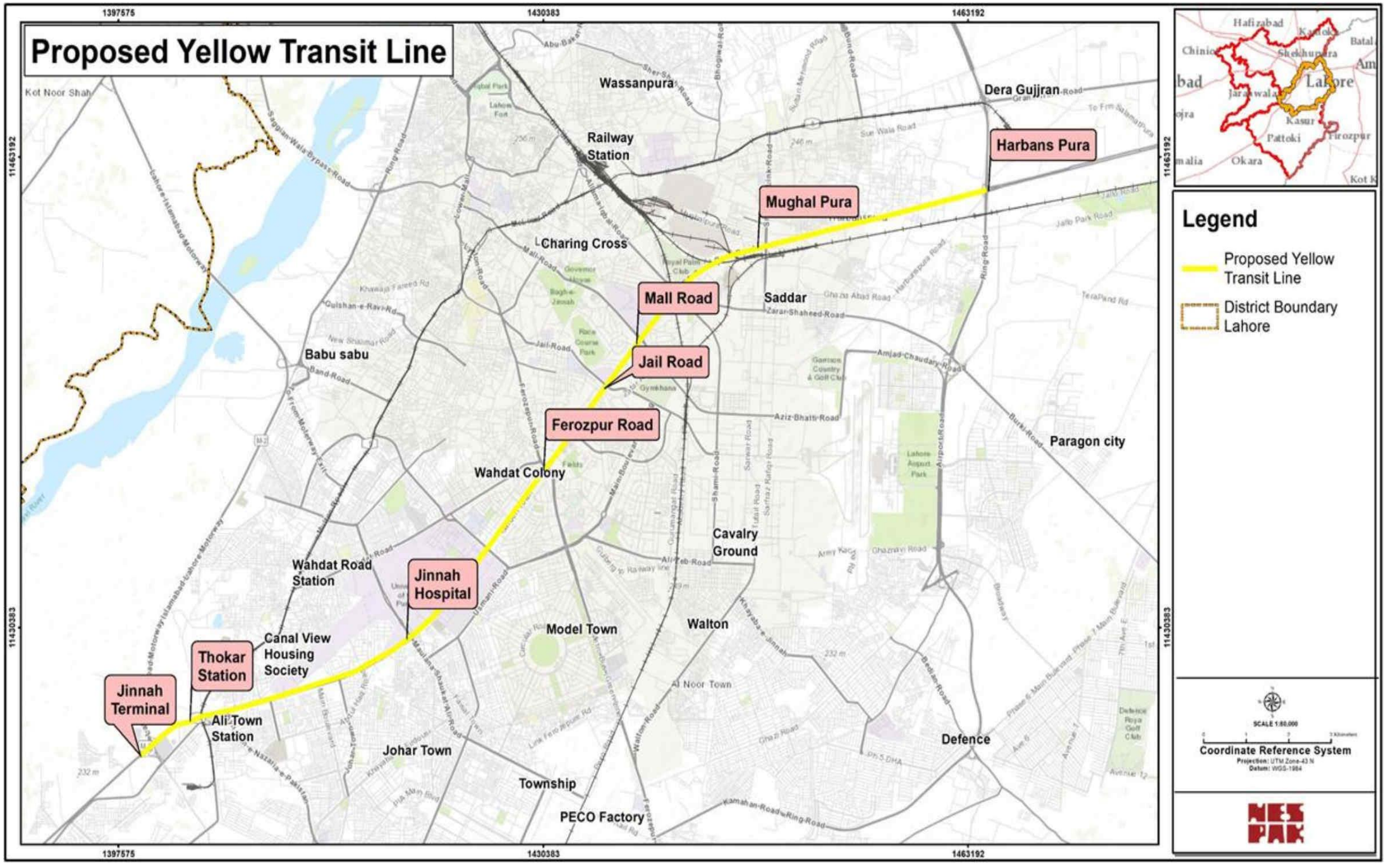
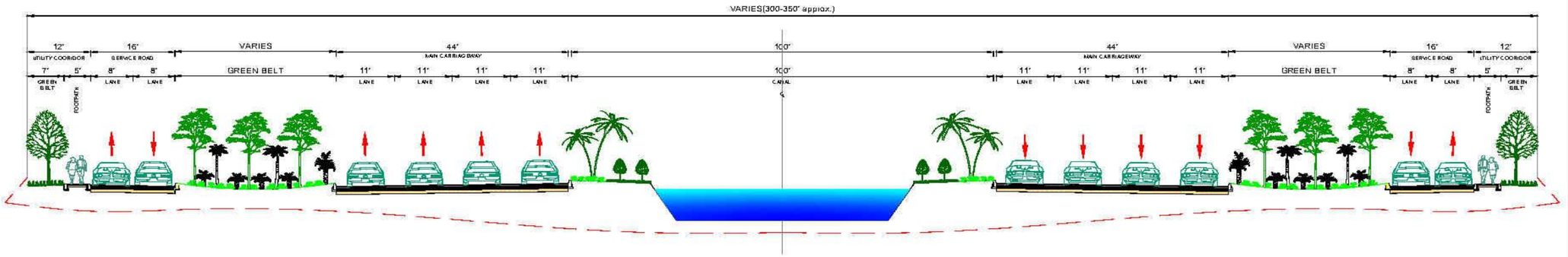
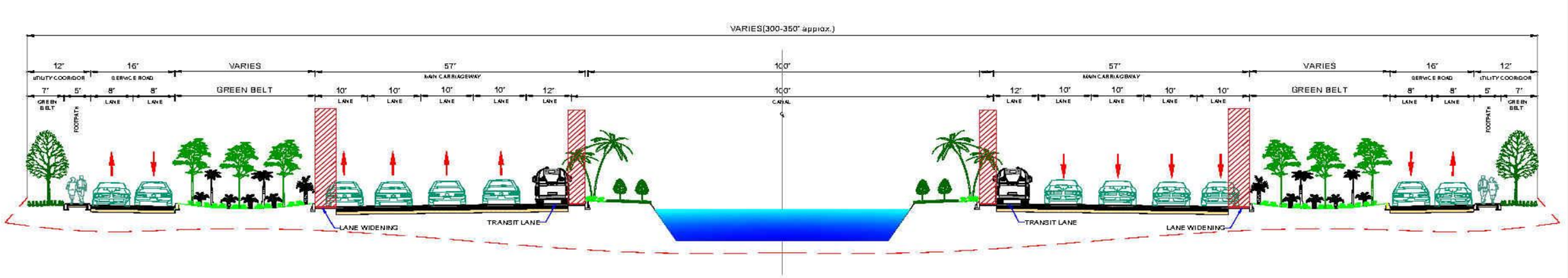


Figure 3.2: Alignment of the Proposed Yellow Line Transit System

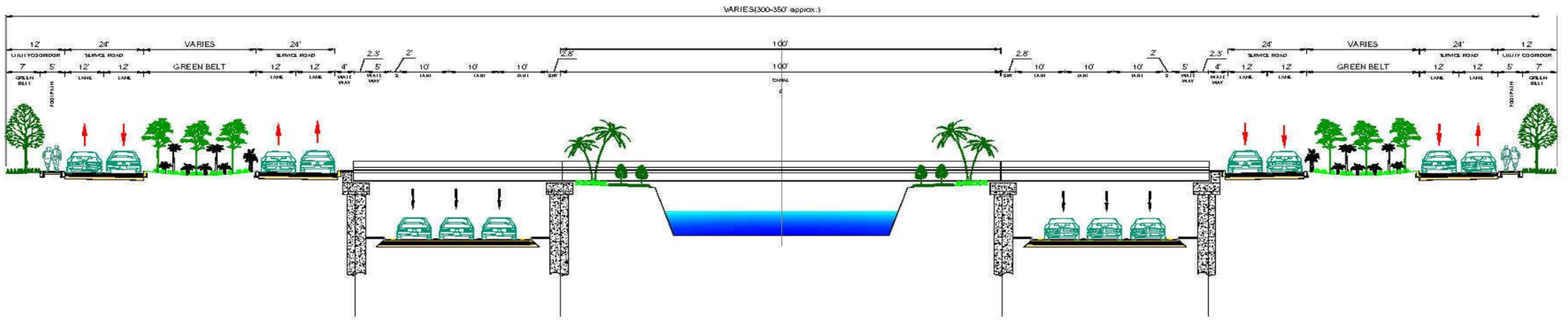


CANAL ROAD EXISTING CROSS SECTION

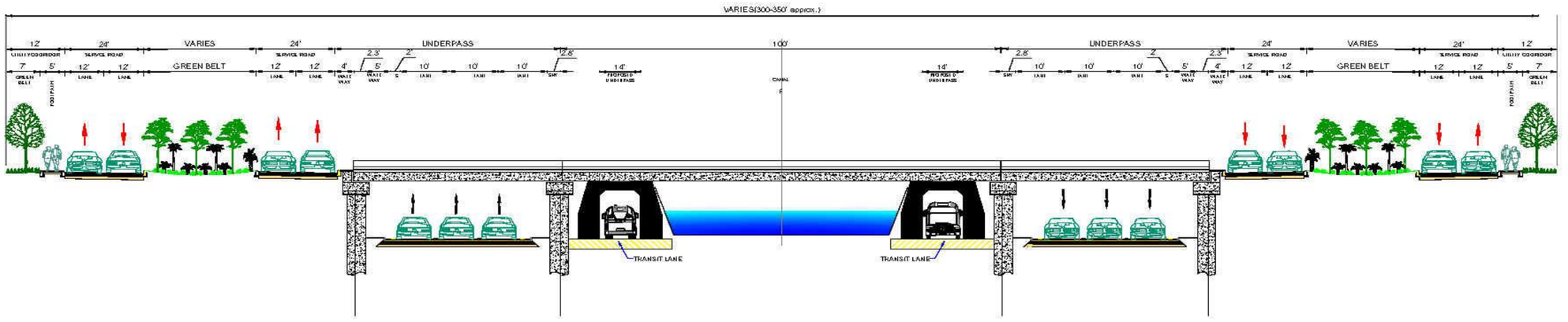


CANAL ROAD EXISTING CROSS SECTION
OPTION-I

Figure 3.3 (a): Typical Cross Section of Proposed Project



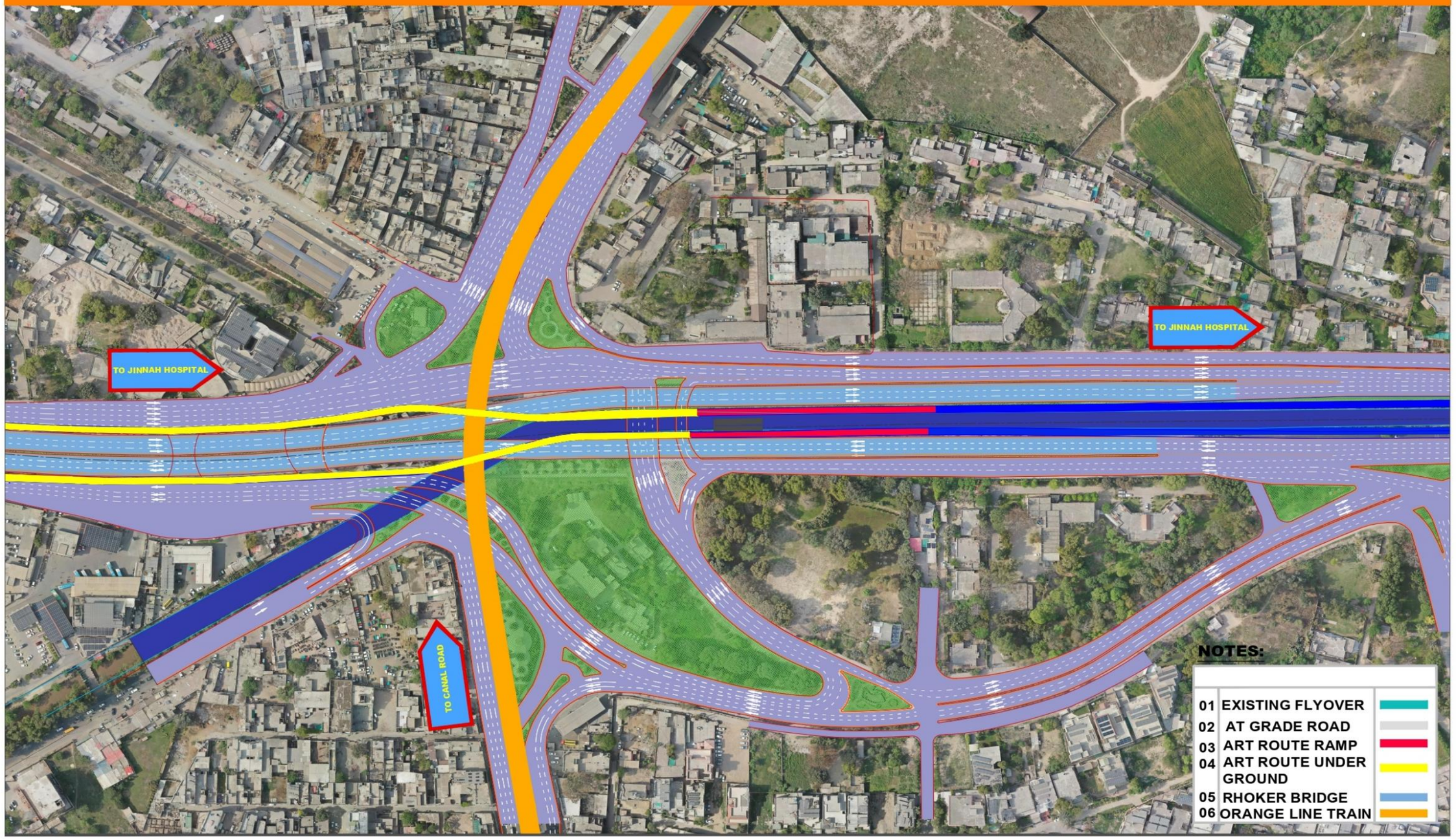
CANAL ROAD EXISTING CROSS SECTION
UNDERPASS

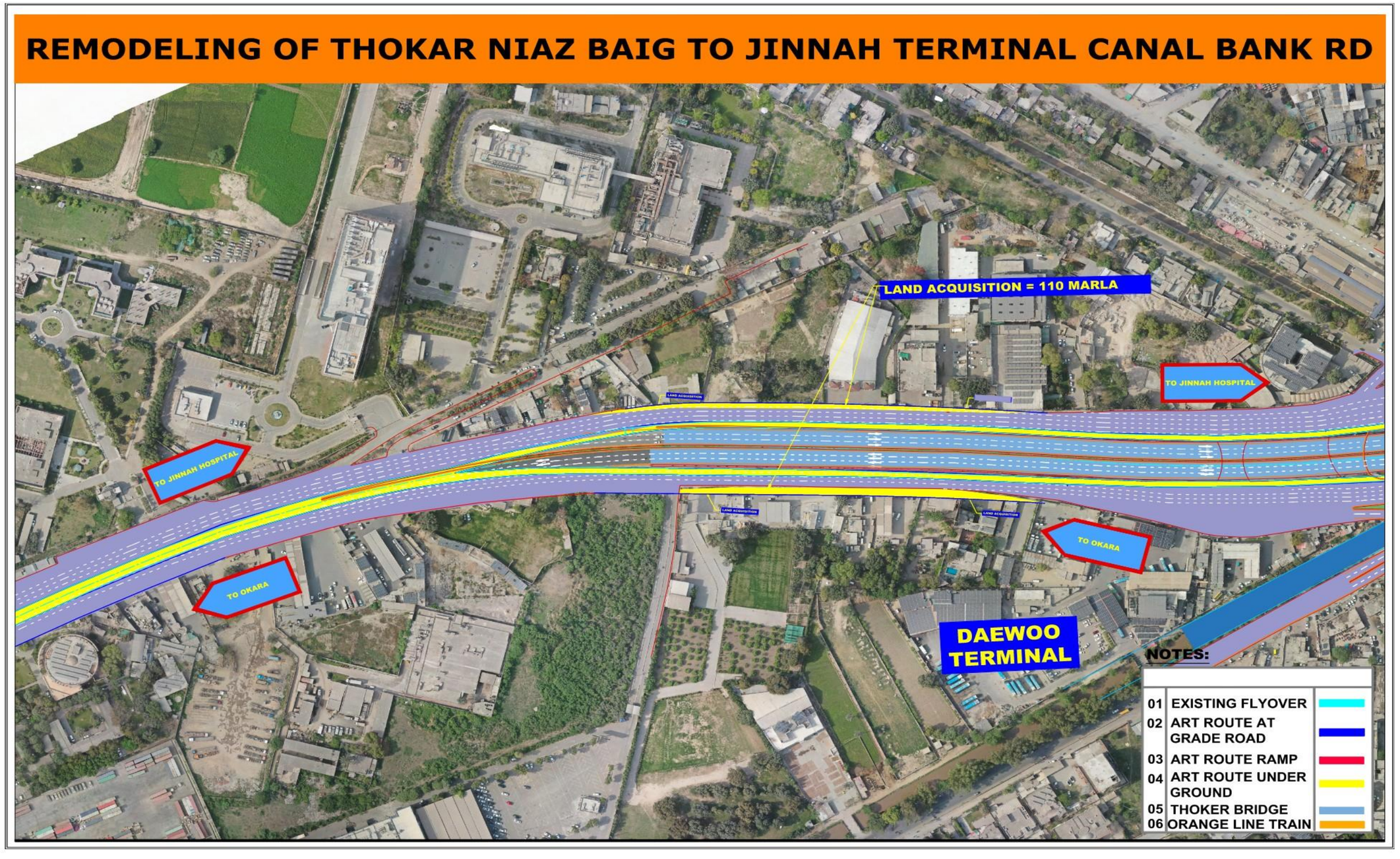


CANAL ROAD PROPOSED CROSS SECTION
UNDERPASS

Figure 3.3 (b): Typical Cross Section of Proposed Project

REMODELING OF THOKAR NIAZ BAIG TO JINNAH TERMINAL CANAL BANK RD




REMODELING OF THOKAR NIAZ BAIG TO JINNAH TERMINAL CANAL BANK RD
LAND ACQUISITION = 110 MARLA
TO JINNAH HOSPITAL
TO JINNAH HOSPITAL
TO OKARA
TO OKARA
DAEWOO TERMINAL
NOTES:
01 EXISTING FLYOVER
02 ART ROUTE AT GRADE ROAD
03 ART ROUTE RAMP
04 ART ROUTE UNDER GROUND
05 THOKER BRIDGE
06 ORANGE LINE TRAIN

3.7 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.

a) Crushed Aggregate of required specifications will be utilized by the contractor from available sources nearby the project area.

b) Good quality natural fine aggregate or sand of acceptable gradation will be obtained from nearby licensed or approved entities dealing with fine aggregates.

c) Asphalt, reinforcement and cement material will be transported from the nearby factories or approved dealers for construction purposes.

3.8 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 3.1: 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		

3.9 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.

3.10 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.

3.11 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.

3.12 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.

3.13 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 Project[2]. Temporary toilets with cesspit will be adequately installed and treated periodically, and after the completion of work, the ground will be restored.

3.14 SOLID WASTE

The solid waste generation is estimated to be 120 kg/day for 200 construction workers during construction phase of the proposed Project[3].

[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: Estimated solid waste generation rate in the study area is about 0.6 kg/person/day (https://www.lwmc.com.pk/uc-plan.php).

3.15 POWER REQUIREMENT / POWER SOURCE

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).

3.16 PROPOSED ALTERNATIVES

To meet the primary objectives of the project, three different alternatives were studied at the early stages of the project. The detail of these alternatives is given below:

Alternative-I: No Project Option
Alternative-II: Yellow Transit Line, Canal Road

a. Alternative – I - No Project Option

Presently, proposed alignment is being used as main access road to travel from all around Lahore and adjoining areas. The accelerated growth of population has led to increase in vehicular traffic on Canal Road. This is the main access road, which provide links to other major roads. Due to excessive use of these roads, the traffic congestion and traffic load is becoming a major issue. Without the project, the existing traffic problem at canal road and the level of service will further aggravate with the passage of time. Thus, it is important to upgrade the existing public transport facilities to cater the increased vehicular movement and traffic congestion.

b. Alternative – II - Yellow Transit Line, Canal Road

Alternative II considers solving the problems of lack of quality public transport system, traffic congestion and associated time delays, conflicts/accidents and reduction in air and noise pollution. Reduced fuel consumption and consequent emissions are also the benefits of this option.

In the light of above discussion, Alternative-II is the most feasible option as it will help resolving traffic congestion resulting in reduction in associated time delays, reduction in fuel consumption, reduction in conflicts/accidents, air pollution and noise. Smooth flow of traffic will also help in lesser wear and tear of vehicles.

4 ENVIRONMENTAL BASELINE

4.1 GENERAL

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

The existing environmental conditions of the proposed project have been considered within the AOI as shown in **Figure 1.2** with respect to physical, biological and socio-economic aspects. The Study Area is selected on the basis of the Project's potential environmental and social impacts on the local resources. Information has been collected from variety of sources, including published literature, DCRs, field observations, etc. 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.

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.

4.2.2 Geology

Lahore city lies on the alluvial plain called Bari Doab. Doab is a local word for area between two rivers. Bari Doab is a part of the Indo-Gangatic alluvial plain formed by the Indus River and its tributaries. It is bounded by Ravi and Chenab rivers in the northwest and west, and Sutlej River in the Southeast. A northeastern boundary of Doab lies near the foothills of the Himalayan Ranges. The Bari Doab is covered by quaternary alluvium which overlies semi-

consolidated tertiary rocks or metamorphic and igneous rocks of Precambrian age. Except for a small area in the northeastern art of Doab where basement rock was encountered no information is available at present regarding the distribution of tertiary and Precambrian rocks in the Doab.[4]

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

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.

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 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.

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

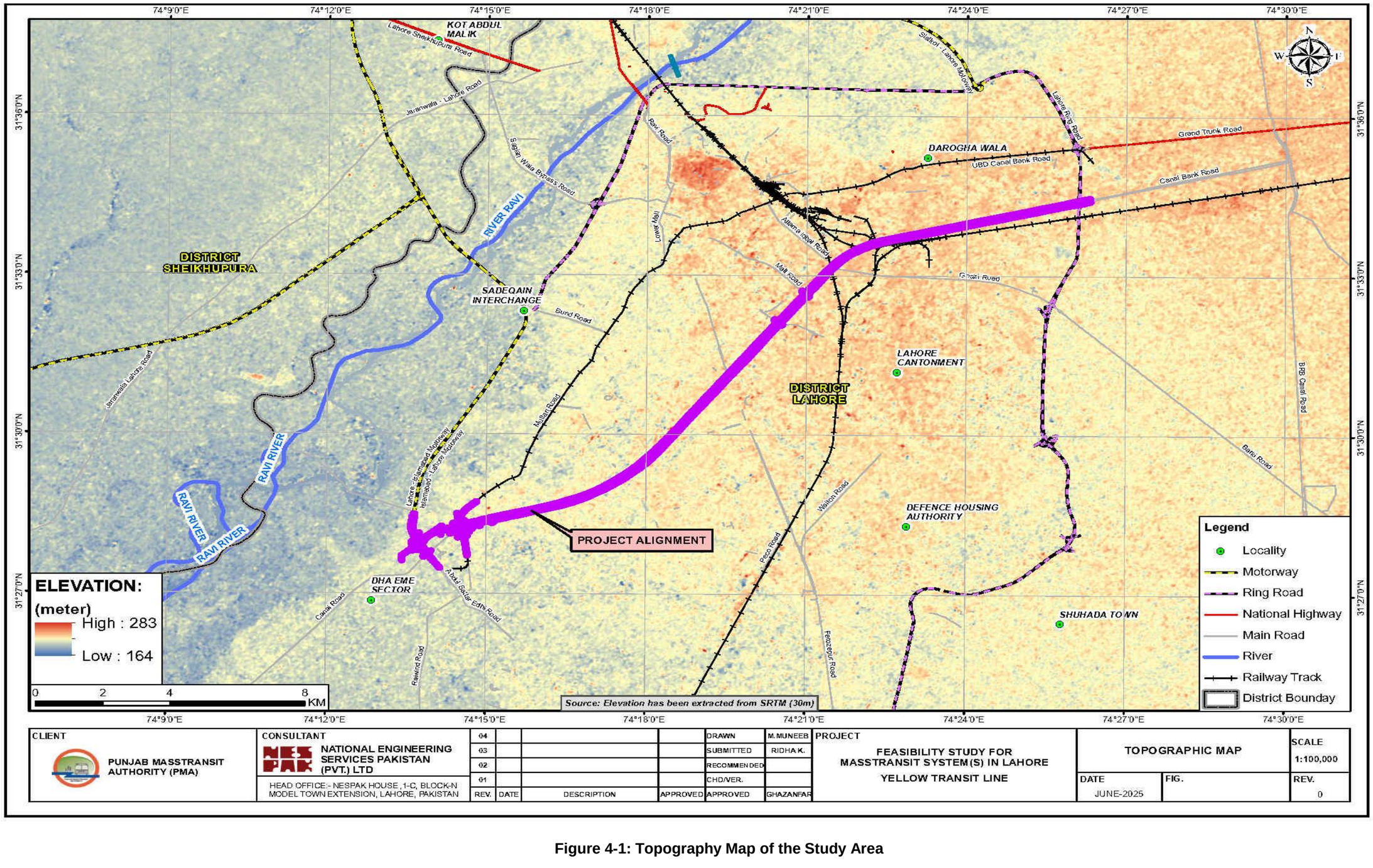


Figure 4-1: Topography Map of the Study Area

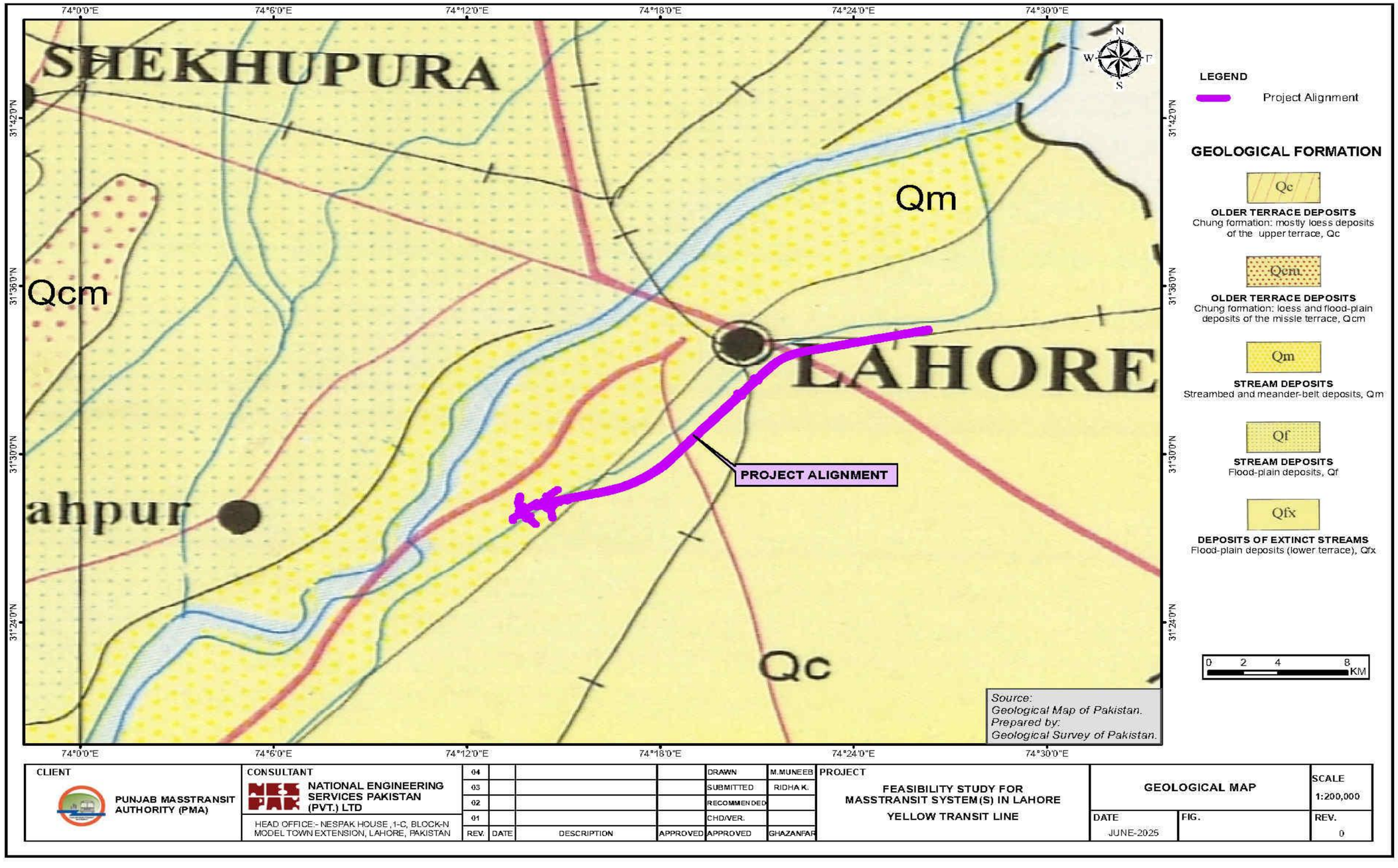


Figure 4-2: Geological Map of the Study Area

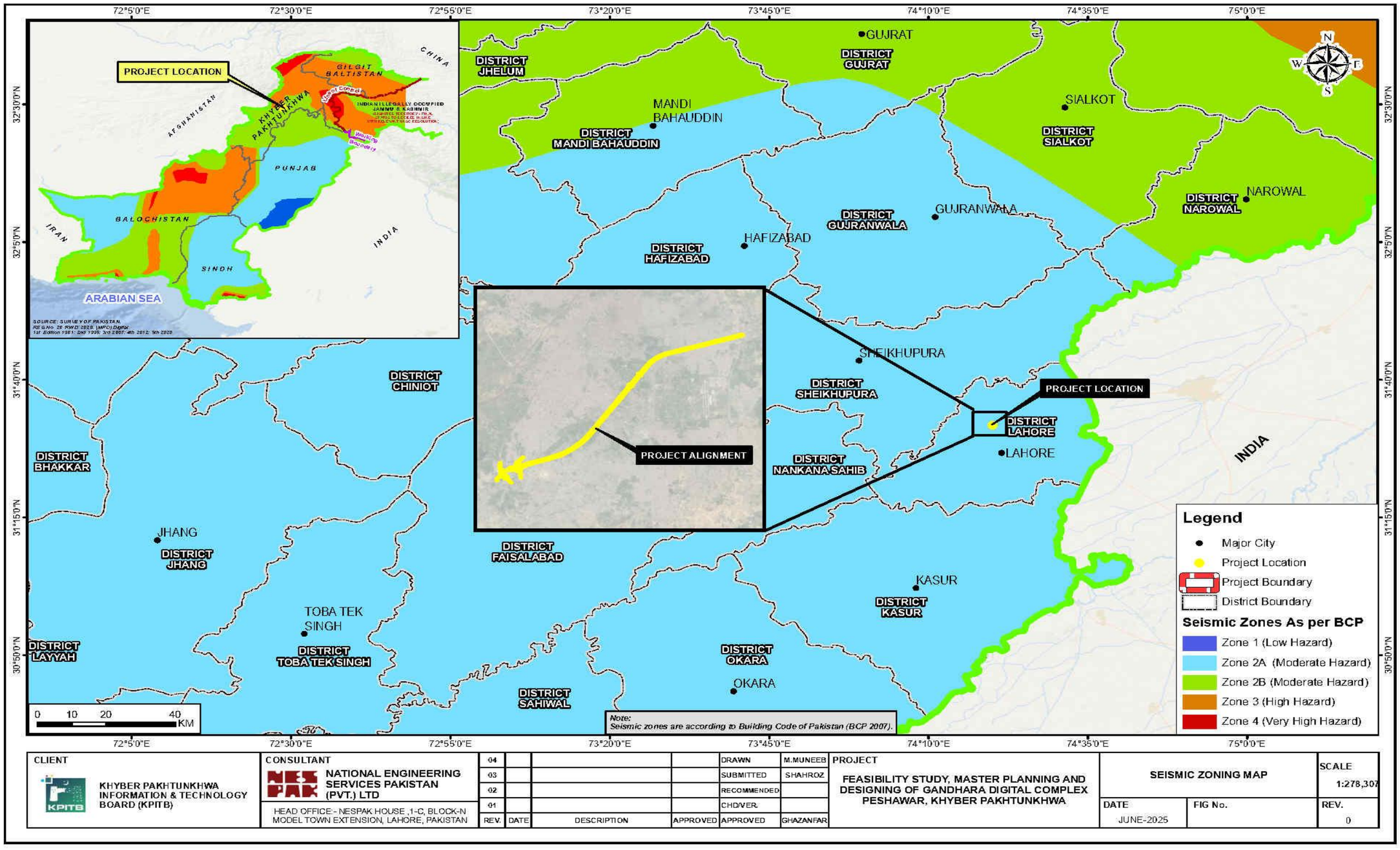


Figure 4-3: Seismology Map of the Study Area

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 27^0C to 47^0C. The winter seasons lasts from November to March, with mean minimum and mean maximum temperature ranges from 2^0C to 18 ^{0}C.[5] The project area receives rains in all the seasons but monsoon rain is pronounced and constitutes a definite rainy season between the month of July and September. The average rainfall is about 1,172 mm per year.

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 2023[6]

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
2023	20	28	34	35	38	40	36	38	38	34	28	24

[5]Meteorological Data for Lahore (1981-2010), Pakistan Meteorological Department.
[6] Meteorological Data for Lahore (2011-2022)

Table 4.2: Mean Minimal Temperatures (ºC) 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
2023	7	12	16	20	24	28	28	28	26	22	18	12

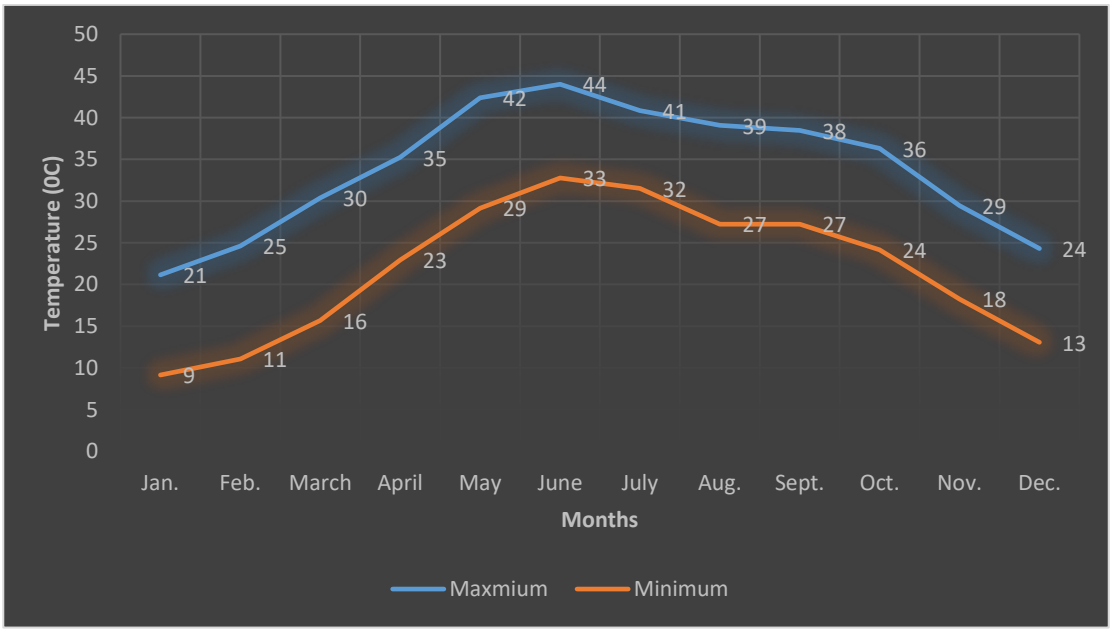


Figure 4-4: Mean Maximum and Minimum Temperature in the Study Area (2011-2023)

Precipitation (Rainfall)

Table 4.3 shows mean monthly precipitation observed in the study area from 2011 to 2022 with an annual average rainfall of 765.41 mm. Figure 4.6 shows the mean monthly precipitation in the study area for the year 2011-2023.

Table 4.3: Mean Monthly Precipitation (2011-2023)[7]

Month	*Precipitation (millimeters)*
January	23.8
February	31.3
March	35.6
April	50.85
May	86.675
June	86.9
July	218.5
August	49.925
September	72.04
October	44.63
November	33.92
December	31.27
Annual	***765.41***

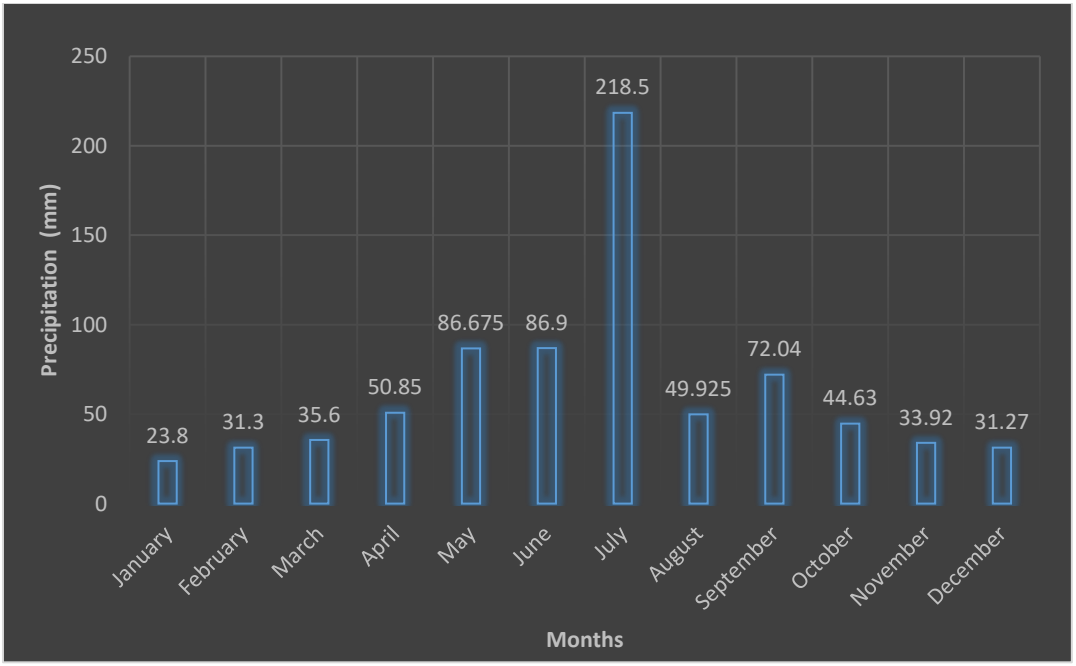


Figure 4-5: Average Precipitation in the Study Area (2011-2023)

Relative Humidity

A mean daily data of humidity on a monthly basis from 2011 to 2023 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 (2011-2023)[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
2023	41	30	38	31	30	34	58	51	50	34	31	29

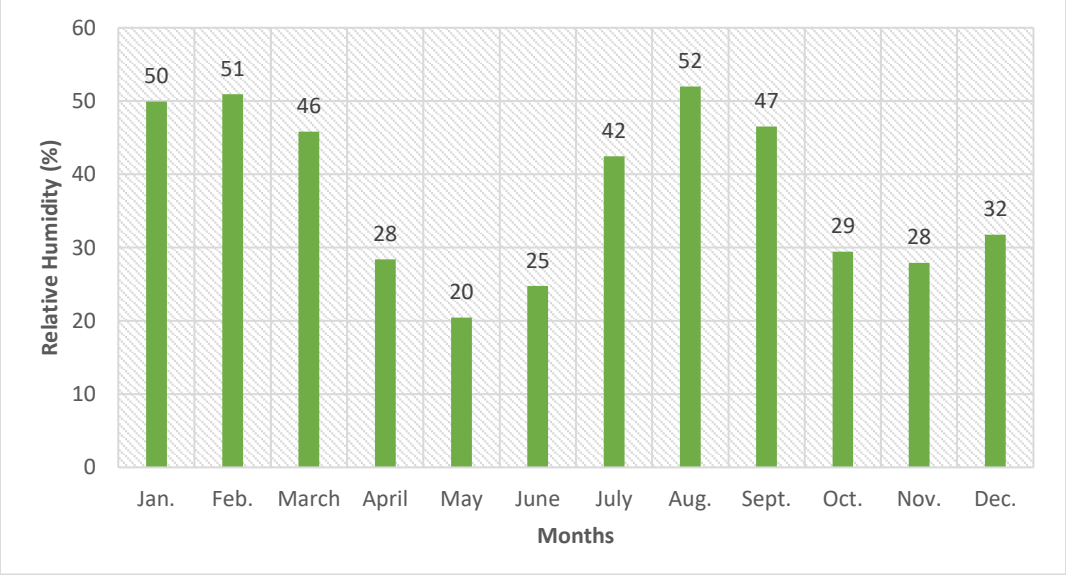


Figure 4-6: Mean Relative Humidity in the Study Area (2011-2023)

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 2023.

Table 4.5: Mean Wind Speed (Km/h) in the Study Area (2011-2023)[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

[8] Meteorological Data for Lahore (2011-2022)
[9] Meteorological Data for Lahore (2011-2022)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
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
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
2023	7.8	9.5	8.7	8.6	10.5	9.5	10.2	9.1	9.4	7.9	6.3	5.6

Figure 4-7: Average Wind Speed in the Study Area from 2011 to 2023

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 325[11] 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.

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

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

4.2.7.4 Khaira Distributary

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

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 4.5** shows the major drains in the study area.

4.2.9 Solid Waste

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

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

LWMC has placed waste storage containers at different points near the study area, waste collected by pickup from these containers and unloaded into nearby compactor or transfer station. Estimated solid waste generation rate in the study area is about 0.6 kg/person/day[12].

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

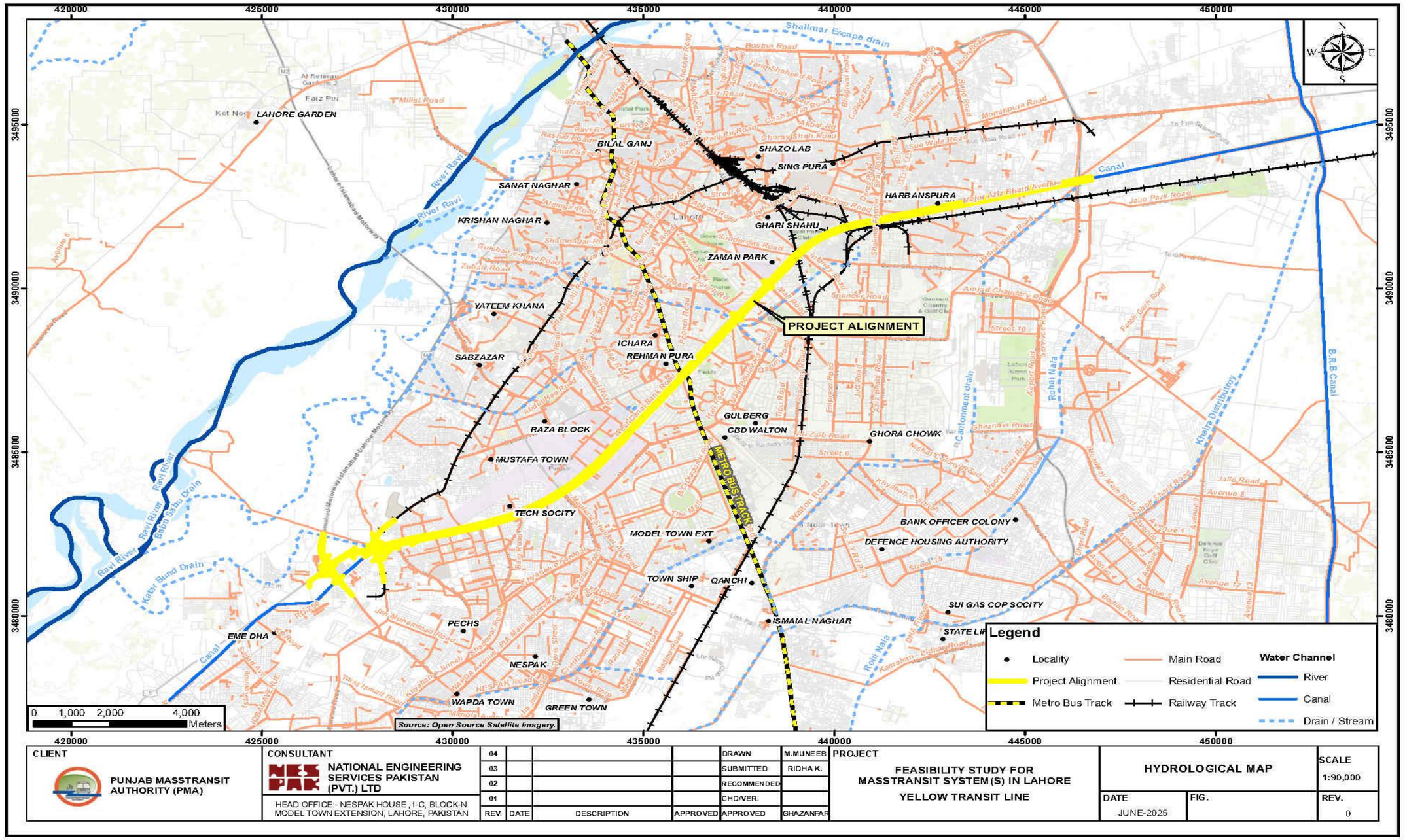


Figure 4.8: Surface Water Resources Map of the Study Area

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. An Environmental Monitoring Map is shown in **Figure 4.10**.

4.3.1 Air Quality

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

The detailed results of ambient air quality monitoring 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 (Ferozpur Road)	Average Concentration (Kalma Chowk)	Limits as Per PEQS, 2016
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	21.50	48.71	80 µg/m³ for 24 Hours
Nitrogen Oxide (NO)	µg/m³	24 Hours	17.49	26.83	40 µg/m³ for 24 Hours
Sulfur Dioxide (SO_2)	µg/m³	24 Hours	17.66	58.99	120 µg/m³ for 24 Hours
Carbon Monoxide (CO)	mg/m³	08 Hours	0.58	1.80	5.0 µg/m³ for 8 Hours
Particulate Matter (PM_{10})	µg/m³	24 Hours	92.76	191.51	150 µg/m³ for 24 Hours
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	28.01	67.54	35 µg/m³ 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 average concentrations of noise level are given in **Table 4.7**.

Table 4.7: Average Concentration of Noise Level

Averaging Time	PEQS, 2016 Category A (Commercial Area)	NL-01 (Ferozpur Road) Average Value in dB (A)	NL-02 Average Concentration (Kalma Chowk)
Day-time	65	67.42	62
Night-time	55	65.48	57

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

4.3.3 Drinking / Ground Water Quality

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

Table 4.8: Results of Drinking Water Analysis

Sr. No.	Parameter	Unit	Test Results (Ground Water) Kalma Chowk	Test Results (Ground Water) Ferozpur Road	Punjab Standards for Ground Water Quality, 2016
A. Physical and Chemical Analysis					
1.	pH	-	7.4	7.8	6.5-8.5
2.	Odor	-	Odorless	Odorless	Non-Objectionable
3.	Taste	-	Non-Objectionable	Non-Objectionable	Non-Objectionable
4.	Color	Pt-Co	0	3	≤ 15 TCU
5.	Turbidity	NTU	0	4.2	< 5 NTU
6.	Total Hardness	mg/l	204	74	< 500 mg/l
7.	Total Dissolved Solids	mg/l	427	209	< 1000
8.	Chloride	mg/l	16	54	< 250
9.	Cyanide (Cn)	mg/l	ND	ND	≤ 0.05
10.	Fluoride (F)	mg/l	0.17	0.58	≤ 1.5
11.	Nitrite	mg/l	5.77	0.006	≤ 3
12.	Nitrate	mg/l	0	0.4	≤ 50
13.	Residual Chlorine	mg/l	0	0.4	0.2-0.5
14.	Aluminum (Al)	mg/l	<0.005	ND	≤ 0.2
15.	Cadmium	mg/l	<0.006	ND	0.01
16.	Copper	mg/l	0.164	0.05	2
17.	Chromium	mg/l	<0.004	ND	≤ 0.05
18.	Mercury	mg/l	<0.001	ND	≤ 0.001
19.	Antimony (Sb)	mg/l	<0.005	ND	≤ 0.005
20.	Nickel	mg/l	<0.02	ND	≤ 0.02
21.	Zinc	mg/l	0.040	1.09	5.0
22.	Arsenic	mg/l	<0.005	ND	≤ 0.05
23.	Barium	mg/l	<0.0035	0.057	0.7
24.	Boron	mg/l	<0.02	ND	0.3
25.	Manganese	mg/l	<0.0015	ND	≤ 0.5
26.	Lead	mg/l	<0.0035	0.001	≤ 0.05
27.	Selenium	mg/l	<0.01	ND	0.01
B. Microbiological Analysis					
1.	Total Coliforms	CFU/ 100 ml	Absent	Absent	Must not be detectable in any 100ml Sample
2.	Faecal Coliforms	CFU/ 100 ml	Absent	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

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. Pictorial views of current landuse are provided in **Plate 4.3**.

Plate 4.3: Current Landuse of the Project 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.

The climate of the area tends to have hot and sometimes extremely hot summers and mild warm winters. The soils are very fertile therefore, climate supports variety of agricultural crops and vegetables, with scare growth of indigenous flora and grasses. The proposed Project is situated in semi-arid region. The region is characterized by dry climate both in summer and winter season. The water precipitation is in the form of occasional seasonal rains, during rainy season (July – September).

4.5.1 Flora

The Project area is under intense pressure of anthropogenic factors which is damaging the local area ecosystem with pace from last many decades. This particular area has been accessible to humans for a long time resulting in low diversity and wildlife abundance. Some of the broad leaved trees exist in the area and these species still survive the on-slaught of urbanization. Same may be found in remote barren areas or in graveyards only. There is probably little natural vegetation left in tract. Natural vegetation of the Lahore region is falling under tropical thorn forest type, but no such designated forest is reported in the Project area and has long ago been replaced completely by weeds and trees.

The study area has a variety of trees. Some of the principal trees, shrubs (plants) and herbs (ground covering plants) of the Project area are given below in **Table 4.10**, which illustrates their nomenclature including local names, English names and Botanical names.

Table 4.9: Inventory of Trees Present in Lahore District

Sr. No.	Common Name	Scientific Name
1	Shisham	*Dalbergia sissoo*

Sr. No.	Common Name	Scientific Name
2	Eucalyptus	*Eucalyptus camaldulensis*
3	Bakain	*Melia azedarach*
4	Neem	*Azadirachta indica*
5	Sirris	*Albizzia lebbe*
6	Jaman	*Syzygium cumini*
7	Pipal (Sacred Fig)	*Ficus religiosa*
8	Ber	*Ziziphus mauritiana*
9	Banyan	*Ficus bengalensis*
10	Alstonia	*Alstonia scholaris*
11	Toot (Mulbery)	*Morus alba*
12	Kikar	*Acacia modesta*
13	Bottle Brush	*Callistemon lanceolatus*

4.5.1.1 Natural Shrubs and Herbs

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

4.5.1.2 Grasses

The Project site is at present partially covered with Khabbal grass, while Kana grass (Saccharummunja) 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 (Uromastixhardwickii) 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 (Ranatigrina) and Indus valley toad.

4.5.2.4 Birds

House sparrow (Passer domesticus), House crow (Corvussplendens) and Mynah (Acredotherestristis) are the most common in the area. In addition, following birds have also been observed in the area.

- Nightingale (Pycnontuscafer)
- Parrot (Psittaculakrameri)
- Pigeon (Columba livia)
- Hoopoe (Upupa epops)

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 exists 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

This section deals with the social conditions of the Project Area. During the desk/ office study, available reports/ documents were comprehensively studied. During the field visit different stakeholders were consulted i.e. residents, shopkeepers, local communities and relevant departments. Observations were taken after giving due consideration to the desk/ office study results. The socioeconomic baseline covers the demography, administrative and political settings, religious and cultural, economic aspects, infrastructure and facilities.

4.6.1 Data/Information Source

For the socioeconomic baseline information, both primary and secondary sources of data were used.

4.6.2 Secondary Data

Secondary data was collected by exploring the relevant documents. Common sources of secondary data for the study include censuses, information collected by government departments, organizational records and data that was originally collected for other research purposes. In this EIA Report, secondary data was derived from District Census Report Lahore, 1998 and Pakistan Bureau of Statistics (Census 2017) for socioeconomic baseline report.

4.6.3 Primary Data

In addition, to the review of secondary data, field visits of the proposed Project were conducted to assess the impact assessment and local communities were also consulted to obtain their views and concerns about the Project.

4.6.4 Location of Lahore City and the Project area

Location of Lahore City is bounded on the North and West by Shiekhupura District, on the east by India and on the south Kasur District. River Ravi flows on the northern side of Lahore. Total land area of the city is 404 sq. Km. Altitude of the city lies between 31-15 and 31-45 North latitudes and 74-01 and 74-39 East longitude. The proposed site of *Energy Resource Center (ERC)* is located in Block, H-III Johar Town, Lahore. It is one ne of the most popular and densely populated areas of Lahore city.

4.6.5 Political and Administrative Setup

The project area falls in the administrative jurisdiction of District Lahore. In district Lahore, Commissioner is the highest ranked administrator of the district. For the collection of revenue and administration, the districts is subdivided into Tehsils. Local governments also administer the area through Union Councils and Tehsils. The total area of the District Lahore is 1,772 square kilometers.

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

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

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

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

A district is composed of Tehsils and is governed by the Deputy Commissioner (DC). Like other districts of the Punjab, the local government system of Lahore comprises UCs

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

4.6.6 Demographic Characteristics of Project Area

The total population of Lahore District was 6,340,114 as enumerated in March 1998 with an intercensal percentage increase of 78.3 since March 1981 when it was 3,544,942 souls. The average annual growth rate of population in the district during intercensal period 1998-2017 was 3 percent. The total area of the district is 1,772 square kilometers which gives population density of 3,566 persons per square kilometer as against 2000 persons observed in 1981 indicating a fast growth rate of the district. Afterwards, massive efforts are made by Government of Pakistan to count the latest population. Census Bureau carried out latest census and released the latest statistics of 2017. The annual growth rate is 3.0% and the population of District Lahore is estimated as 11,126,285 persons out of which 5,824,131 were male and 5,300,931 were female. Sex ratio is measured as 109.87 percent. Table 4.8 gives Households, Population Increase, Sex Ratio and Growth Rates of Lahore District, for the year of 2017.

Table 4.10: Households, Population Increase, Sex Ratio and Growth Rates

Area	Households	Population-2017				Population 1998	Sex Ratio 2017	1998-2017 Average Annual Growth Rate
		Male	Female	Transgender	All Sexes			
Lahore	1,757,691	5,824,131	5,300,931	1,223	11,126,285	6,340,114	109.87	3.00

Source: Pakistan Bureau of Statistics (Census 2017)

The sex ratio is an important demographic indicator, which is defined as the “number of males per hundred females”. According to census 2017, Sex ratio is measured as 109.87 percent. Lahore is a young city with over 40% of its inhabitants below the age of 15. The average life expectancy stands at less than 60 years of age.

4.6.6.1 Rural and Urban Distributions

According to Census of 2017, district Lahore falls 100% in the urban area with **1,757,691** number of households.

4.6.6.2 Religion

The population of the district is predominantly Muslims i.e. 93.9 percent. The next higher percentage is of Christians with 5.8 percent followed by Ahmadis 0.2 percent. While other minorities like Hindu etc. are very small in number.

4.6.6.3 Mother Tongue

The mother tongue refers to the language used for communication between parents and their children in any household. Punjabi is the predominant language being spoken by majority (86.2 percent) of the population of the district followed by Urdu, Pushto and Siraiki being spoken by 10.2, 1.9, and 0.4 percent. Sindhi is spoken by 0.1 percent.

4.6.6.4 Ethnic Structure

The main castes and groups of the Lahore District are Jatt, Rajput, Malik, Butt, Pathan, Mughal, Sheikh, Gujjar, Komboh and Arain. Besides, there are also village artisans, which include Lohars (blacksmiths), Tarkhan (carpenter), Kumhars (potters), Mochis (cobblers), Machhis (water-carries), barbers and weavers etc.

4.6.7 Age Distribution

The demographic characteristics of the sample survey as given in **Table 4.11** shows that 10% of the respondents were up to 30 years of age, 42% of the respondents were aged between 31-45 years while, 26% were 46-60 years and 22% respondents were more than 60 years of age. These figures show that sampled respondents were mature enough to give their opinion about the proposed project and have envisioned of its impacts.

Table 4.11: Age Composition of the Respondents

Sr. No.	Respondents Age	Number	Percentage
1	18-30	5	10
2	31-45	21	42
3	46-60	13	26
4	above 60	11	22
Total		**50**	**100**

4.6.8 Education

Educational level of the respondents is shown in **Table 4.12**. The majority (i.e. 26%) have graduation level education. While 2nd highest category is the respondent having matric & intermediate level education i.e. 22%. Due to urban area majority of the respondents are educated.

Table 4.12: Educational Level of the Respondents

Sr. No.	Education of the Respondent	Number	Percentage
1	Upto Primary	5	10
2	Matric	11	22
3	Intermediate	11	22
4	Graduation	13	26

5	Masters & above	10	20
Total		**50**	**100**

4.6.9 Marital Status

The marital status of the sampled respondents was also inquired during the survey. As per social survey, the majority of respondents (i.e. 78%) are married and 22% are unmarried. **Table 4.13** represents the marital status of the respondents in tabular form.

Table 4.13: Marital Status of the Respondents

Sr. No.	Marital Status	Number	Percentage
1	Married	39	78
2	Un-Married	11	22
Total		**50**	**100**

a) Religion

Respondents were asked about their religion status during the survey. 100 percent respondents reported their religion Islam.

b) Ethnic Structure

According to baseline survey, it was found that the largest part of the respondents i.e. 32% were Rajput. While 26% were Sheikh, 22% were Jutt. The castes of the sampled respondents are given in **Table 4.14.**

Table 4.14: Caste / Ethnic Group of the Respondents

Sr. No.	Respondents Castes	Number	Percentage
1	Arain	5	10
2	Rajput	16	32
3	Sheikh	13	26
4	Jutt	11	22
5	Butt	5	10
Total		**50**	**100**

4.6.10 Economic Conditions

a) Occupational Structure

Social survey results depict that about 46% of the respondents were doing private job, 22% were doing their business, 20% were laborer workers while 12% were students. Details regarding the occupational structure in the Study Area are given below in **Table 4.15**.

Table 4.15: Occupational Categories of the Respondents

Sr. No.	Occupation	Number	Percent
1	Private Job	23	46
2	Business	11	22
3	Labour	10	20
4	Students	6	12

Total	**50**	**100**

b) Income Level of the Respondents

Income is an indicator for assessing the livelihood/well-being of the household. From the **Table 4.16,** it is clear that majority of the respondents 50% fall in the income group of Rs. 32,001-50,000, 26 % belong to income group of more than Rs. 50,000, 12% of the respondents were earning their monthly income between Rs. 21000-32,000.

Table 4.16: Monthly income for all Activities/Services

Sr. No.	Monthly Income	Number	Percent
1	21000 - 32000	12	24
2	32001-50000	25	50
4	Above 50,000	13	26
Total		**50**	**100**

c) Average Monthly Expenditures

Table 4.17 shows that majority of the respondents i.e. 60% reported their monthly expenditure in the range of Rs. 32,001-50,000, 22% respondents were monthly spending more than Rs. 50,000/-. 9% respondents reported their monthly average expenditures in the range of Rs. 21,000-32,000/- The respondents whose expenditures are more than their income, manage their livelihood on the basis of weekly income. They are mostly labourer who takes loan for grocery from shopkeeper.

Table 4.17: Average Monthly Expenditure

Sr. No.	Monthly Expenditure	Number	Percentage
1	21000 - 32000	9	18
2	32001-50000	30	60
3	Above 50,000	11	22
Total		**50**	**100**

d) Housing Ownership Status

Sampled respondents were asked about their housing ownership status in order to know their level of living standard as reflected in **Table 4.18.** Majority of respondents i.e. 58 percent were living in their own houses while 42 percent were living in rented houses.

Table 4.18: Housing Ownership Status

Sr.No.	Response	Number	Percentage
1	Self-Owned	29	58
2	Rented	21	42
Total		**50**	**100**

4.6.11 Awareness Regarding the Proposed Project

A large number of respondents 76% were not aware of the proposed project. Only 24% were those, who had prior knowledge of the project as shown below in **Table 4.27**.

Table 4.19: Awareness about the Project

Sr. No.	Awareness of the Project	Number	Percentage
1	Yes	12	24
2	No	38	76
Total		**50**	**100**

4.6.11.1 Educational Facilities

Lahore is an old first class seat of learning in Pakistan. The world famous and the oldest university of Pakistan i.e. University of the Punjab is located in this city. The pioneer University of Engineering and Technology is also in Lahore. There has been a significant development in the educational sector of this district. University of the Punjab has been extended and its new campuses are constructed along the Lahore branch of Upper Bari Doab canal. This provides an ideal environment for teachers and taught in the green lush area surrounded by New Muslim Town, Wahdat Colony, PCSIR Colony, Faisal Town and Garden Town.

Project Area

In the project and its surrounding areas private and government educational institutions are present, which include: University of the Punjab, University of Management and Technology (UMT), the University of Central Punjab (UCP), campuses of the City, Unique, Lahore Grammar, Kips schools, Step Institutions and College of Tourism Hotel Management, Bloomfield, Informatics Group Collages, Pakistan Institute of Fashion and Design etc. Similar to these, several colleges, and degree-awarding institutions are also present at a walking distance.

4.6.11.2 Health Facilities

Ample medical and health facilities are available in the Lahore Metropolitan Corporation area and its suburbs. Shaukat Khanam Hospital is the latest addition in the medical care facilities in Lahore for the most dangerous disease in the country i.e. Cancer. There are also other hospitals of voluntary organizations which provide health cover to the general public. King Zaid Bin Sultan Hospital is also a very advanced addition in the medical care for Lahore. Among the prominent hospitals are Lahore General Hospital, Lady Willingdon Hospital, Mayo Hospital, Fatima Jinnah Hospital, The Children Hospital, Services Hospital, and Ganga Ram Hospital etc.

Pakistan Kidney and Liver Institute and Research Center (PKLI & RC) is one of the bigger transplant centers in the world. It not only provides free of cost medical services to the poor, but also provides employment to people, including training for doctors, nurses and paramedics. PKLI&RC has facility of 800 beds for patients. Besides, a number of private medical practitioners, Hakims and homeopathic doctors are also practicing in the city.

Project Area

The overall health condition of the residents is good in the project area and the common diseases were pointed out by the local people and medical practitioners, i.e. flu and fever, sugar. and blood pressure. More than 170 government and private health care institutions that are working near the proposed project area and some are:

- Shaukat Khanam Hospital;
- Doctors Hospital;
- Jinnah Hospital; and
- Inmol Cancer Hospital.

The people of the local communities get their treatment from both government as well as private hospitals.

4.6.11.3 Transportation

Lahore is linked with the rest of the country by air, rail and road. Ample transportation facilities are available in the Lahore Metropolitan Corporation area and its suburbs. The city has higher and better transportation facilities as compared to other area of Punjab. Lahore's main public transportation system is operated by the Punjab Transport Company (PTC) and Punjab Mass Transit Authority (PMTA). The backbone of its public transport network is the PMTA's Lahore Metro Bus and Orange Line Train of the Lahore Metro. LTC and PMTA also operate an extensive network of buses, providing bus service to many parts of the city and acting as a feeder system for the Metro bus.

Auto rickshaws and Cabs play an important role of public transport in Lahore. There are auto rickshaws, often simply called autos, in the city. Motorcycle rickshaws, usually called "chingchi", are also a very common means of domestic travel.

Radio cab services like Uber, Careem and inDriver have been recently introduced by some private companies, which are now-a-days, is used as common mean of transportation by local population.

4.6.11.4 Roads

Lahore is one of the most accessible cities of Pakistan. In addition to the historic Grand Trunk Road (G.T. Road), a Motorway (M-2) was completed in 1997 from Lahore to Islamabad and (M-3) in 2018 from Lahore to Karachi. The government has built

underpasses to ease congestion and prevent traffic jams, and according to official figures, Lahore has the highest number of underpasses in Pakistan.

4.6.11.5 Railways

The Pakistan Railways headquarters is located in Lahore. Pakistan Railways provides an important mode of transportation for commuters and connects distant parts of the country with Lahore for business, sight-seeing, pilgrimage, and education. The Lahore Central Railway Station, built during the British colonial era, is located in the heart of the city.

4.6.11.6 Airport

Allama Iqbal International Airport is the third largest civil airport by traffic in Pakistan, serving Lahore, the capital of Punjab province as well a large portion of the travelers from the Punjab province. The airport currently has three terminals: the Allama Iqbal terminal, the Hajj terminal and a cargo terminal. The airport is located about 15 km from the centre of the city. Expansion work of airport started in 2018, it will increase terminal, car parking space and passenger capacity to 25 million.

4.6.11.7 Archeological and Cultural Property/ Places of Interest

Lahore's modern city space consists of the historic walled city of Lahore in the northern part of the city, which contains several world and national heritage sites. The most common places of interest in Lahore city, i.e. Royal Fort Lahore, Minar-e-Pakistan, Badshahi Mosque, Wazir Khan Mosque, Grand Jamia Mosque Bahria Town, Shrine of Data Ganj Bakhsh, Shrine of Madhu Lal Hussain; Lahore Museum, Shalimar Garden, Jallo Park, Lahore Zoo; Tomb of Allama Iqbal, Tomb of Anarkali, Tomb of Nur Jahan, Tomb of Jahangir and Wagah Border

Project Area

There is no declared heritage site in the project area.

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

Task	Purpose of Consultation with Stakeholders
	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, PMA, Forest Department, Wildlife Department, Parks and 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 will be 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.

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 the Environmental Protection Agency, PHA, Wildlife Department, and local communities including PAPs.

5.4 APPROACH FOR THE CONSULTATION AND INFORMATION DISSEMINATION

A series of public consultations were conducted to gather feedback and address concerns from various stakeholders, including provincial and district-level departments, potential project-affected persons (PAPs), local communities, housing societies and the general public residing within the Project area.

The consultation process involved meetings with identified potential Project-Affected Persons (PAPs), community gatherings, semi-structured interviews, and one-on-one discussions with government, private, and civil society organizations. During these consultations, stakeholders were informed about the Project's objectives and scope, and their concerns and suggestions were carefully documented.

Consultations were conducted at three levels:

- Institutions/Departments Level
- Housing Societies
- Community level

5.4.1 Consultations with Departments

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 Environmental Protection and Climate Change Department	Dr. Amir Farooq, Director – EIA	24-06-2025
2.	Parks and Horticulture Authority (PHA) Lahore	Abdullah Cheema, Director Horticulture Canal Road	24-06-2025
3.	Wildlife Department	Mr. Mudassar Hassan, Deputy Director	20-06-2025

The **Table 5-4** indicates the details of issues raised/discussed and suggestions given during the consultation. **Plate 5-1** shows the pictorial view of department consultations.

Table 5-4: Detail of Issues/Points Raised/Discussed during Departmental Consultations

Sr. No.	Department/ Organization	Suggestions
1.	Punjab-EP&CCD	• It was suggested that all the relevant Acts, laws, regulations, and guidelines especially the Punjab Environmental Protection Act, 2017 and Smog Regulations should be followed during the preparation of EIA report; • Stakeholder Consultations with all the relevant stakeholders should be carried out; • Environmental Monitoring in the Project area should be considered; • Green Land should not be utilized for construction purposes; • Tree cutting should be avoided as much as possible; • Ensure continuous sprinkling of water on daily basis in the Project area to reduce emission of dust particles; • Health and Safety Management Plan shall be prepared and implemented to avoid health and safety issues occurring during the construction period of the Project; • Solid waste produced shall be properly managed and disposed of in identified designated areas; • Construction material will be removed as early as possible on the construction sites:

Sr. No.	Department/ Organization	Suggestions
		• Alternate routes shall be provided in consultation with Traffic Police to the residents, educational institutions and road users for their movement and to avoid the chaotic situation of traffic at this bottleneck; • Proper barricading shall be provided along excavation sites to avoid accidents and casualties; and • If tree cutting is involved then it should be avoided as much as possible and trees should be replanted and Tree Plantation Plan shall be provided.
2.	Wildlife Department	• The NESPAK team visited the subject office to brief the officials regarding the Project and share details; and • They appreciated the proposed Project and shared the information mentioned below: ▪ No Wildlife protected area falls under the proposed Project area; ▪ They also suggested avoiding negative impacts on local biodiversity and green cover, if any; ▪ Loss of trees will be discouraged to keep the ecosystem balanced and to protect the habitat of wildlife of the region; and ▪ Required details of the faunal species of the region were also provided.
3.	PHA	• The NESPAK team visited the subject office to brief the officials regarding the Project and share details; and • They appreciated the proposed Project and shared the information mentioned below: ▪ Tree cutting will be avoided up to maximum level; ▪ Extensive plantation will be conducted to ensure Project sustainability and to enhance/conserve the local environment; ▪ A feasible provision of budget for the tree plantation plan shall be included in the Project cost; and ▪ Required details of the floral species of the Project area were also provided.

Consultation with PHA

Consultation with Punjab-EP&CCD

Consultation with Wildlife Department

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 Categories of Stakeholders Contacted

Different categories of stakeholders contacted during consultation are shown in the **Table 5-7.**

Table 5-5: Stakeholders Contacted in the Project Area

Sr. No.	Stakeholder Category
1.	People of the surrounding communities
2.	Local Residents
3.	Business/ shop owners
4.	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. The major categories participated in these meetings were local residents 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 and social 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 are presented in an annotated form given in **Table 5-8**.

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.	The construction of the proposed Project will result in mobility issues for the local community, restricting access to residences.	The alternate route should be provided to the local communities for convenience in mobility. Construction activities should be halted during peak hours. Proper compensation shall be paid for the acquired land as per prevailing market rates.	The possible alternate route will be provided before the commencement of the civil work on the proposed Project. Land must be acquired from the landowners in accordance with the agreement before the commencement of construction activities.
2.	Health and safety and noise issues will arise for residents and students due to the construction activities.	Labour will be bound to work and stay in the designated area or camp sites to ensure the safety and privacy of female residents. Ensure minimum transportation of construction materials and use of construction machinery during peak working hours and at night.	The contractor should be bound to take all protective and precautionary measures to protect the health of the local people.
3.	Disturbance of the social amenities.	Participants were of the view that due to the construction of the proposed Project, several social amenities will be disturbed. These social amenities should be restored before the commencement of the	Social amenities should be restored before the execution of the civil work.

Sr. No.	Concerns Raised by Participants	Mitigation Proposed by Participants	Action to be taken by Project Executors
		construction work to avoid any inconvenience for the local community.	
4.	The movement of construction machinery and loaded trucks transporting materials during the construction period will lead to increased congestion on the access road.	The appropriate diversion plan will be developed to avoid traffic blockage/disruption due to the use of heavy machinery especially near sensitive receptors such as schools and mosques.	The Contractor should be bound to make a site-specific traffic management plan in consultation with the traffic police during the construction phase.
5.	Due to construction activities as well as the influx of labour, the movement of the citizens particularly of females, residing in the area will be restricted.	In order to tackle this situation, construction should be carried out in scheduled hours. So that after construction hours, the local community, particularly females can easily move in the area.	People should be aware of complete construction activity plans so that they can move in the area freely and safely.
6.	Dust emissions from construction activities such as deep excavations, transportation of construction materials and use of construction machinery.	Dust pollution will be controlled by water sprinkling regularly.	The contractor should be bound to take all protective and precautionary measures to keep safe the health and properties of the local people.
7.	Job and labour opportunities for local people.	The skilled and unskilled workforce should be hired from the local community. It will enhance the acceptability of the proposed Project among local people.	The contractor should be bound to hire skilled and unskilled workers from the local community as a priority.

Plate 5-3: Pictorial View of the Community Consultations

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 / AOI 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 landuse 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	o	o	o		o	o	o	0	o	o	o	o	o	o	o	o	o	0	o	o	o	o
Geotechnical Investigation	o	o	2	o	o		o	o	o	o	o	2	0	o	o	o	o	o	0	2	o	o	o	o
Socio-Economic Surveys	2	2	o	o	o		o	o	o	0	o	o	o	o	o	o	o	o	o	0	o	o	o	o
B. Construction Phase																								
Site Clearance	9	9	9	2	8	4	2	2	o	12	o	10	0	6	10	3	o	2	2	9	4	2	o	6
Earthwork and Excavation	9	9	9	2	8	8	4	4	o	12	o	8	o	6	2	3	2	o	2	9	4	2	o	6
Establishment of Construction Camps & Workshop	2	2	4	o	8	8	o	2	o	4	o	4	0	8	o	o	4	4	4	8	4	2	o	6
Transportation & Storage of Construction Materials	4	6	6	4	4	2	o	4	o	2	o	o	0	o	o	o	4	o	2	6	4	o	o	4
Use of Construction Material and Heavy Machinery	3	8	9	o	4	o	o	2	o	4	o	o	o	o	2	2	o	o	2	8	o	4	o	4
Installation and operation of Batching and Asphalt Plants	4	8	8	2	4	2	2	o	o	2	o	o	o	2	o	o	o	o	o	6	4	o	4	4
Spoil Disposal	3	3	o	2	6	o	o	o	o	6	o	4	o	o	o	o	2	o	4	4	6	o	o	2
Structural & Civil Work	8	8	8	2	7	2	2	2	o	6	o	o	o	2	2	o	2	4	4	9	4	3	o	8
Drainage, Water Supply & sewerage works	4	6	6	2	6	4	2	2	o	6	o	o	o	2	2	o	2	4	4	9	4	4	o	8
Construction of residential/commercial units	o	2	4	4	6	4	2	2	o	2	o	o	o	o	o	o	o	2	o	4	o	o	o	8
C. Operational Phase																								
Movement of Residents, Employees & Visitors	2	4	4	4	9	10	4	4	o	4	o	6	o	o	0	0	4	o	o	2	6	6	6	6
Consumption of water	o	o	o	4	o	o	o	o	o	o	o	o	o	o	0	0	o	o	o	o	o	o	o	o
Municipal solid waste and wastewater generation	o	o	o	o	6	o	6	6	o	o	o	o	o	o	0	0	o	o	2	6	4	o	o	2
Maintenance of Area Facilities	o	2	2	2	6	2	o	o	o	o	o	o	o	o	0	0	o	o	o	6	o	o	o	2
Landscaping/ Maintenance of Green areas	o	2	2	o	2	o	o	o	o	o	o	o	o	o	0	0	o	o	o	4	4	o	o	2

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

6.5 POTENTIAL ENVIRONMENTAL IMPACTS AND MINTIGATION 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 Design & Layout Planning

Incompatible layout plan and engineering design of the project's structures can undermine the overall aesthetic beauty and ambience of the project area. Also low utilization of the available spaces and not designing the structures taking into account, the prospective and futuristic needs can result in structures with low social acceptability and functionality.
This impact is permanent and moderate negative in nature.

Mitigation Measures:

- All structural, layout and engineering designing of Yellow Line should be in strict accordance with the applicable bylaws and engineering parameters.

6.5.1.2 Topography

The topography of the project area is flat. The topography of the project areas will not be changed as proposed ART system will run on existing canal road.

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.

6.5.1.3 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.

6.5.2 Green Building Concept

The building sector is one of the major global energy consumers and GHG emitters. These emissions are related to the energy needs for cooling, heating, ventilation, hot water, lighting, etc. Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle. Green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation

Mitigation Measures

- Plan for use of solar panels at operation phase should be considered. Its strongly recommended to install solar panels at roof top of complex;
- Roof top gardening should be practiced during the operation phase of the proposed Project;
- Ensure adequate insulation to reduce heat loss through batching plants;
- Plan for reuse of construction waste materials may be formulated;
- A good camp design and an efficient worksite management plan should be prepared during design stage that may help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels;
- Rain water harvesting system may be considered through collection of water from roofs and its proper usage to irrigate green areas and also for domestic use with proper treatment; and

- **Green Buildings:** Following green building characteristics should be considered during design phase and Green Certification for the proposed Project should be ensured:
    - **Location and Transport:** Do not build in environmentally sensitive locations and provide public transport to reduce private car use.
    - **Sustainable Site:** Protect and maintain the natural habitat, reduce pollution and the use of natural resources and facilitate interaction with nature.
    - **Efficient Use of Water:** Minimize the use of water during construction and provide mechanisms to reduce the building's water footprint.
    - **Energy:** Reduce energy consumption, use renewable energy and increase energy efficiency to reduce pollution.
    - **Materials and Resources:** Incorporate recycling systems, use sustainable materials and save as many resources as possible during construction.
    - **Indoor Air Quality (IAQ):** Address the quality of the space for its occupants, such as air cleanliness, thermal control and noise pollution.
    - **Design Innovation:** Implement innovative sustainability strategies during its construction.
- **Water Conservation:** Following water conservation techniques should be considered during design phase:
    - **Pressure Reducing Valves:** High water pressures waste a lot of water. Water pressure reducing valves should be installed within the proposed NSIT. It will protect the downstream plumbing system components as well as reduces the water consumption.
    - **Insulation of Pipes**: Water pipes should also be insulated for water conservation. When pipes are properly insulated it ensures hot water is immediately available and when the tap is closed it supplied back to the plant, consequently reducing the energy demand of the heating unit. With insulated pipes, the user is less likely to waste by waiting for it with the taps open.
    - **Efficient Taps/Showers/Toilets:** Water-efficient taps/showers/toilets work in two ways, they can either reduce the water flow rate through the tap or they can support the user to avoid wastage of water by automatically turning it off. It will be compulsory for each residential and commercial unit to install efficient taps/showers for water conservation.
    - **Greywater Recycling Systems:** The water used in most building structures is thought of in terms of clear clean water coming in, and sewage or black water going out. However, greywater is something that is in between that. In the domestic setting, greywater systems collect water from sources like baths, hand basins, and showers. This collected water is reused for washing machines, toilet flushing, and other external usages. The main idea behind greywater recovery is simply getting the most out of the water through its efficient reuse.
    - **Efficient Irrigation Technology:** Efficient outdoor irrigation technologies like smart irrigation controllers, sprinklers for drip irrigation, etc. should be installed in lawns, gardens and parks.
    - **Rainwater Harvesting:** Rainwater harvesting systems can vary from the basic small ones, like the attachment of a water butt to a rainwater down-pipe, to the complexly designed large ones like those which collect rainwater from large areas and serve momentous numbers of properties. When it comes to domestic purposes, these systems are relevant to both commercial and domestic properties. When collected, rainwater can be used for garden irrigation, toilet flushing, and even in washing machines. Rainwater harvesting system should be designed for proposed building. It should be ensured during

design of buildings that every building should install own rainwater harvesting system.

6.5.2.1 Green Corridor

The development of a Green Corridor along the Lahore Canal (ART Corridor) presents a strategic opportunity for sustainable urban enhancement in the study area. it will contribute to improved air quality through increased vegetation that acts as a natural filter for pollutants and absorbs carbon dioxide. The plantation of native trees and shrubs along the corridor will also enhance biodiversity, providing habitats for birds, insects, and small mammals that are increasingly displaced by urban expansion. The corridor will function as a natural buffer against noise pollution and mitigate the urban heat island effect by reducing surface temperatures through shading and evapo-transpiration.

6.5.2.2 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 sever e 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**.

6.5.2.3 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.

6.5.2.4 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 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.

6.5.2.5 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.

6.5.2.6 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.

6.5.2.7 Social Issues

During the construction phase of the project, it might be difficult for the students to get access to their school/colleges if located on other side of track. Similarly, the patients may also face difficulty of access to the hospitals. Moreover, this will result in causing inconvenience to the nearby residents and affecting their daily life activities. There may also be a crossing problem for the pedestrians during the construction/ operation stage of the project. Security arrangements would be made along the track and stations. This impact is temporary and moderate negative in nature.

Mitigation Measures:

- The provision of pedestrian overhead bridges or crossings on every station, public awareness through media, proper traffic diversion plans, appropriate sign boards, and timely completion of the project.

6.5.3 Potential Environmental Impacts during Construction Phase

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

6.5.3.1 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 stations, underpasses and depots. 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.

6.5.3.2 Land Acquisition

Due to the construction of the LRMTS, land acquisition will occur. This will result in loss of infrastructure; commercial activities and disturbance to people.

Mitigation Measures:

The compensation for the structures, plots, private and public properties etc. has to be made as per LAA 1894.

6.5.3.3 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.

6.5.3.4 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 approve 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 in to the land it will meet the requirements of the PEQS for disposal of wastewater.

6.5.3.5 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).

6.5.3.6 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.

6.5.3.7 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**.

6.5.3.8 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.

6.5.3.9 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/day[13] 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:

[13] 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.

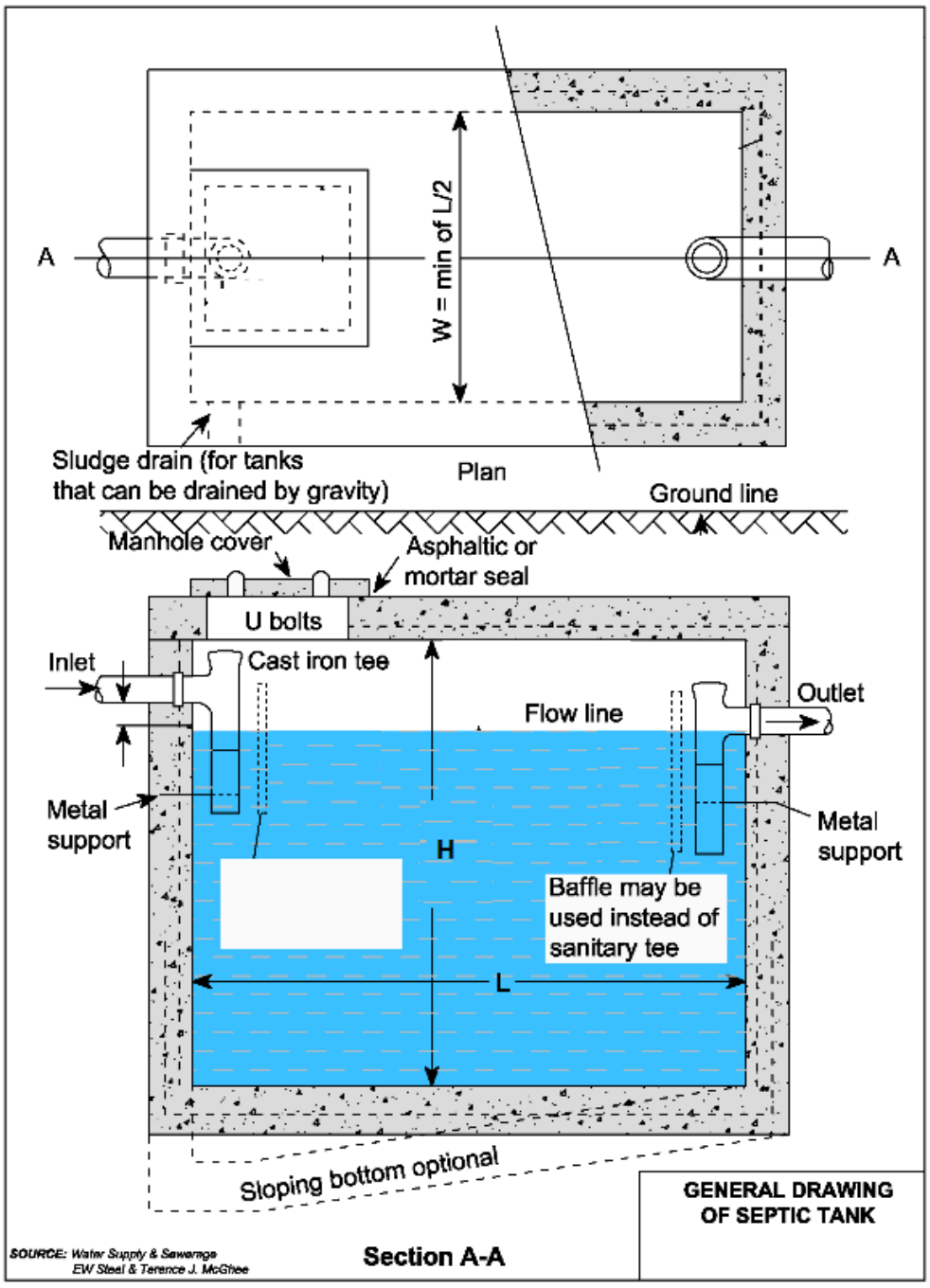


Figure 6.1: General Drawing of Septic Tank

6.5.3.10 Solid Waste Generation at Construction Camps

The solid waste generation is estimated to be 120 kg/day[14] 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

[14] Source: Estimated solid waste generation rate in the study area is about 0.6 kg/person/day (https://www.lwmc.com.pk/uc-plan.php).

- 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.

6.5.3.11 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 Canal Road and other approached 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.

6.5.3.12 Climate Change and 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 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 (PMA, consultants, contractors, concessionaires) need to become aware that their actions at all stages of a project can contribute to reducing the CO_2 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 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.

6.5.3.13 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 PMA and should be implemented in close consultation with the RESCUE Services and other concerned departments;
- Training of the Contractor and PMA 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 PMA management.

6.5.3.14 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 contactor in close coordination with the provincial emergency services.
- The Occupational Health and Safety Plan is attached as **Annex-VII**.

6.5.3.15 Issues of Smog

Construction activities related to proposed project can significantly contribute to smog issues in Lahore City, primarily due to various pollutants released during the construction phase. Some of the key elements contributing to smog during construction include:

- Particulate Matter (PM): Construction activities generate dust and particulate matter, especially from excavation, demolition, material handling, and transportation of construction materials. These fine particles can remain suspended in the air for long periods, contributing to smog formulation and enhancement of existing smog issue.
- Vehicular Emissions: Construction sites often involve heavy machinery and trucks for transportation of materials. These vehicles emit pollutants such as nitrogen oxides (NOx), volatile organic compounds (VOCs), and particulate matter that will contribute to smog formation in reaction with sunlight and other pollutants in the atmosphere.
  - Incomplete Combustion: Inefficient combustion of fuels, often used in construction equipment, can release pollutants like sulfur dioxide (SO2), nitrogen oxides (NOx), and particulate matter, which contribute to smog formation.
  - Lack of Dust Control Measures: Inadequate measures to control dust and particulate matter at construction sites, such as un-covered construction materials, lack of water sprinkling, or absence of dust barriers, can significantly contribute to increased airborne particles.

Mitigation Measures:

To mitigate or reduce smog issues and impacts of construction activities on smog formation, following measures can be taken:

- Implement robust air quality monitoring systems to track pollution levels and take necessary actions accordingly.
- Implement and enforce regulations regarding air emissions as per PEQS, dust control measures, and the use of cleaner technologies in construction machinery and vehicles.
- Encourage the use of electric or hybrid machinery and vehicles to reduce air emissions.
- Employ effective dust control measures, such as water sprinkling, covering materials, and using dust barriers, to minimize the release of particulate matter.
- Educate construction workers and the public about the importance of adopting eco-friendly practices to reduce smog formation.

- Vehicle Inspection & Certification System (VICS) should be implemented in true letter & spirit to reduce environmental pollution caused by unfit motorized vehicles.

6.5.3.16 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 heath workers in disease treatment; immunization program and providing health service;
- Reducing the impacts of vector borne diseases will be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which include prevention of larval and adult propagation of vectors

through sanitary improvements and elimination of breeding habitat close to human settlements and by eliminating any unusable impounding of water;

- The Contractor will prepare the construction camp management plan which, in addition to other components, will include the labor influx management plan. This will be reviewed and approved by PMA; 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.

6.5.3.17 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;
- 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; 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.

6.5.3.18 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-VIII**.

6.5.3.19 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

6.5.3.20 Flora

The project will involve destruction of vegetation cover on construction areas particularly along proposed project construction. It is initially examined that approximately 737 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 route 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 route 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;
- Total 10,000 trees will be planted in compensation and area enhancement (**Annex-X**);
- The proponent shall implement the program with the help of PHA 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.

6.5.3.21 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 earthworks 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.

6.5.3.22 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.

6.5.4 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.

6.5.4.1 Air Quality

The operational phase will improve the air quality of the project area by reducing vehicular emissions and traffic congestion. This impact is permanent and positive.

6.5.4.2 Noise and Vibrations

The Yellow Line is forecast to reduce the private transport in Lahore. The reduction in vehicles will result in reduction of noise associated with traffic. The noise generated due to Yellow line is expected to be minimal due to electric traction. This impact is permanent and positive.

6.5.4.3 Solid Waste Generation

No hazardous waste is expected to be generated in operation phase except during road maintenance works. However, miscellaneous municipal wastes from stations, refreshment and ticketing booths comprising wrappings, papers, eatables, empty cans or bottles, food residues and other similar wastes that will be thrown out of rail.

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;
- 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;
- Installation of sign boards for solid waste at all the stations of Yellow Line; and
- Daily housekeeping of stations should be carried out to minimize the generation of waste.

6.5.4.4 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.

6.5.4.5 Environmental Quality

Environmental quality is an indicator of regional quality of life, supporting the health and well-being of the public and the attractiveness and sustainability of the urban and natural environment. The LMTS environmental improvement mechanisms include the effects within three general categories:

Technology Effect: Reduced vehicle emissions due to the propulsion technology or fuel efficiency changes.

Ridership Effect: Trips diverted from private vehicles which increase transit ridership.

System Effect: Reduced vehicle emissions from reduced congestions.

These impacts are permanent and have a major positive impact on environment.

6.5.4.6 Socio-economic Impacts

Employment opportunities

Employment opportunities will be generated at operation stage including skilled and unskilled labour. Indirect employment will be generated by hiring subcontractors for services e.g: for waste management etc.

7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 GENERAL

Environmental Management Plan (EMP) is a tool for the implementation of the 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 (PMA), 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 (PMA), 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 PMA 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:

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

The employer/ proponent (PMA) 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 Chairman PMA, Project Director PMA and Deputy Director, PMA will provide overall guidance and oversight and will be responsible for ensuring effective implementation of the project.

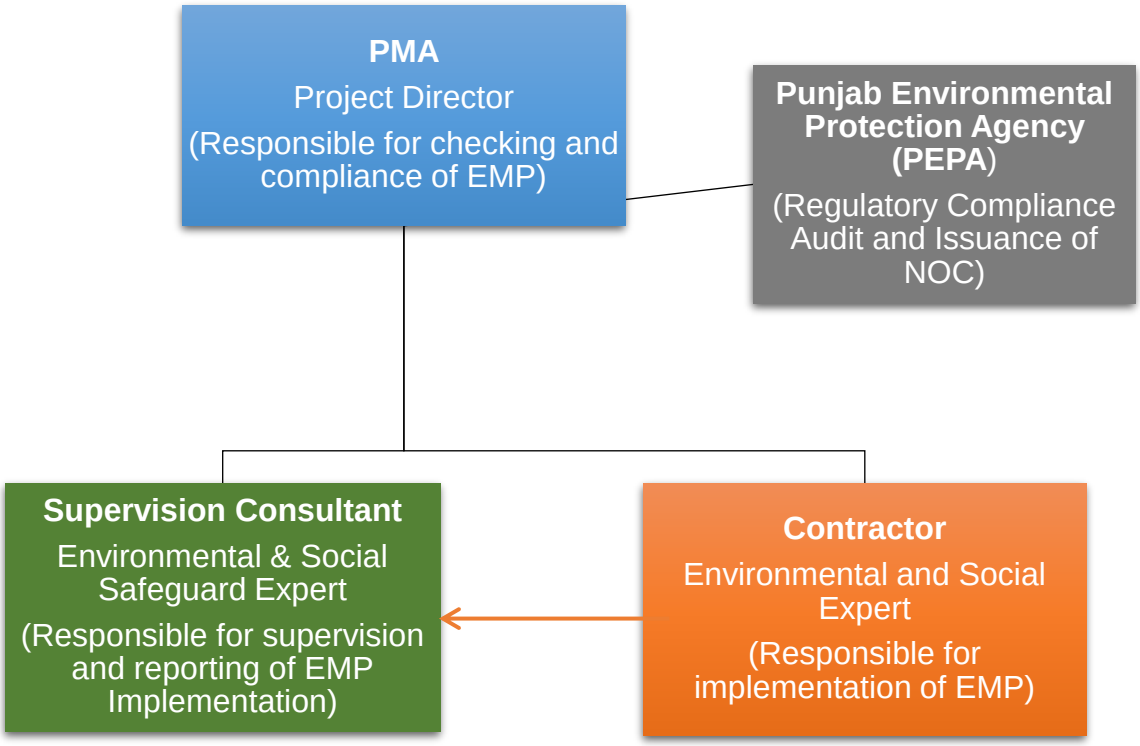


Figure 7.1: Organizational Setup for the Implementation of EMP at Construction Stage

7.4.3 Roles and Responsibilities for EMP Implementation during construction Phase

a. PMA/ 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 PMA 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 PMA 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 Agency (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 PMA 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 PMA 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 PMA during the O&M phase. PMA 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 PMA, 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. 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.	**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
3.	**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
4.	**Site Selection for 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	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		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.			
5.	**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

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
6.	**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. Temporary road may also affect the habitat of locally available fauna. This impact is site-specific, temporary, irreversible and low significant.	• 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.	• Audits and Checks	Design Consultant	Proponent
7.	**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

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
Construction Phase					
8.	**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 stations, depots, underpasses 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.	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.	• Visual observation and photographic record • Site restoration and rehabilitation plan implementation	Construction Contractor	Proponent, SC
9.	**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,	• 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, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	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.	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.			
10.	**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	• 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, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	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.	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 approve 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.			
11.	**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, SC

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).			
12.	**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, SC

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.				
13.	**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 Management Plan is attached as Annex-IV.	• Visual observation and photographic record • NOC record of permits • Check and audits	Construction Contractor	Proponent, SC
14.	**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; • Camps will be designed to be self-	• Visual observation and photographic record. • Waste Management plan implementation	Construction Contractor	Proponent, SC

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.	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.			
15.	**Wastewater Generation at Construction Camps** Wastewater will be generated at the	To dispose the liquid waste generated from the construction activities, the following steps will be taken by the Contractor:	• Visual observation and photographic record. • Waste Management	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	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[15] 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.	• 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		
16.	**Solid Waste Generation at Construction Camps** The solid waste generation is estimated to be 90 kg/day[16] 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 waste minimization, reuse and	• Visual observation and photographic record. • Waste Management plan implementation	Construction Contractor	Proponent, SC

[15] Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/day)
[16] 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.	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			

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				Implementation	Monitoring
		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.			
17.	**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 Canal 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, vibrational impacts, etc. Considering	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;	• Vehicle maintenance record • Training record • Implementation of TMP • Regular visual observations	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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	these consequences.	• 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.			
18.	**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 (PMA, consultants, contractors, concessionaires) need to become aware that their actions at all stages of a project can contribute to reducing the CO_2 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 equipment running unnecessarily or	• Regular environmental monitoring, sampling and testing reports • Vehicle inspection record • Plantation record	Construction Contractor	Proponent, SC

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.	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.			
19.	**Natural and Man-Made Disasters**	• An Emergency Response Plan (ERP)	• Trainings, drills, record keeping • ERP implementation	Construction Contractor	Proponent, SC

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 PMA and should be implemented in close consultation with the RESCUE Services and other concerned departments; • Training of the Contractor and PMA 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 PMA management.	• Visual observation and photographic record.		
20.	**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, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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	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 contactor in close coordination with the provincial emergency services. • The Occupational Health and Safety Plan is attached as Annex-VII.			
21.	**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	Construction Contractor	Proponent, SC

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 heath workers in disease treatment; immunization program and providing health service; • Reducing the impacts of vector borne diseases will be accomplished	worker		

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 PMA; 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.			
22.	**Issues of Smog** Construction activities related to proposed project can significantly contribute to smog issues in Lahore City, primarily due to various pollutants released during the construction phase i.e. Particulate Matter (PM), Vehicular Emissions, Incomplete Combustion and	• Implementation of robust air quality monitoring systems to track pollution levels and take necessary actions accordingly. • Implement and enforce regulations regarding air emissions as per PEQS, dust control measures, and the use of cleaner technologies in construction machinery and vehicles. • Encourage the use of electric or hybrid machinery and vehicles to	Audits and Checks	Construction Contractor	SC, Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Lack of Dust Control Measures.	reduce air emissions. • Employ effective dust control measures, such as water sprinkling, covering materials, and using dust barriers, to minimize the release of particulate matter. • Educate construction workers and the public about the importance of adopting eco-friendly practices to reduce smog formation. • Vehicle Inspection & Certification System (VICS) should be implemented in true letter & spirit to reduce environmental pollution caused by unfit motorized vehicles.			
23.	**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	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. • Strengthen the existing local health and medical services for the benefit of labor as well as the surrounding villages; • Ensure cleanliness and hygienic	• Implementation of HSE Plan • Use of PPEs • Community concerns record • Medical reports of worker	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	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	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.			
24.	**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	• 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	• Audits and Checks	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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	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.	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-VIII**.			
25.	**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 (Annex-IX) shall be adopted in case of any accidental discovery of cultural heritage.	• Implementation of chance find procedure	Construction Contractor	SC, Proponent
26.	**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.	• 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	• Implementation of Tree Plantation Plan • Visual Observations	Construction Contractor in association with PHA or Forest Department	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	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.	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; • 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			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		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.			
27.	**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	• 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;	• Visual Observations	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	earthworks 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	• 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.			
28.	**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	• 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	• Visual observations • Regular monitoring, audit and checks	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	residents. Furthermore, difference in cultural values may also cause discomfort to local residents.	inconvenience in accessibility to the locals.			
		O&M Phase			
29.	**Solid Waste Generation** No hazardous waste is expected to be generated in operation phase except during road maintenance works. However, miscellaneous municipal wastes from stations, refreshment and ticketing booths comprising wrappings, papers, eatables, empty cans or bottles, food residues and other similar wastes that will be thrown out of rail.	• 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; • 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; • Installation of sign boards for solid waste at all the stations of Yellow Line; and • Daily housekeeping of stations should be carried out to minimize the generation of waste.	• Implementation of WMP • Regular monitoring, sampling and testing • Regular monitoring, audit and checks	Proponent	
30.	**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	• 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;	• 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
	help in absorbing flue gases emitting from vehicles and public transport passing through the project area, which shall help to improve the air quality.	• 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.			

KEY

DC	Design Consultant
CC	Construction Contractor
SC	Supervision Consultant
PMA	Punjab Mass Transit 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 PMA 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.	• PMA • Contractor • PMA	• 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.	• PMA • Contractor • PMA	

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.	• PMA • Contractor • PMA	
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.	• PMA • Contractor • PMA	
5.	Fumes and gases	Monitoring of CO, CO_2, SOx, NO_x, Lead and $PM_{2.5}$ PM_{10}, Vehicular emissions and its compliance with PEQS 2016.	Sensitive receptors (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.	• PMA • Contractor • PMA	

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility	Duration
6.	Ecological Resources	Disturbance to natural habitat and uncontrolled floral cutting which can be avoidable.	Natural habitats within the AOI of the proposed project.	• Visual checks to ensure that only marked trees are cut within the Project corridor; and • Monitoring of Wildlife / birds hunting.	• Once before the start of construction activities; and • Visual inspection daily / weekly during construction and O&M phase.	• PMA • Contractor • PMA	
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, PMA. 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) PMA 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 (12 Months)						
Ambient Air Quality	CO, NO_2, SO_2, Lead, SPM, $PM_{2.5}$ and PM_{10}	1x3x4= 12	Quarterly @ Rs. 30,000 per sample	CC and SC	24 hours	360,000/-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x3x4= 12	Quarterly @ Rs. 2,000 per point	CC and SC	24 hours	24,000/-
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	1x2x4= 8	Quarterly @ Rs. 20,000 per sample	CC and SC	-	160,000/-
Surface Water Quality	**Physical Parameters:** Temperature, pH, Color, Total Dissolved Solids, and Total Suspended Solids	1x2x4= 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) =	***704,000/-***
B) Operation Phase (12 Months)						
Ambient Air Quality	CO, NO_2, SO_2, Lead, SPM, $PM_{2.5}$ and PM_{10}	1x3x2 = 6	Biannually @ Rs. 30,000 per sample	PMA	24 hours	180,000/-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x3x2 = 6	Biannually @ Rs. 2,000 per point	PMA	24 hours	12,000/-
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	PMA	-	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,	1x2x2 = 4	Biannually @ Rs. 20,000 per point	PMA	-	80,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Barium, Iron, Manganese, Boron and Total chloride					
					TOTAL (B) =	***352,000/-***
					GRAND TOTAL (A+B) =	***1,056,000/-***

KEY

CC	Construction Contractor	SC	Supervision Consultant
PMA	Punjab Mass Transit Authority		

Notes:

- Provision must be given in annual budget of operation phase for environmental monitoring. For this, the cost of operation phase (i.e. Rs. 352,000/-) 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, 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 the PHA, which has the requisite expertise and experience for such tasks. Detailed Tree Plantation Plan has been prepared by PHA after quantitative assessment of tree cutting involved for proposed project during design stage. The detailed tree plantation plan is attached as **Annex-X**.

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.

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

Provided by	Contents	Trainees	Duration
Monitoring, and Occupational Health and Safety	• 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.	PMA 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 PMA	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	PMA / SC
2	Quarterly	Contractors' environmental staff	PMA / SC
3	Semi-Annual Environmental Monitoring Report (SAEMR)	Construction Supervision Consultant (CSC)	PMA / SC
4	Annual Report	Contractors' environmental staff	PMA / SC
5	Completion Report	Contractors' environmental staff	PMA / 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 PMA 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 PMA 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

PMA 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 PMA website.

7.12 EMP COST

The contractor will be responsible for implementation of mitigation measures and environmental Monitoring during construction phase, whereas PMA 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. 6,000 per person for 200 employees *Pre-Construction Phase:* 200 x 6,000 x 1 = 1,200,000 *Construction Phase:* 200 x 6,000 x 2 = 4,000,000	2,400,000 /-	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. 4x20,000=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 @ 50,000/Month	600,000/-	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. 100,000 per month for 12 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/-	Health and Safety Cost for 200 Workers was calculated for PPEs and other site arrangements
6.	HSE Expert	HSE Expert to monitor / conduct all HSE related activities e.g. TBTs, PPEs, housekeeping, safety signage, emergency preparedness, etc. during construction and operational phase *Construction Phase:* 1 x 12 x 200,000 = 2,400,000	4,800,000/-	Cost for hiring HSE Experts along with their monthly logistics during construction and operational phase.

Sr. No.	Activity	Description	Cost (Rs.)	Rationale
		Operational Phase: 1 x 12 x 200,000 = 2,400,000		
7.	Environmental Testing Cost	Ambient air, drinking water, surface water and noise	1,056,000/-	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. 200,000/- per session during construction phase). 3 x 300,000 = 600,000	900,000/-	Refer to **Table 7.4** for details.
9.	Environmental Audit	Environmental Auditing through third party twice a year during construction and operational phase 2x 400,000 = 800,000 *Operational Phase:* 2 x 400,000 = 800,000	1,600,000/-	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 after detailed assessment to enhance the landscape of the project area. Plantation at available spaces may be carried out especially at the median.	40,000,000	Annex-X
		Total =	***56,097,500/-***	

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 56.097 Million**.

8 CONCLUSION AND RECOMMENDATIONS

8.1 GENERAL

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

8.2 CONCLUSION

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

- The project will involve destruction of vegetation cover on construction areas particularly along proposed project route.
- 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 phase;
- Oil spillages from construction machinery, resulting in soil and groundwater contamination;
- Cutting of trees/bushes/crops falling within the proposed CoI;
- Occupational and community health and safety issues; and
- Solid waste handling and disposal and waste water generation during operation phase.

8.3 RECOMMENDATIONS

An Environmental Monitoring/Management Plan (EMP) for both 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:

- Cutting of trees and disturbance of trees shall be avoided as far as possible and select the alternate route 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 route may

be considered for proposed project, in which minimum ecological and environmental losses are expected;

- NOC for tree cutting from the concerned authority is mandatory;
- Tree plantation plan should be implemented in true letter and spirit;
- The construction 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 PMA that cause minimal/no damage to the prevailing environmental conditions of the project area;
- Formulation and implementation of a comprehensive safety and security plan by contractor before the start of the construction activities for the camps which should be comprised of a training manual, use of safety equipment, emergency preparedness and code of ethics;
- Wearing of Personal Protective Equipment (PPEs) such as helmet, masks, adequate footwear for bituminous pavement works, protective goggles and gloves should be made compulsory during construction activities and formulation and implementation of Health and Safety Plan (HSP) for construction workers;
- Preparation and implementation of Solid Waste Management Plan during construction stage by contractor in close coordination with concerned authorities for collection, reuse, recycling and disposal of waste;
- Employment opportunities should be provided to local people for skilled and unskilled works during construction stage;
- A provision of adequate budget in the overall cost of the Project and on-site space for plantation as per guidelines of the concerned departments should be provided in the design of proposed 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.

ANNEXURES

ANNEX-I
TOOLS FOR BASELINE DATA

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED

Interview Schedule

Name of Interviewer _____ Date _____

Location / Home Town _____ Tehsil & District_____

A- Demographic Characteristics.

1. Name of the Respondent_____ Father Name _____
2. Cell #_____
3. Gender 1 Male_____ Female_____ Age. _____
4. What is your education level?

   I. Illiterate ___ II. Primary___ III. Middle _____IV. Metric _ V. Intermediate ___
   VI. Graduate & above _____

5. Profession _____
6. Marital Status

   1. Married_____ 2. Un-married_____
7. Language Spoken _____
8. Caste / Ethnic Group _____
9. Religion _____
10. What Type of your family system?

    1. Joint_____ 2. Nuclear _____
11. Total number of family members living with you.

    Male _____ Female_____ Total_____

B- Socio-Economic Characteristics.

12. What are the major sources of your household income?

    1. Govt, job_____ 2. Private job---------- 3. Labour _____ 4. Business_____
    5. Student _____ 6. Any other_____
13. What is your average monthly income? (Rs)

    1. Less than 10000 _____
    2. 10,000 – 17,500 _____ _
    3. 17,501 -- 30,000 _____
    4. 30,000 - 40, 000 _____
    5. Above 40,000 _____
14. How much is your average monthly expenditure? (Rs).

    1. Less than 10,000 _____
    2. 10,000 –20,000 _____
    3. 20,000 -30,000 _____
    4. 30,000 -40,000 _____
    5. above 40, 000 _____

15. Status of ownership (In case of shop keeper/business owner/ resident)?

1. Owner 2.Renter

16. What type of construction of your house (In case of resident)?

1. Pacca _____ 2. Semi Pacca _____ 3. Katcha _____

17. Do you have any livestock? Yes _____ No _____

18. If yes, how much? _____

If yes, what type of livestock do you have?

i. Sheep ____ ii. Goat _____
iii. Cow _____ iv. Poultry_____
v. Donkey____ vi. Horse _____
vii. Bull_____ viii. Buffalo _____

19. Do you have any Land?

i. Yes_____ ii. No_____ Acres_____

20. Major Crops:

i. Wheat _____
ii. Maize _____
iii. Cotton _____
iv. Sugarcane _____
v. Any Other _____

21. Possession of Household Items: ----------

22. Since how long are you living/working in this area?

Period _____

a) From which locality do you come here for business/ job?

Name of place_____ Distance_____

b) Why do you prefer this locality for business, job? _____

C- Civic Amenities.

23. Which of the following facilities available in your area?

1. Electricity__ 2. Water supply___ 3.Gas___ 4. Sewerage system____5. Telephone
6. _____Mobile service_____ 7. Metal Road_____

24. What are the sources of household water being used in the project area?

1. Govt supply _____ 2. Bore hole____3. Hand pumps _____4. Any other_____

25. Are you satisfied with the water quality?

1. Yes _____ 2. No _____

If no, then what are the reasons of dissatisfaction?

1. Odorous water _____ 2. Polluted water_____
3. Saline water _____ 4. No response _____

26. Is your house connected with sewerage system?

1. Yes 2. No

27. Are you satisfied with performance of current sewerage system in this area?

1. Yes 2. No

If no, then reasons _____
_____
_____

28. What is the source of energy for cooking and lightening in this area?

1. _____ 2. _____ 3. _____

29. During last one year did you borrow any money?

1. Yes_____ 2. No_____

a) If yes, then what were Sources of borrowing

I- Bank_____ II- Money Landers_____ III- Private _____

b) If, yes than how much money & what purpose _____

D- Social Institutions (Education & Health).

30. Which of the following Educational Facility is available in or nearby your residential area?

1. Primary 2. Middle 3. Matric 4. Above

Are you satisfied with existing educational facility in your area? 1. Yes 2. No

31. Which of the following Health Facility is present in or nearby your residential area?

1. BHU 2. RHC 3. THQ 4. Any Other Distance_____

Are you satisfied with existing Health facility? 1. Yes 2. No

32. What are the major common diseases in the area?

1. _____ 2. _____ 3. _____ 4. _____

33. Currently what mode of transport being used by you?

1. _____ 2. _____ 3. _____

a) Why do you prefer this road for travelling? _____

E- Cultural Characteristics.

34. Is there any shrine/mosque in this area?

1. Yes 2. No

If yes, then

Name_____ Place_____

35. Are there any Protected/ archaeological/historical site in this area?

1. Yes 2. No

If yes, then

Name_____ Place_____

Significance _____

36. Specify the existing Non -Government Organizations (NGOs) in your area and state of their area of work?

Name of Organization _____ Area of interest _____

37. Do you know that duailization and rehabilitation of existing road is going to be constructed? 1. Yes_____ 2. No_____

(If no then tell him about the proposed Project)

F- Assessment of Environmental & Social Impacts.

38. In your opinion should this project be implemented here?

1. Yes 2. No

If yes, then reasons if no, then reasons

39. Perceptions of Respondents for Action Associated With the Project?

Sr. No.	Possible impacts/effects of the Project	1	Increase	2	Decrease
1	Employment opportunities				
2	Industrial Development Opportunities				
3	Living standard				
4	Unemployment				
5	Loss of Land				
6	Resettlement				
7	Income generating activities				
8	Electricity Supply Quality				
9	Mobility (Access to Resources)				
10	Other specify				

40. Will you feel any disturbance during construction/operation of the Project?

i. Yes_____ ii. No_____

i. If yes, then type of disturbance

Sr. No.	Project Impact	Yes	Remarks
1	Loss of Structures		
2	Loss of Commercial Structure		
3	Loss of Land		
4	Trees to be Cut (Nos)		
5	Dust Generation		
6	Noise Pollution		
7	Any Other		

41. What protective measures do you suggest during construction to safeguard your interests?

Protective measures _____

42. In your opinion, what are some of the pressing needs of this area (other than proposed project)? _____

43. Any other observations by Interviewer during site visit? _____

Signature of Interviewer: _____

ANNEX-II
ENVIRONMENTAL MONITORING REPORT

PNAC LAB 208 ISO 17025

ASIAN ENVIRONMENTAL SERVICES PVT. (LTD)
www.asianenvirolab.com

ENVIRONMENTAL MONITORING & ANALYSIS REPORT

NLC CBD PACKAGE-I Lahore

- Ambient Air Monitoring
- Noise Level Monitoring
- Drinking Water Analysis
- Ground water Analysis

Reference No.: AES-FMO-NL-236/2023 | Dated: 07 November, 2023

Asian Environmental Services Pvt. Ltd.
has prepared this report as per prerequisites of client.
Any other individual using the content of this document shall do so at their own liability.
The client is responsible for lawful usage of this reported data.

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Client Details	
Name of Contact Person	Mr. Abid Ali Chana
Designation	Superintendent Office
Contact No.	0300-3086509
Email	nlcmucbd@gmail.com
Address	PMU NLC Infrastructure Development Works and Construction of Parking Plaza at CBD Walton (Phase-1, Package 1 & 2 Project Lahore

AES Details	
AES Director	Mr. Aleem Butt
Contact No.	0300-0303616
Email	info@asianenvirolab.com
Address	C-3, Jhelum Block, Green Forts-II, Lahore

Aleem Butt
Director Asian Environmental Services

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-FMO-NL-236/2023-AA-01	Monitoring Point	Near Construction Site CBD Package-I Lahore.
Date of Monitoring	31-10-2023 to 01-11-2023	Monitoring Coordinates	31°30'13" N 74°20'6" E

Sr. No.	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1	13:00	1.83	26.99	49.95	76.84	62.80
2	14:00	1.77	28.23	51.33	79.46	63.60
3	15:00	1.82	29.09	49.74	78.73	64.93
4	16:00	1.89	28.73	49.55	78.18	65.99
5	17:00	1.94	28.29	49.25	77.43	64.13
6	18:00	1.97	27.81	48.60	76.30	63.06
7	19:00	2.00	27.37	48.18	75.45	61.73
8	20:00	1.92	27.16	47.83	74.89	60.40
9	21:00	1.84	26.79	47.35	74.05	59.87
10	22:00	1.77	26.60	47.89	74.39	58.81
11	23:00	1.71	26.24	47.41	73.55	58.27
12	00:00	1.69	26.53	46.93	73.36	57.48
13	01:00	1.68	26.32	46.36	72.58	57.48
14	02:00	1.71	25.82	47.41	73.13	56.14
15	03:00	1.76	25.99	47.89	73.78	55.35
16	04:00	1.72	26.07	48.27	74.24	54.28
17	05:00	1.73	25.65	48.77	74.32	52.95
18	06:00	1.78	25.23	47.98	73.11	52.42
19	07:00	1.76	25.74	48.86	74.51	53.48
20	08:00	1.71	26.37	49.61	75.88	55.61
21	09:00	1.77	26.79	49.92	76.61	57.74
22	10:00	1.82	26.72	49.97	76.59	59.60
23	11:00	1.84	26.58	49.94	76.42	60.93
24	12:00	1.87	26.89	49.92	76.71	58.82
Average Concentration		1.80	26.83	48.71	75.44	58.99

Monitored By

Reviewed By (TM)

Approved By (QM)

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-FMO-NL-236/2023-AA-01	Monitoring Point	Near Construction Site CBD Package-I Lahore.
Date of Monitoring	31-10-2023 to 01-11-2023	Monitoring Coordinates	31°30'13" **N** 74°20'6" **E**

Parameters	Units	Monitoring Duration	LDL	Average Obtained Concentration	PEQS	Remarks
Nitrogen Dioxide (NO_2) *	µg/m³	24 Hours	1.00	48.71	80.0	Optimal
Nitrogen Oxide (NO)*	µg/m³	24 Hours	1.00	26.83	40.0	Optimal
NO_x*	µg/m³	24 Hours	1.00	75.44	120.0	Optimal
Sulphur Dioxide (SO_2) *	µg/m³	24 Hours	1.00	58.99	120.0	Optimal
Carbon Monoxide (CO)*	mg/m³	24 Hours	0.01	1.80	05.0	Optimal
Ozone (O_3)	µg/m³	01 Hours	1.00	45.67	130	Optimal
Particulate Matter (PM_{10}) *	µg/m³	24 Hours	1.00	**191.51**	150	High
Particulate Matter ($PM_{2.5}$) *	µg/m³	24 Hours	1.00	**67.54**	35	High

*Parameters are approved from Punjab Environment Protection Agency.

Abbreviations:
LDL= Lower Detection Limit PEQS= Punjab Environmental Quality Standards µg/m³ = Micro Gram per Meter Cube

Remarks:
Optimal = Compliance with Permissible Range **Marginal** = Close to Extreme Edge **High** = Exceeds from Permissible Range
Low = Less Than Permissible Range

Monitored By

Reviewed By (TM)

Approved By (QM)

Document No. AES/LMS/FRM-110, Date of Issue 01 April, 2022, Revision No. 01

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Ambient Air Monitoring Report

Reference Number

Reference Number	AES-FMO-NL-236/2023-AA-01	Monitoring Point	Near Construction Site CBD Package-I Lahore.
Date of Monitoring	31-10-2023 to 01-11-2023	Monitoring Coordinates	31°30'13" N 74°20'6" E

Sr. No.	Time	Ambient Temperature ^{0}C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
1	13:00	36	NE	4.5	42	758.80
2	14:00	36	NE	4.7	41	758.90
3	15:00	37	NE	4.4	40	759.40
4	16:00	37	NE	4.1	40	759.70
5	17:00	37	NE	3.7	39	759.10
6	18:00	37	E	3.1	39	758.70
7	19:00	36	E	2.9	40	758.40
8	20:00	36	E	2.7	41	757.80
9	21:00	36	E	2.3	42	757.40
10	22:00	35	SE	1.9	44	757.10
11	23:00	34	SE	1.7	45	756.70
12	00:00	34	SE	1.4	46	756.30
13	01:00	34	SE	1.2	47	755.90
14	02:00	33	SE	1.4	47	755.50
15	03:00	33	E	1.5	47	755.10
16	04:00	32	E	1.7	46	754.70
17	05:00	31	E	1.9	46	755.20
18	06:00	31	SE	2.3	46	755.80
19	07:00	30	SE	2.6	45	756.30
20	08:00	31	SE	2.8	44	756.90
21	09:00	32	SE	3.2	44	757.40
22	10:00	33	N	3.5	43	757.90
23	11:00	34	N	3.9	43	758.30
24	12:00	35	N	3.9	42	758.50

Monitored By

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Noise Monitoring Report

Monitoring Details

Reference Number	AES-FMO-NL-236/2023-AA-01	Monitoring Point	Near Construction Site CBD Package-I Lahore.
Date of Monitoring	31-10-2023 to 01-11-2023	Monitoring Coordinates	31°30'13" N 74°20'6" E

Sr. No.	Time	Noise dB(A)		PEQS
1	13:00	64		
2	14:00	65		
3	15:00	66		
4	16:00	64		
5	17:00	63	Day Time	75
6	18:00	62		
7	19:00	62		
8	20:00	60		
9	21:00	60		
10	22:00	59		
11	23:00	59		
12	00:00	57		
13	01:00	56		
14	02:00	56	Night Time	65
15	03:00	55		
16	04:00	57		
17	05:00	54		
18	06:00	57		
19	07:00	59		
20	08:00	60		
21	09:00	62		
22	10:00	62	Day Time	75
23	11:00	64		
24	12:00	66		

Monitored By

Reviewed By (TM)

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Reference No.	AES-FMO-NL-236/2023-DW-190	Reporting Date	07-11-2023
Nature of Sample	Drinking Water	Sampling Method Reference	AES/LMS/QSP-014
Grab/Composite	Grab	Sample Collected by	AES
Sampling Date	31-10-2023	Sample Receiving Date	01-11-2023
Analysis Completion Date	06-11-2023	Lab Temp & Humidity	24.6°C & 52 %
Ambient Temperature & Humidity at the Time of Sampling			36°C & 42%
Sample ID	AES-FMO-DW-190/2023	Sampling Location	DW from Water Cooler
Client Details	NLC CBD Package-I , Lahore.		

Drinking Water Analysis Results

Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
Lab Analysis					
Color*	SMWW 2120 C	≤ 15 TCU	0	N.A.	Optimal
Taste*	SMWW 2160 C	Non-Objectionable	Non-Objectionable	N.A.	Optimal
Odor*	SMWW 2150 B	Non-Objectionable	Non-Objectionable	N.A.	Optimal
Turbidity*	SMWW 2130 B	< 5 NTU	0	N.A.	Optimal
Total Hardness (as $CaCO_3$) **	SMWW 2340 C	< 500 mg/L	204	± 1.79	Optimal
Total Dissolved Solids (TDS)**	SMWW 2540 C	< 1000 mg/L	427	± 8.02	Optimal
pH**	SMWW 4500 H^+ B	6.5- 8.5	8.01	± 0.04	Optimal
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	<0.005	N.A.	Optimal
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005	N.A.	Optimal
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	<0.005	N.A.	Optimal
Barium (Ba)	SMWW 3113 B	0.7 mg/L	<0.0035	N.A.	Optimal
Boron (B)	SMWW 3113 B	0.3 mg/l	<0.02	N.A.	Optimal
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	<0.006	N.A.	Optimal
Chloride (Cl^-) **	SMWW 4500 Cl^- B	< 250 mg/L	16	± 1.73	Optimal
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	<0.004	N.A.	Optimal
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.164	N.A.	Optimal
Cyanide (CN^-)*	SMWW 4500 CN^- F	≤ 0.05 mg/L	0	N.A.	Optimal
Fluoride (F^-)**	SMWW 4500 F^- C	≤ 1.5 mg/L	0.17	± 0.103	Optimal
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	<0.005	N.A.	Optimal
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	<0.015	N.A.	Optimal
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001	N.A.	Optimal
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	<0.02	N.A.	Optimal
Nitrate (NO_3^-) *	SMWW 4500 NO_3^- B	≤ 50 mg/L	5.77	± 1.21	Optimal
Nitrite (NO_2^-) *	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0	N.A.	Optimal
Selenium (Se)	SMWW 3114 B	0.01 mg/L	<0.01	N.A.	Optimal
Residual Chlorine (Cl_2) *	SMWW 4500 Cl^- B	0.5 mg/L	0	N.A.	Optimal

07-11-2023

Document No. AES/LMS/FRM-110, Date of Issue 01 April, 2022, Revision No. 01

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Reference No.	AES-FMO-NL-236/2023-DW-190	Reporting Date	07-11-2023
Nature of Sample	Drinking Water	Sampling Method Reference	AES/LMS/QSP-014
Grab/Composite	Grab	Sample Collected by	AES
Sampling Date	31-10-2023	Sample Receiving Date	01-11-2023
Analysis Completion Date	06-11-2023	Lab Temp & Humidity	24.6°C & 52 %
Ambient Temperature & Humidity at the Time of Sampling			36°C & 42%
Sample ID	AES-FMO-DW-190/2023	Sampling Location	DW from Water Cooler
Client Details	NLC CBD Package-I , Lahore.		

Drinking Water Analysis Results

Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
Phenolic Compounds (as Phenols) *	SMWW 5530 D	NGVS	0	N.A.	-
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.040	N.A.	Optimal
Microbiological Analysis					
Total Coliforms*	SMWW 9222 B	0 CFU/ 100 mL	0	N.A.	Optimal
Fecal Coliforms *	SMWW 9222 D	0 CFU/ 100 mL	0	N.A.	Optimal

*Parameters are approved from Punjab Environment Protection Agency.

**Parameters are accredited from Pakistan National Accreditation Council.

The reported expanded uncertainty is based on combined standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

Abbreviations:

PEQS = Punjab Environment Quality Standards
SMWW = Standard Methods for the examination of Water and Wastewater
TCU = True Color Unit
N.A. = Not Available
CFU = Colony forming Unit
NTU = Nephelometric Turbidity Unit
MU = Measurement Uncertainty
NGVS = No Guideline Value Set

Remarks:

Optimal = Compliance with Permissible Range
Marginal = Close to Extreme Edge
High = Exceeds from Permissible Range
Low = Less Than Permissible Range

Report Disclaimer

- The remaining portion of the sample (s) will be disposed off after 15 days after the issuance date of report from the laboratory unless otherwise instructed (Condition Apply).
- This report shall not be reproduced in part/parties.
- The provided results relate only to the sample provided/collected.
- Values reflect the testing results; decision for usage of report totally depends on client.

Analyzed By 01/11/23

Reviewed By (TM) 07-11-2023

Approved By (QM)

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GROUND WATER ANALYSIS REPORT

Sample Detail

Reference No.	AES-FMO-NL-236/2023-GW-139	Reporting Date	07-11-2023
Nature of Sample	Ground Water	Sampling Method Reference	AES/LMS/QSP-014
Grab/Composite	Grab	Sample Collected by	AES
Sampling Date	31-10-2023	Sample Receiving Date	01-11-2023
Analysis Completion Date	06-11-2023	Lab Temp & Humidity	24.6°C & 52 %
Ambient Temperature & Humidity at the Time of Sampling			36°C & 42%
Sample ID	AES-FMO-GW-139/2023	Sampling Location	DW from Water Cooler
Client Details	NLC CBD Package-I , Lahore.		

Ground Water Analysis Results

Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
Lab Analysis					
Color*	SMWW 2120 C	≤ 15 TCU	0	N.A.	Optimal
Taste*	SMWW 2160 C	Non-Objectionable	Non-Objectionable	N.A.	Optimal
Odor*	SMWW 2150 B	Non-Objectionable	Non-Objectionable	N.A.	Optimal
Turbidity*	SMWW 2130 B	< 5 NTU	0	N.A.	Optimal
Total Hardness (as $CaCO_3$) **	SMWW 2340 C	< 500 mg/L	474	± 5.14	Optimal
Total Dissolved Solids (TDS)**	SMWW 2540 C	< 1000 mg/L	817	± 8.02	Optimal
pH**	SMWW 4500 H^+ B	6.5- 8.5	7.40	± 0.04	Optimal
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	<0.005	N.A.	Optimal
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005	N.A.	Optimal
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	<0.005	N.A.	Optimal
Barium (Ba)	SMWW 3113 B	0.7 mg/L	<0.0035	N.A.	Optimal
Boron (B)	SMWW 3113 B	0.3 mg/L	<0.02	N.A.	Optimal
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	<0.006	N.A.	Optimal
Chloride (Cl^-) **	SMWW 4500 Cl^- B	< 250 mg/L	51	± 1.73	Optimal
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	<0.004	N.A.	Optimal
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.165	N.A.	Optimal
Cyanide (CN^-)*	SMWW 4500 CN^- F	≤ 0.05 mg/L	0	N.A.	Optimal
Fluoride (F^-)**	SMWW 4500 F^- D	≤ 1.5 mg/L	0.22	± 0.103	Optimal
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	<0.005	N.A.	Optimal
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/L	<0.015	N.A.	Optimal
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001	N.A.	Optimal
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	<0.02	N.A.	Optimal
Nitrate (NO_3^-) *	SMWW 4500 NO_3^- D	≤ 50 mg/L	7.66	± 1.21	Optimal
Nitrite (NO_2^-) *	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0	N.A.	Optimal

07-11-2023

Document No. AES/LMS/FRM-110, Date of Issue 01 April, 2022, Revision No. 01

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ASIAN ENVIRONMENTAL SERVICES PVT. (LTD)
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GROUND WATER ANALYSIS REPORT

Sample Detail

Reference No.	AES-FMO-NL-236/2023-GW-139	Reporting Date	07-11-2023
Nature of Sample	Ground Water	Sampling Method Reference	AES/LMS/QSP-014
Grab/Composite	Grab	Sample Collected by	AES
Sampling Date	31-10-2023	Sample Receiving Date	01-11-2023
Analysis Completion Date	06-11-2023	Lab Temp & Humidity	24.6°C & 52 %
Ambient Temperature & Humidity at the Time of Sampling			36°C & 42%
Sample ID	AES-FMO-GW-139/2023	Sampling Location	DW from Water Cooler
Client Details	NLC CBD Package-I , Lahore.		

Ground Water Analysis Results

Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
Selenium (Se)	SMWW 3114 B	0.01 mg/L	<0.01	N.A.	Optimal
Residual Chlorine (Cl_2) *	SMWW 4500 Cl- B	0.5 mg/L	0	N.A.	Optimal
Phenolic Compounds (as Phenols) *	SMWW 5530 D	NGVS	0	N.A.	-
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.042	N.A.	Optimal
Microbiological Analysis					
Total Coliforms*	SMWW 9222 B	0 CFU/ 100 mL	0	N.A.	Optimal
Fecal Coliforms *	SMWW 9222 D	0 CFU/ 100 mL	0	N.A.	Optimal

*Parameters are approved from Punjab Environment Protection Agency.

**Parameters are accredited from Pakistan National Accreditation Council.

The reported expanded uncertainty is based on combined standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

Abbreviations:

PEQS = Punjab Environment Quality Standards
SMWW = Standard Methods for the examination of Water and Wastewater
TCU = True Color Unit
N.A. = Not Available
CFU = Colony forming Unit
NTU = Nephelometric Turbidity Unit
MU = Measurement Uncertainty
NGVS = No Guideline Value Set

Remarks:

Optimal = Compliance with Permissible Range
Marginal = Close to Extreme Ecge
High = Exceeds from Permissible Range
Low = Less Than Permissible Range

Report Disclaimer

- The remaining portion of the sample (s) will be disposed off after 15 days after the issuance date of report from the laboratory unless otherwise instructed (Condition Apply).
- This report shall not be reproduced in part/parties.
- The provided results relate only to the sample provided/collected.
- Values reflect the testing results; decision for usage of report totally depends on client.

Analyzed By: 07/11/23

Reviewed By (TM): 07-11-2023

Approved By (QM): 07/11/2023

----------End of Report----------

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ANNEX-III
EMERGENCY RESPONSE PLAN

GUIDELINE EMERGENCY PREPAREDNESS AND RESPONSE PLAN

1.1 PURPOSE

The purpose of this Emergency Response Procedure is to provide measures and guidance for the establishment and implementation of emergency preparedness plans for the project. The aim of the Emergency Response Procedure is to:

i. Ensure all personnel and visitors to the office/job sites are given the maximum protection from unforeseen events.
ii. Ensure all personnel are aware of the importance of this procedure to protection of life and property.

1.2 EMERGENCY PREPARATION AND RESPONSE MEASURE SCOPE

The emergency management program is applied to all Project elements and intended for use throughout the Project life cycle. The following are some emergencies that may require coordinated response.

i. Construction Accident
ii. Road & Traffic Accident
iii. Hazardous material spills
iv. Structure collapse or failure
v. Trauma or serious illness
vi. Sabotage
vii. Fire
viii. Environmental Pollution
ix. Loss of person
x. Community Accident

1.3 RESPONSIBILITIES

The detailed roles and responsibilities of certain key members of the Emergency Response team available to assist in emergency are provided in **Table 1** below.

Table 1: Emergency Response Team

Action Group	Responsibility
Emergency Coordinator	▪ Overall control of personnel and resources. ▪ The Emergency Coordinator will support and advise the Site Safety Supervision as necessary. ▪ Serves as public relations spokes persons, or delegates to some staff member the responsibility for working with news media regarding any disaster or emergency. Also assure proper coordination of news release with appropriate corporate staff or other designated people.
Site Safety Supervision (Emergency Commander)	▪ Overall responsibility for activating emergency plan and for terminating emergency actions. ▪ Be alternative of emergency response chairpersons. ▪ Disseminates warnings and information as required to ensure all people in the immediate area have been warned and evacuated either by alarms or by word of mouth. ▪ Supervise the actions of the Emergency Response Team to ensure all persons are safe from the danger. ▪ Notify outside authorities if assistance is required. ▪ Carries the responsibility for coordinating actions including other organizations in accordance with the needs of the situation.

Action Group	Responsibility
	▪ Ensure maximum co-operation and assistance is provided to any outside groups called to respond to an emergency. ▪ Establish and appoint all emergency organization structure and team. ▪ Assures adequate delegation of responsibilities for all key positions of assistants on the Project to assist with any foreseeable emergency. ▪ Ensure resources available to purchase needed emergency response equipment and supplies. ▪ Assures that all persons on the Emergency Response Team aware and fully understand their individual responsibilities for implementing and supporting the emergency plan. ▪ Establish the emergency drill schedule of all identified emergency scenarios, track the status and evaluate the emergency. ▪ The Emergency Commander shall ensure that senior management personnel have been reported of the emergency as soon as practical after the event.
Security Team	▪ Ensure that the exit route is regularly tested and maintained in good working order. ▪ Maintain station at the security gate or most suitable location to secure the area during any emergency such that only authorized personnel and equipment may enter, prevent access to the site of unauthorized personnel. ▪ Assist with strong/activation of services during an emergency. ▪ Ensure vehicles and obstructions are moved to give incoming emergency vehicles access to the scene, if ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct any incoming emergency service to the site of emergency.
Rescue & Medical Team	▪ Protect the injured from further danger and weather. ▪ Provide treatment to the victim(s) to the best of their ability by first aid and then transfer to hospital. ▪ Remain familiar with the rescue activities and rescue apparatus. ▪ Assist outside medical services personnel when they arrive
General Administration Team	Response to support any requested general facilities for assisting Emergency Response Team in their work.
Government Relation Team	▪ Coordinate with local government on a matter of concerned in the emergency response plan to liaise with local officers in their affair for support Emergency Response Team. ▪ Coordinate emergency plan with the government authorities, local community.
Environment Team	In case of emergency related to the environmental pollution such as the chemical spill, oil spill into the ambient, the environment team will support the technical advice to control and mitigate the pollution until return to the normal situation.
Department Heads	▪ Call up of personnel into the safe location for protective life and property. ▪ Take immediate and appropriate action while Emergency Response Team is being mobilized. ▪ Keep in touch with the Emergency Commander ▪ Control and supervise operators and contractors on the implementation of this procedure, with consultation with Safety Team as necessary. ▪ Provide and maintain emergency equipment of their responsible areas.

Action Group	Responsibility
Other Staff and Employees	▪ All other staff and employees will remain at their workstations or assembly point unless directed otherwise from Emergency Response Team. ▪ Each supervisor will ensure that all members of his work group are accounted for and keep in touch with each of their Department Head.

1.4 PROCEDURE

Emergency situation and injuries to person can occur at any time or place either on Project site or elsewhere. The most two common types of emergencies on site are fire and serious accident.

Figure 3.1 Emergency Procedures for Fire

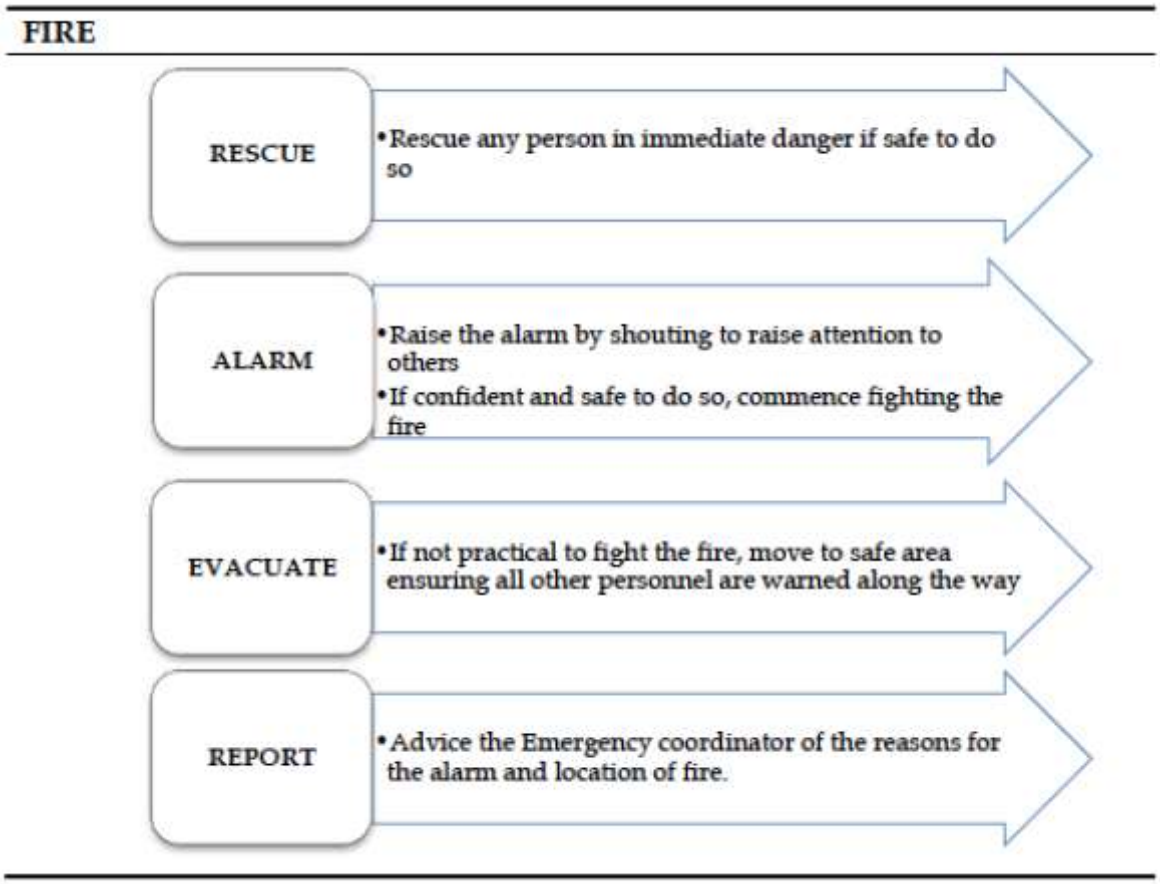
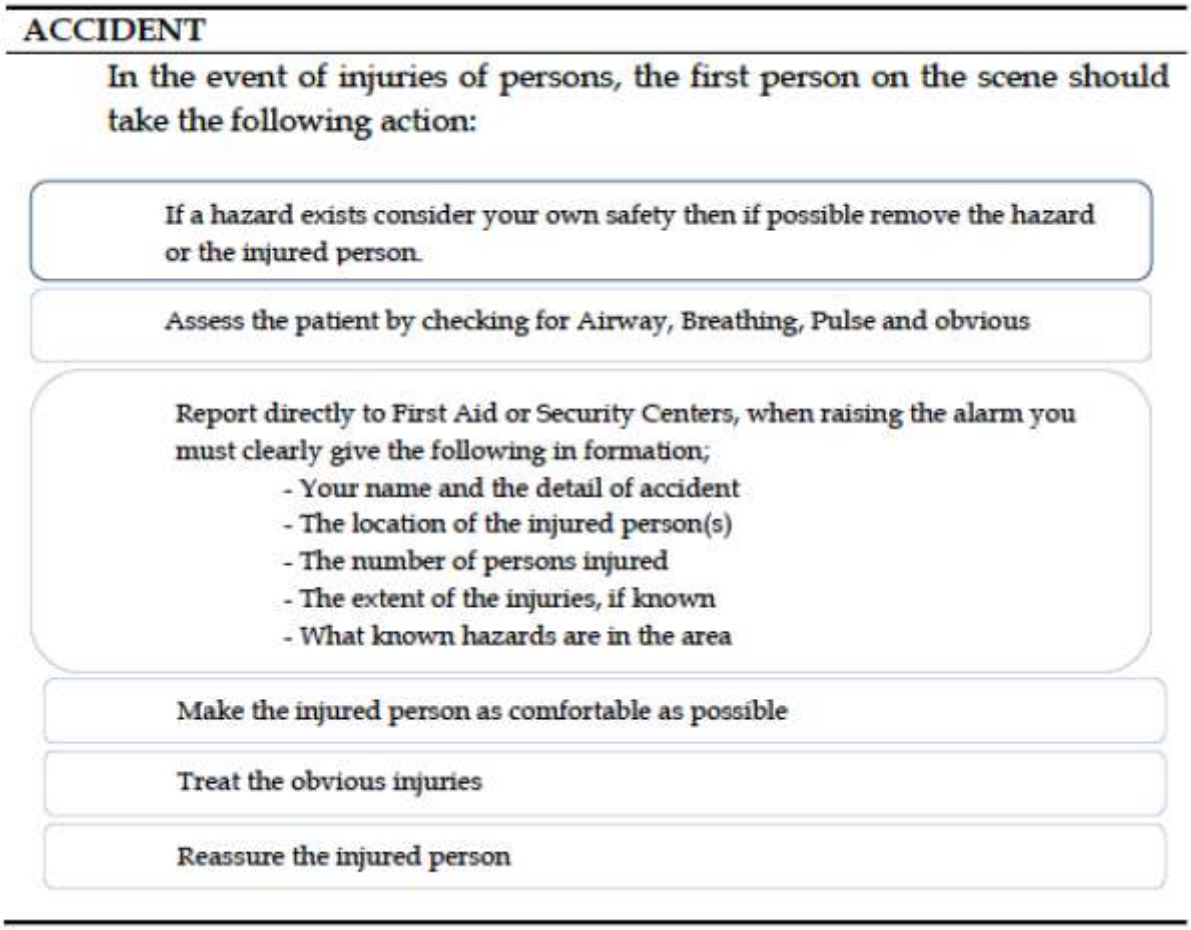


Figure 3.2 Emergency Procedures for Serious Accident



3.5 COMMUNICATION WITH AUTHORITIES / PRESS AT SITE

In the event of an accident or incident, only senior staff is permitted to give factual information to the authorities for resource of liability exposure. The press must be avoiding politely, at all costs, with the terse comment that “the matter is under investigation and relevant information when available will be provided by our Head Office” Do not ever give your opinion or story.

1.5 FIRST AID PERSONS

Upon advice of medical emergency, make immediate assessment to response required and if necessary, advise security to summon ambulance or medical assistance, the qualified first aid attendant should also,

- Provide treatment to the victim(s) to the best of his/her ability.
- Ensure the safety of victims by ceasing any work activity in the area.
- Protect the injured from further danger and weather.
- Assist medical services personnel when they arrive.

1.6 GENERAL ADMINISTRATION TEAM

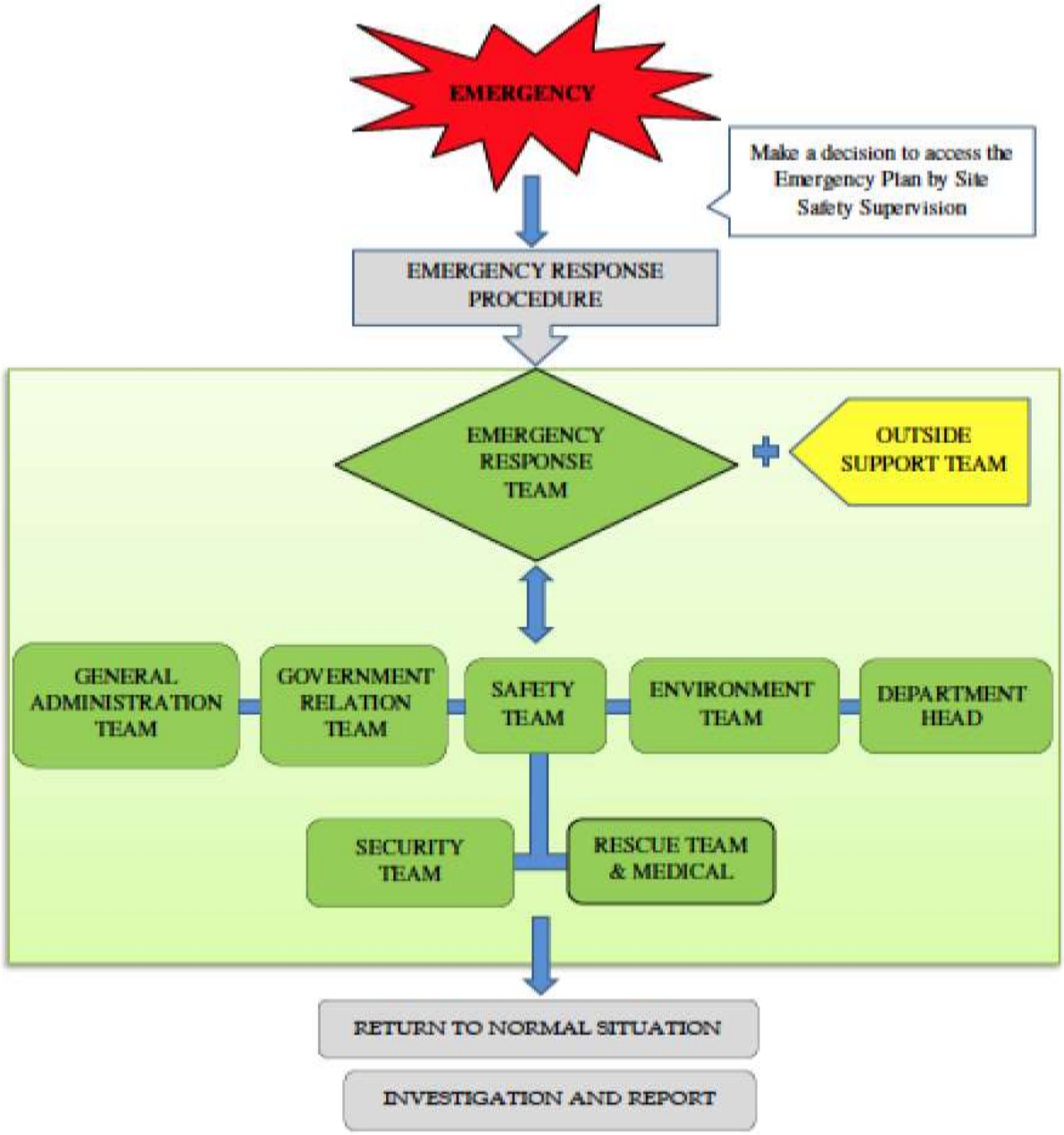
Upon advice of medical emergency, maintain contact with first aid personnel and summon ambulance if required.

1.7 SECURITY TEAM

- If ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct vehicle closest to the scene.
- Prevent access to the site of unauthorized personnel (press, etc.).

1.8 EMERGENCY COORDINATOR

- The Emergency Coordinator shall assist emergency personnel at the scene as required through allocation of company resources.
- The Emergency Coordinator shall ensure next-of-kin are properly notified as soon as possible and give whatever company support and assistance is necessary to assist them bundle the situation
- The Emergency Coordinator shall ensure that senior management personnel are advised of the emergency as soon as practical after the event.



Note: Name of contact person and call number from Owner/Contractor to be determined.

1.9 INCIDENT AND ACCIDENT REPORT

Section A: Identification Data

Report No:	Date of Reported:	Reporter:	Sign:
Job Title:		Company Name:	

Section B: Violence Rate

Accident Violence: ☐ 01-Death ☐ 02-Serious Injury ☐ 03-Lost Time Injury ☐ 04-First Aid ☐ 05- Not Injury ☐ 06-Near Miss

Property Damage Cost: ☐ 1-2,000 USD ☐ 2,001-10,000 USD ☐ 10,001-50,000 ☐ > 50,001

Section C: Environmental Impact

Affected area	☐ Construction area	☐ Public area	
Receptor	☐ None	☐ Workers	☐ Community
Type of pollution	☐ Physical	☐ Chemical	☐ Biological
Toxicity	☐ Non-toxic	☐ Low - toxic	☐ High - toxic
Return to Normal	☐ 1 day	☐ 1 day to 1 week	☐ ≥ 1 week
Cumulative impact	☐ Non-cumulative	☐ Cumulative	

Section D: Injured/Illness Employee

1.Name:	Sex:	Date of Birth: Month	Day	Year	Age:	Regular Job Title:	Experience: In this job title Years Weeks	In this Project Years Weeks
	☐ Male ☐ Female							

Site:	Company:	Reference:	Phone No:	Social Security Number

Part of Body Injured or Affected:

☐ Head ☐ Hands ☐ Face ☐ Nose
☐ Eyes ☐ Legs ☐ Teeth ☐ Neck
☐ Trunk ☐ Toes ☐ Elbow ☐ Shoulder
☐ Back ☐ Ankle ☐ Wrist ☐ Foot
☐ Arms ☐ Thump ☐ Fingers ☐ Internal

Remark: .....

Nature of Injury or Illness:

☐ Laceration ☐ Amputation ☐ Puncture ☐ Fracture
☐ Strain & Sprain ☐ Burns ☐ Contusion ☐ Dry Heat Friction
☐ Hernia ☐ Foreign Body ☐ Chemical ☐ Contamination
☐ Skin (Occupationnel) ☐ Rash ☐ Irritation

Remark: .....

2.Name:	Sex:	Date of Birth: Month	Day	Year	Age:	Regular Job Title:	Experience: In this job title Years Weeks	In this Project Years Weeks
	☐ Male ☐ Female							

Site:	Company:	Reference:	Phone No:	Social Security Number

Part of Body Injured or Affected:

☐ Head ☐ Hands ☐ Face ☐ Nose
☐ Eyes ☐ Legs ☐ Teeth ☐ Neck
☐ Trunk ☐ Toes ☐ Elbow ☐ Shoulder
☐ Back ☐ Ankle ☐ Wrist ☐ Foot
☐ Arms ☐ Thump ☐ Fingers ☐ Internal

Remark: .....

Nature of Injury or Illness:

☐ Laceration ☐ Amputation ☐ Puncture ☐ Fracture
☐ Strain & Spain ☐ Burns ☐ Contusion ☐ Dry Heat Friction
☐ Hernia ☐ Foreign Body ☐ Contamination ☐ Chemical
☐ Skin (Occupationnel) ☐ Rash ☐ Irritation

Remark: .....

Section E: Accidents/incident Details

Date Accident/Incident Occurred:	Time Accident/Incident Occurred:	Exact Location of the Accident / Incident:

Details of the actual Job Being done at the time:

Details of Accident / Incident / What actually happened?

Section F: Accident Cause (Basic cause mark X / Contributing cause, if any mark O)

UNSAFE CONDITIONS		UNSAFE ACTS	
1	☐ Inadequately Guarded	1	☐ Operating Without Authority / Training
2	☐ Unguarded	2	☐ Operating at Unsafe Speed
3	☐ Defective Tools, Equipment, or Subetance	3	☐ Marking SHE Device Inoperative
4	☐ Unsafe Design or Construction	4	☐ Using Unsafe Equipment or Equipment Unsafely
5	☐ Hazardous Arrangement	5	☐ Unsafe Loading, Placing, Mixing
6	☐ Unsafe Illumination	6	☐ Taking Unsafe Position
7	☐ Unsafe Ventilation	7	☐ Working on Moving or Dangerous Equipment
8	☐ Unsafe Clothing	8	☐ Distraction, Teasing, Horse Play
9	☐ Insufficient Instruction	9	☐ Failure to use Personal Protective Devices
10	☐ Lack of system of work	10	☐ Lack of effective instruction or supervision

Why was the unsafe act committed? _____ Why did the unsafe condition exist? _____

Section G: Guide to Corrective Action (Base on the cause checked above, I am taking the following corrective action)

UNSAFE ACT	UNSAFE CONDITION	If Supervisor can't handle, then recommend to
☐ Stop the Behaviour	☐ Remove	☐ Site Engineer, or
☐ Study the job	☐ Guard	☐ Site Manager, or
☐ Instruct (tell-show-try-check)	☐ Warn	☐ Project Manager, or
☐ Follow Up	☐ Supervisory Training	☐ Safety Committee
☐ Enforce		

Detail below any immediate remedial actions that have been taken:

Detail below any corrective and preventative actions that could be taken to prevent future re-occurrence:	Responsible	Completion Date

Section H: Witness Statement	
Witness Name	Interviewer Name

Section I: Reviewed & Recommend by			
Recommendation:			
Reviewed By:	Position:	Signature:	Date:

Remarks : If Accident or Incident happened with lost time injury and affected to the publicity must further report to Safety Department;
: First Aid Cases will not applicable to this form;
: The accident report shall submit to Safety Department within 3 days
: Attached the photograph or sketch the location of accident / incident;

1.10 SUGGESTED CONTENTS OF EPRP

The Contractor should prepare the EPRP based on the guidelines provided in the above sections. The suggested structure of the EPRP is listed below:

1. Purpose
2. Applicable Scope
3. Preparation Basis
4. Emergency Response System
   - 4.1 Generals
   - 4.2 Emergency Response System
   - 4.3 Responsibilities
5. Major Safety Risks
6. Precautionary Measures
   - 6.1 Training and Exercise
   - 6.2 Hazard Source Monitor
   - 6.3 Alert Action
   - 6.4 Management Measures
7. Control Measures
   - 7.1 Response
   - 7.2 Response Procedures
   - 7.3 Emergency Response
   - 7.4 Emergency Completion and Restoration
8. Emergency Response Report and Settlement
9. Supporting Measures
   - 9.1 Communication
   - 9.2 Emergency Team
   - 9.3 Funding for Emergency
   - 9.4 Provisions and Resources
10. Records

ANNEX-IV
GUIDELINE QUARRY MANAGEMENT PLAN

Quarry Management Plan

1.0 Introduction

After the completion of construction phase of the proposed project, it is the responsibility of the contractor to restore the site that has been disturbed due to construction activities.

2.0 General Quarry Planning and Progressive Rehabilitation

A well-considered quarry development plan prior to starting work, or when opening up new areas will greatly reduce the effort required to achieve appropriate leading practice environmental and safety outcomes for quarry rehabilitation and closure.

The selection of a site, sequencing of quarrying and rehabilitation and final land-use should all be carefully planned prior to commencement of work at a quarry or borrow pit.

2.1 Progressive Rehabilitation

Progressive rehabilitation refers to the rehabilitation of completed parts of a quarry while extractive operations continue in other parts of the quarry. As new quarry sections are opened, worked out areas should be progressively rehabilitated to avoid increasing the total disturbed area of a quarry. Overburden and topsoil can be stripped from areas being opened up and placed directly onto worked out areas which are being rehabilitated. This will avoid double handling of materials and prevent degradation of the topsoil.

Progressive rehabilitation helps to minimize the visual impact of a quarry, control dust and erosion. It also assists in fostering good landowner and community relations.

Recommended progressive rehabilitation practices are:

- Agree on the final land form and use of a site with the relevant landowner.
- Rehabilitate in accordance with the intended final use of the land.
- Plan and develop the quarry in stages towards terminal areas so that progressive rehabilitation works can commence as soon as possible).
- Once the final landform is established, re-vegetate areas to stabilize the landform and to give the vegetation maximum time to establish while the quarry is still in operation.

2.2 Re-vegetation

Establishing a self-sustaining cover of vegetation is the best way to stabilize disturbed sites in the long term. Re-vegetation also minimizes the visual impact of quarries. Generally, the vegetation type which existed before the disturbance, or a similar vegetation type will regenerate most successfully.

Prior to the commencement of a quarrying activity the type of re-vegetation should be agreed with the landowner, and should be consistent with the proposed final land-use.

Some indigenous plant species may not thrive in areas where soil conditions are substantially different after quarrying. If this is the case, and the objective is to re-establish vegetation, which fulfils the function of the original native vegetation, then some species from outside the quarry area, may have to be introduced. Care must be taken to avoid introducing a species, which could become an unacceptable fire hazard, invade surrounding areas of native vegetation or become agricultural weeds.

Where agriculture is the planned land-use then the species planted should be those commonly used for pasture or crops known to be successful on soils of similar texture, drainage status, pH and fertility. Suitable legumes should always be considered for their ability to improve soil fertility.

3.0 Rehabilitation of Borrow Pits

Borrow pits are areas either in a road reserve or adjacent land holdings that have been used to extract materials such as gravels and soils. They can vary considerably in size, depending on the quantity of material taken and the borrow pits' reserve body of remaining material. The variable size, shape and nature of borrow pits preclude very specific recommendations; however the following general conditions apply:

- Before extraction commences, licenses and permits should be checked and limits of disturbance and/or clearing must be clearly marked out on the site before any ground disturbing activity takes place; and
- At the completion of extraction, the former borrow pit must be made stable and safe. This usually requires the sides of the pit to be reshaped with gentle safe grades. All disturbed areas associated with borrow pits must be retopsoiled, seeded, fertilized and mulched (if appropriate) as part of the restoration plan. Main Roads has been discouraging the conversion of borrow pits to stock watering points.

ANNEX-V
WASTE MANAGEMENT PLAN

CONSTRUCTION WASTE MANAGEMENT PLAN

1. GENERAL INTRODUCTION

Construction work refers to a wide range of materials depending on their origin; they are categorized as excavation material, demolition materials and worksite waste material. Construction waste material of the proposed project consists mainly of concrete, bentonite, masonry, limestone, sandstone, metal, and wood. In addition to this, significant amount of municipal waste will also generates from the construction camps.

2. ORIGINS AND CAUSES OF CONSTRUCTION WASTE

Origins of Waste	Causes of Waste
Contractual	▪ Errors in contract documents; and ▪ Contract documents incomplete at commencement of construction.
Design	▪ Design changes; ▪ Design and detailing complexity; ▪ Design and construction detail errors; ▪ Unclear and unsuitable specifications; and ▪ Poor coordination and communication (late information, last minute client requirements, slow drawing revision and distribution).
Procurement	▪ Ordering errors (i.e. ordering items not in compliance with specification); ▪ Over allowances (i.e. difficulties to order small quantities); and ▪ Supplier errors.
Transportation	▪ Damage during transportation; ▪ Difficulties for delivery vehicles accessing construction sites; ▪ Insufficient protection during unloading; and ▪ Inefficient methods of unloading
On-Site Management and Planning	▪ Lack of on-site waste management plans; ▪ Improper planning for required quantities; ▪ Delays in passing information on types and sizes of materials and components to be used; ▪ Lack of on-site material control; and ▪ Lack of supervision.
Material Storage	▪ Inappropriate site storage space leading to damage or deterioration; ▪ Improper storing methods; and ▪ Materials stored far away from point of application.
Material Handling	▪ Materials supplied in loose form; ▪ On-site transportation methods from storage to the point of application; and ▪ Inadequate material handling.
Site Operation	▪ Accidents due to negligence; ▪ Unused materials and products; ▪ Equipment malfunction;

Origins of Waste	Causes of Waste
	▪ Poor craftsmanship; ▪ Use of wrong materials resulting in their disposal; ▪ Time pressure; and ▪ Poor work ethics.
Residual	▪ Waste from application processes (i.e. over preparation of mortar); ▪ Off-cuts from cutting materials to length; ▪ Waste from cutting uneconomical shapes; and ▪ Packaging.
Other	▪ Weather ▪ Vandalism ▪ Theft

3. CONSTRUCTION WASTE MANAGEMENT PLAN

i) Waste Management Goals

The contractor established goal that this project will generate at least 50 percent less waste into landfills and the processes shall be employed to ensure that this goal is met. These shall include prevention of damage to materials to be incorporated into the work due to mishandling, improper storage, contamination, inadequate protection, minimizing poor quantity estimation, and through design.

ii) Responsibility

a) The Contractor shall be responsible for the implementation of the administrative portions of this program, including the notification of subcontractor management, the training of the site supervisor and the onsite posting of this plan.

b) The site supervisor shall be responsible for the implementation of the onsite portions of this program including the training of subcontractor personnel.

iii) Waste Prevention Planning

a) In addition to other requirements specified herein it is a requirement for the work of this project that the contractor comply with the applicable city waste disposal requirements.

b) Of the inevitable waste that is generated, the waste materials designated in this specification shall be salvaged for reuse and or recycling where practical and possible. Waste disposal in landfills shall be minimized as much as possible.

c) Project Construction Documents: The Contractor will contractually require all subcontractors to comply with the Construction Waste Management Plan (WMP)". A copy of the WMP will accompany all subcontractor agreements and require subcontractor participation.

d) The "Construction Waste Management Plan" shall be implemented and executed as follows and as on the chart:

   i) Salvageable materials will be diverted from disposal where feasible;
   ii) There will be a designated area on the construction site reserved for materials that can be recycled;
   iii) Areas shall be marked to designate what recycle materials are to be stored there; and
   iv) Hazardous waste shall be managed by a licensed hazardous waste vendor.

iv) Communication and Education Plan

a) This Waste Management Plan will be posted onsite;
b) Each subcontractor will be made aware of the intent of this project with respect to reduction of waste and recycling. Onsite recycling containers and/or areas will be plainly marked;
c) The subcontractor will be expected to make sure all their crews comply with the Waste Management Plan;
d) All recycling containers and areas will be clearly marked;
e) Lists of acceptable and unacceptable materials will be posted at the site; and
f) All subcontractors will be informed in writing of the importance of non-contamination with other materials or trash.

v) Motivation Plan

The Contractor will conduct a pre-award meeting for subcontractors. Subcontractors under consideration will be required to attend the meeting to review project goals and requirements with the project team. Attendance will be a prerequisite for award of subcontracts. This document will be an attachment to every subcontract. Copies of the attachment will be posted prominently at the job site.

vi) Expected Project Waste, Disposal, and Handling

The following chart identifies waste materials expected on the proposed project, their expected disposal methods and handling procedures. New items may be added as needed.

Material	Disposal Method	Handling Procedure
Land Clearing Debris	Keep separate for reuse and or wood sale. Suitable materials may be delivered to a composting site. Separate topsoil and rock for future landscaping use.	Keep separated in designated areas onsite.
Clean Dimensional Wood and Palette Wood	Keep separate for reuse by on-site construction or by site employees for either heating stoves or reuse in home projects. May be offered to public.	Keep separated in designated areas onsite.
Painted or Treated Wood	Reuse, off site recycle, and landfill.	Keep separated in designated areas onsite. Place in “Trash” container.
Concrete	Recycle when possible.	Keep separated in designated areas onsite.
Concrete Masonry Units	Keep separate for re-use by on-site construction or by site employees	Keep separated in designated areas onsite
Metals	Recycle off site when possible. Separate copper wire when possible.	Keep separated in designated areas onsite. Place in “Metals” container.
Gypsum drywall (unpainted)	Recycle with supplier when possible.	Keep scraps separate for recycling – stack on pallets in provided onsite. All scrap drywall should be taken back by contractor to drywall supplier
Paint	Reuse onsite; donate to Habitat for Humanity Restore.	Keep separated in designated areas onsite
Insulation	Reuse and landfill.	Keep separated in designated areas onsite.
Glass	Recycle locally.	Keep separated in designated areas onsite.
Plastics	Plastic Bottles: recycle locally; be aware of plastics that are acceptable to recycle facility.	Keep separated in designated areas onsite.

vii) Waste Disposal Company:

a) Lahore Waste Management Company

b) Local Government

viii) Recycle Hauler

a) To be determined;

b) Contact Address; and

c) Some or all recycle may be hauled by the authorized representative.

ix) Possible Recycle Locations and Acceptable Materials

a) Coordinate with companies in Lahore or which are registered with LWMC that accept materials for recycle; and

b) Using the above as a resource, a list will be kept indicating local opportunities for recycle of expected materials. New locations should be added as needed.

ANNEX-VI
TRAFFIC MANAGEMENT PLAN

GUIDELINE TRAFFIC MANAGEMENT PLAN

1. Need for Plan

During the construction period of the project, considerable vehicular movement carrying large amounts of material and machinery is expected. This will definitely interrupt the local traffic and is therefore important to manage the traffic to avoid the nuisance to local residents in terms of noise, dust, congestion and inconvenience.

2. The plan

The objective of Traffic Management Plan (TMP) is to define the requirements that should be implemented to mitigate any potential negative risks to the environment, workers or the community resulting from construction traffic.

The TMP will advise and inform site Contractors and external suppliers of equipment and materials of access and entry points along with other key information such tipping areas and wash-out areas. It is intended to compliment and work alongside relevant EMP. The TMP will be classed as “live” and therefore be subjected to updates as required.

The Contractor, at the time of the execution of the project, will prepare a comprehensive TMP in coordination with local traffic police department, RUDA, emergency services and local administrative department. RUDA and CSC will review and approve the Contractor’s TMP. The Contractor’s TMP shall include following mitigation measures during its preparation:

- Undertake a road conditions assessment prior to and following the peak construction period, to assess any damage to road infrastructure that can be attributed to Project development.
- Repair damage as appropriate or enter into a voluntary agreement with the relevant roads authority to reimburse the cost of any repairs required to the public road network as a result of the Project.
- Spoil dumpsites located close to project site to minimize journey distance and limit movements to site access roads.
- Construction of worker accommodation on site to reduce light vehicle movements relating to travel to/ from the site.
- Provision of bus/minibus services for personnel living in nearby settlements.
- Movements of construction workers will be planned to avoid the busiest roads and times of day when traffic is at its greatest.
- Schedule deliveries and road movements to avoid peak periods.
- Driver training for HGV drivers and refresher course every six months for project drivers.
- Speed restrictions for project traffic travelling through communities (to be agreed with National Highway Authority and Client).
- Run a safety campaign to improve the people’s knowledge of the traffic hazard on their roads, public information and other activities to address the issues.

- Run a pedestrian awareness programme.
- Temporary signage

The traffic management plan for the project corridor is provided below.

3. Other Recommendations

It is important to manage public access routes during construction because it can cause delay to local traffic and create a safety hazard both on and offsite. People working and living near the tower sites would be annoyed by the emissions, noise and visual intrusion of queuing vehicles. Some important factors involved in access routes and site traffic are as follows:

3.1. Public Access Routes

The use of public road for site access may be restricted in terms of:

- Vehicle size, width and type of load
- Time limits
- Parking
- Pedestrian conflicts

Contractor should have consultation with the local police or local authority to address these issues and to effectively manage them before the beginning of the construction.

3.2. Site Workers Traffic

Site personnel should not be permitted to park vehicles right on the road; this will lead to disruption in material deliveries. Designated parking areas with appropriate parking space will be needed for this purpose; any plain area near construction site can be used for this purpose.

3.3. Site Rules

- Access to and from the site must be only via the specified entrance.
- On leaving the site, vehicles must be directed to follow the directions given.
- Drivers must adhere to the site speed limits.
- All material deliveries to site must keep allocated time limits.
- No material or rubbish should be left in the loading-unloading area.
- Develop a map for alternate routes showing material delivery services.
- Assign designated personnel on site to receive deliveries and to direct the vehicles.
- Monitor vehicle movement to reduce the likelihood of queuing or causing congestion in and around the area.
- Project vehicles should have a unanimous badge or logo on windscreen displaying that they belong to the project.

4. Contractor’s Obligation

The traffic management plan of the Contractor should be safe enough and widening of any access roads and construction of the detours (as applicable and practical) must be completed

prior to start of project construction activities so that heavy vehicular transportation for construction activities do not hinder the normal course of traffic lanes. Contractor must ensure that road closures are carried out by a competent person. The Contractor obligation must include the display of traffic signs according to the need to divert the traffic volume and to guide the road users in advance. The traffic sign, traffic light should be placed from any diverting route or road marking.

The Contractor should consider the environmental and social impacts of the traffic during construction. It will be sole responsibility of the Contractor to implement a plan which produces minimum nuisance to the local people and to the environment. Safety of the people should be given due importance. It will be under Contractor obligation to notify the traffic management plan and its later changes to CSC, RUDA, emergency services and Traffic Police, and also publish weekly programme in the local newspaper.

ANNEX-VII
OCCUPATIONAL HEALTH AND SAFETY PLAN

GUIDELINE OCCUPATIONAL HEALTH AND SAFETY PLAN

Occupational Health and Safety covers all personnel working under the project and will be in line with the World Bank EHS guidelines on health and safety.

The Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and, specifying how consultation, training and information are to be provided to employees at various workplaces.

Some of the risks/hazards associated with workplaces are due to working close to or at sites associated with the various project construction activities. Other risks associated with the project construction phase include risk of increase of vector borne and other different diseases.

The following sections will be implemented during the construction phase to address and ensure workers' health and safety.

1.1 SCREENING AND REGULAR UNANNOUNCED CHECKING OF WORKERS

As per the procedure for hiring workers, all contractors and labor agencies are required to make all prospective workers undergo medical tests to screen for diseases and sicknesses, prior to selection and employment of any worker. The contractor is also responsible for ensuring that no worker who has a criminal record is employed at the project site. It will be ensured that all workers undergo medical tests to screen diseases at source and at sites in consultation with the designated Health Officer.

In addition to this, the Project Management will also undertake sudden, unannounced checks on workers to look for diseases such as COVID-19, HIV, STDs, and hepatitis and take necessary steps as mandated by the Contractual agreement between the Contractor and the Worker(s).

1.2 MINIMIZING HAZARDS AND RISKS AT THE WORKPLACE

To ensure safety at all work sites, the following will be carried out:

i. Installation of signboards and symbols in risky and hazardous areas, to inform workers to be careful.
ii. Construction of barricades around construction sites and deep excavated pits, to cordon off and deter entry of unauthorized personnel and workers into these areas.
iii. Providing a safe storage site/area for large equipment such as power tools and chains, to prevent misuse and loss.
iv. Proper Housekeeping: Ensuring that materials are all stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse. Brick stacks will not be more than 7 feet in height and for concrete blocks they will not be more than 6 feet high.
v. Removing all scrap timber, waste material and rubbish from the immediate work area as the work progresses.
vi. Where scaffolds are required, ensuring that each scaffold or its components shall be capable of supporting its own weight and at least 4 times the maximum intended load applied or transmitted to it. The platform/scaffold plank shall be at least 15 inches wide and 1.5 inches thick. The rope should be capable of supporting at least 6 times the maximum intended load applied or transmitted to that rope. Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer and shall be

constructed and loaded in accordance with that design. Where scaffolds are not provided, safety belts/safety nets shall be provided;

vii. Ensure that all ramps or walkways are at least 6 feet wide, having slip resistance threads and not inclined at more than a slope of 1 vertical and 3 horizontal.

viii. Stacking away all excavated earth at least 2 feet from the pit to avoid material such as loose rocks from falling back into the excavated area and injuring those working inside excavated sites.

ix. Constructing support systems, such as bracing to adjoining structures that may be endangered by excavation works nearby.

x. Only a trained electrician to construct, install and repair all electrical equipment to prevent risks of electrical shocks and electrocution.

xi. Install fire extinguishers and/or other fire-fighting equipment at every work site to prepare for any accidental fire hazards.

1.3 PROVISION OF PERSONAL PROTECTIVE EQUIPMENT

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. This will be included in the construction cost for each Contractor. Depending on the nature of work and the risks involved, contractors must provide without any cost to the workers, the following protective equipment:

i. High visibility clothing for all personnel during road works must be mandatory.

ii. Helmet shall be provided to all workers, or visitors visiting the site, for protection of the head against impact or penetration of falling or flying objects.

iii. Safety belt shall be provided to workers working at heights (more than 20 ft) such as roofing, painting, and plastering.

iv. Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet.

v. Ear protecting devices shall be provided to all workers and will be used during the occurrence of extensive noise.

vi. Eye and face protection equipment shall be provided to all welders to protect against sparks.

vii. Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapor.

viii. Safety nets shall be provided when workplaces are more than 25 feet (7.5 m) above the ground or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors or safety belts is impractical.

The specific PPE requirements for each type of work are summarized below.

Table 1: PPE Requirement List

Type of Work	PPE
Elevated work	Safety helmet, safety belt (height greater than 20 ft), footwear for elevated work.
Handling work safety	Helmet, leather safety shoes, work gloves.
Welding and cutting work	Eye protectors, shield and helmet, protective gloves.
Grinding work	Dust respirator, earplugs, eye protectors.
Work involving handling of chemical substances	Dust respirator, gas mask, chemical-proof gloves. Chemical proof clothing, air-lined mask, eye protectors.
Wood working	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Blasting	Hard hat, eye and hearing protection.
Concrete and masonry work	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Excavation, heavy equipment, motor graders, and bulldozer operation	Hard hat, safety boots, gloves, hearing protection.
Quarries	Hard hat, eye protectors, hearing protection, safety footwear, leather

Type of Work	PPE
	gloves and dust respirator.

1.4 PROCEDURES TO DEAL WITH EMERGENCIES SUCH AS ACCIDENTS, SUDDEN ILLNESS AND DEATH OF WORKERS

First aid kits will be made available at all times throughout the entire construction period by the respective contractors. This is very important, because most work sites will be at some distance from the nearest hospital. In addition to the first aid kits, the following measures should be in place:

i. Provision of dispensaries by the individual EPC contractor.
ii. A vehicle shall be on standby from the Project Office so that emergency transportation can be arranged to take severely injured/sick workers to the nearest hospital for immediate medical attention.
iii. A designated Health Officer/worker for the Project will be identified as a focal person to attend to all health and safety related issues. This employee's contact number will be posted at all work sites for speedy delivery of emergency services. The focal person shall be well versed with the medical system and facilities available at the hospital.
iv. Communication arrangements, such a provision of radios or mobile communication for all work sites, for efficient handling of emergencies, will be made.

1.5 RECORD MAINTENANCE AND REMEDIAL ACTION

The Project Management will maintain a record of all accidents and injuries that occur at the work site. This work will be delegated by the contractor to the site supervisor and regularly reviewed every quarter by project management. Reports prepared by the contractor shall include information on the place, date and time of the incident, name of persons involved, cause of incident, witnesses present and their statements. Based on such reports, the management can jointly identify any unsafe conditions, acts or procedures and recommend for the contractor to undertake certain mitigative actions to change any unsafe or harmful conditions.

1.6 COMPENSATION FOR INJURIES AND DEATH

Any casualty or injury resulting from occupational activities should be compensated as per the local labor laws of Pakistan. Where compensation is sought by the injured party, proper procedures for documentation of the case will be followed, including a detailed report on the accident, written reports from witnesses, report of the examining doctor and his/her recommendation for treatment. Each individual contractor will be responsible for ensuring compensation for the respective workers.

1.7 AWARENESS PROGRAMS

The Project management will undertake awareness programs through posters, talks, and meetings with the contractors to undertake the following activities:

i. Dissemination sessions will clarify the rights and responsibilities of the workers regarding interactions with local people (including communicable disease risks, such as HIV/AIDS, COVID-19), work site health and safety, waste management (waste separation, recycling, and composting), and the illegality of poaching.
ii. Make workers aware of procedures to be followed in case of emergencies such as informing the focal health person who in turn will arrange the necessary emergency transportation or treatment.

1.8 NOMINATION OF A HEALTH AND SAFETY FOCAL PERSON

Within each site (especially if different sites are being implemented by different contractors), a Health and Safety Focal Person will be appointed. The Terms of Reference for the focal person will mainly be as follows:

i. Function as the focal person/representative for all health and safety matters at the workplace;
ii. Responsible for maintaining records of all accidents and all health and safety issues at each site, the number of accidents and its cause, actions taken and remedial measures undertaken in case of safety issues;
iii. Be the link between the contractor and all workers and submit grievances of the workers to the contractor and instructions/directives on proper health care and safety from the contractors back to the workers;
iv. Ensure that all workers are adequately informed on the requirement to use Personal Protective Equipment and its correct use;
v. Also responsible for the first aid kit and making sure that the basic immediate medicines are readily available.

1.9 SUGGESTED CONTENTS OF OCCUPATIONAL HEALTH AND SAFETY PLAN

The suggested contents of Occupational Health and Safety Plan to be developed by the Contractor(s) are described below:

a Purpose
b Scope of Application
c Complying Basis
d Occupational Health and Safety Objectives
e Organization and Responsibility
- Contractor's Project Manager
- HSE Management Department of the Contractor(s)
- Medical Treatment Room of the Contractor(s)
- Subcontractor's Project Manager
- Subcontractor's HSE Managers
- Occupational Health and Safety
- Community Health and Safety

f Health Plan
- Labour Protection
- Sanitary Epidemic Prevention

g Safety Plan
- Summary
- Qualification Review
- Safety Training
- Construction Plans and Documents
- Control Measures
- Monitoring Measures
- Management of the Key Safety Accidents

h Public Security Plan
i Local Community Health and Safety

ANNEX-IX
CHANCE FIND PROCEDURE

ARCHAEOLOGICAL 'CHANCE FIND' PROCEDURE

1. BACKGROUND

The purpose of this document is to address the possibility of archaeological deposits becoming exposed during ground altering activities within the project area and to provide protocols to follow in the case of a chance archaeological find to ensure that archaeological sites are documented and protected as required.

The Antiquities Act, 1975, protects archaeological sites, whether on Provincial Government owned or private land. They are non-renewable, very susceptible to disturbance and are finite in number. Archaeological sites are an important resource that is protected for their historical, cultural, scientific and educational value to the general public and local communities. Impacts to archaeological sites must be avoided or managed by development proponents. The objectives of this 'Archaeological Chance Find Procedure' are to promote preservation of archaeological data while minimizing disruption of construction scheduling It is recommended that due to the moderate to high archaeological potential of some areas within the project area, all on site personnel and contractors be informed of the Archaeological Chance Find Procedure and have access to a copy while on site.

2. POTENTIAL IMPACTS TO ARCHAEOLOGICAL SITES

Developments that involve excavation, movement, or disturbance of soils have the potential to impact archaeological materials, if present. Activities such as road construction, land clearing, and excavation are all examples of activities that may adversely affect archaeological deposits.

3. RELEVANT LEGISLATION

It ensures the protection, preservation, development and maintenance of antiquities in the provinces of Pakistan. The Act defines "antiquities" as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the relevant provincial governments to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, any archaeological discovery made during the course of the project.

4. REMEDIES AND PENALTIES

The Antiquities Act, 1975 provides for heritage inspection or investigation orders, temporary protection orders, civil remedies and penalties to limit contraventions. These powers provide:

''A contravention of any provision of this Act or the rules shall, where no punishment has been specifically provided be punishable with rigorous imprisonment for a term which may extend to two years, or with fine up to rupees ten hundred thousand, or with both. ''

5. ARCHAEOLOGICAL 'CHANCE FIND' PROCEDURE

If you believe that you may have encountered any archaeological materials, stop work in the area and follow the procedure below:

The following 'chance-find' principles will be implemented by the contractor throughout the construction works to account for any undiscovered items identified during construction works:

i. Workers will be trained in the location of heritage zones within the construction area and in the identification of potential items of heritage significance.
ii. Should any potential items be located, the site supervisor will be immediately contacted and work will be temporarily stopped in that area.

iii. If the site supervisor determines that the item is of potential significance, an officer from the Department of Archaeology (DoA) will be invited to inspect the site and work will be stopped until DoA has responded to this invitation.
iv. Work will not re-commence in this location until agreement has been reached
v. between DoA and NTDC as to any required mitigation measures, which may include excavation and recovery of the item.
vi. A precautionary approach will be adopted in the application of these procedures.

6. DETAILED PROCEDURAL STEPS

- If the Director, department of Archaeology receives any information or otherwise has the knowledge of the discovery or existence of an antiquity of which there is no owner, he shall, after satisfying himself as to the correctness of the information or knowledge, take such steps with the approval of the Government, as he may consider necessary for the custody, preservation and protection of the antiquity.
- Whoever discovers, or finds accidentally, any movable antiquity shall inform forth with the Directorate within seven days of its being discovered or found.
- If, within seven days of his being informed, the Director decides to take over the antiquity for purposes of custody, preservation and protection, the person discovering or finding it shall hand it over to the Director or a person authorized by him in writing.
- Where the Director decides to take over an antiquity, he may pay to the person by whom it is handed over to him such cash reward as may be decided in consultation with the Advisory Committee.
- If any person, who discovers or finds any movable antiquity contravenes the provisions of the Act, he shall be punishable with imprisonment for a term which may extend to five (05) years, or with fine not less than fifteen hundred thousand rupees or with both and the Court convicting such person shall direct that the antiquity in respect of which such contravention has taken place shall stand forfeited to Government.
- The Director or any officer authorized by him with police assistance may, after giving reasonable notice, enter into, inspect and examine any premises, place or area which or the sub-soil of which he may have reason to believe to be, or to contain an antiquity and may cause any site, building, object or any antiquity or the remains of any antiquity in such premises, place or area to be photographed, copied or reproduced by any process suitable for the purpose.
- The owner or occupier of the premises, place or area shall afford all reasonable opportunity and assistance to the Director.
- No photograph, copy of reproduction taken or made shall be sold or offered for sale except by or with the consent of the owner of the object of which the photograph, copy or the reproduction has been taken or made.
- Where substantial damage is caused to any property as a result of the inspection, the Director shall pay to the owner thereof reasonable compensation for the damage in consultation with the Advisory Committee.
- If the Director after conducting an inquiry, has reasonable grounds to believe that any land contains any antiquity, he may approach the Government to direct the Revenue Department to acquire such land or any part thereof and the Revenue Department shall thereupon acquire such land or part under the Land Acquisition Act, 1894 (I of 1894), as for a public purpose.

ANNEX-X
TREE PLANTATION PLAN

TREE PLANTATION/ AFFORESTATION PLAN

The basic purpose of afforestation/plantation of suitable species in the project area is to reduce the risk been made due to different construction activities for the proposed project. The expected risk made will be compensated by planting of saplings to enhance green cover and improve the overall environment of the area. Afforestation will not only reduce the risk been made but will also increase the Green cover, carrying capacity and aesthetics of the area along with many positive aspects and impacts. Total ten Thousand (10,000) plants should be planted for environmental enhancement of the area.

Plantation will be done after the construction work immediately. Plantation of indigenous trees species is highly important to maintain the biodiversity and ecological balance. It is also important to prevent global warming, soil erosion and pollution. Afforestation purifies the environment and helps in reducing the carbon dioxide level. Along with the importance of construction, the afforestation activity will further help in enhancing the socio-economic condition of the area and project sustainability.

Note: *The PHA Lahore will be engaged for carrying out the proposed activates.*

IMPORTANCE OF TREE PLANTATION

- Trees contribute to their environment by providing oxygen, improving air quality, climate amelioration, conserving water, preserving soil, and supporting wildlife.
- Trees control climate by moderating the effects of the sun, rain and wind. Leaves absorb and filter the sun's radiant energy, keeping things cool in summer.
- Trees also preserve warmth by providing a screen from harsh wind.
- Trees also lower the air temperature and reduce the heat intensity of the greenhouse effect by maintaining low levels of carbon dioxide.
- Both above and below ground, trees are essential to the eco-systems in which they reside.
- Trees absorb and store rainwater which reduce runoff and sediment deposit after storms. This helps the ground water supply recharge, prevents the transport of chemicals into streams and prevents flooding.
- Trees, shrubs and turf also filter air by removing dust and absorbing other pollutants like carbon monoxide, sulfur dioxide and nitrogen dioxide.

OBJECTIVES

- To Restore native species
- To improve the quality of air and reduce its pollution
- To add color to the landscape and enhances the beauty of the environment
- To uplift the quality of our living environment through active planting, proper maintenance and preservation of trees together with other vegetation.
- To Protect and conserve flora and fauna of the project area.
- To attract rain which is a positive impact on the project area at all.

- To reduce sedimentation by plantation in the project area which will act as protection wall against wind born dust particles.

AREA ENHANCEMENT PLAN

Plants will be raised along the nearby available project area or along roads, two on either side of the road. Distance from the outer boundary of the ROW and between two plants will be kept as 4 meters. Total number of plants will be **10,000** in Number.

**The PHA or concerned Authority will update the standards of planting and choice of species as per the actual requirements and site suitability.*

TREES RECOMMENDED

Following Trees Are Recommended for Plantation

Sr. No.	Local/English Name	Scientific Name
1	Neem	*Azadirachta indica*
2	Sukh Chain	*Pongamia pinnata*
3	Sirris	*Acacia lebbek*
4	Jacarnda	*Jacaranda moniosifolia*
5	Silver Oak	*Grevillea robusta*
6	Pilkan	*Ficus virens Spp*
7	Jaman	*Eugenia jambolina*
8	Kachnar	*Bauhinia variegate*

PLANTATION TECHNIQUE

Plantation of suitable broad leaved species is to be carried out in the project area or immediate vicinity (as per suitability) of the project area. The project area can be afforested and vegetation cover can be improved by adopting standard afforestation technique of digging pits. The project area is suitable for plantation activities and can be managed thoroughly with care.

WHEN TO PLANT

Planting should be completed early in the rains in as short a time as possible. The trees must be given time to become well established prior to the dry season. A good rule of thumb is to start planting when the soil is moist to a depth of 15-25 cm or to the bottom of the planting hole. Failures because planting is too late are more common than failures because of planting too early. To obtain good results and avoid labor shortage in these areas considerable preparatory planning is needed. The size of the plantation might have to be adapted to the availability of labour. If dry sites cannot be planted in time, planting should be postponed until the next season.

Cost

Break-up of Expenditure per Avenue kilometer @ Rs. 1500/- per diem: Break-up of Expenditure per Avenue kilometer or 250 plants @ Rs. 1500/- per diem:

FIRST YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Layout	1 Av.km	2 MD/Av.km	3000.00
2.	Digging of Pits 2.5 ft. each 2.5x250 = 625 cft.	625 cft.	5 MD/Av.km	7500.00
3.	Cost of Plants including	250 No.	Rs100/- plant	25,000.00
4.	Cost of planting of plants	250 No.	Rs. 25/- plant	6250.00
5.	Carriage of plants from private nursery to site including loading/unloading	250 No.	Rs. 10/- plant	2500.00
6.	Cost of Manure and Bhall (silt) including carriage	1 Av. Km		20,000.00
7.	H/watering 50 times 250x50 with water bowser, one driver and one coolie	12500 no.	5MD/per %0	100,000.00
8.	Weeding twice 250x2	500 no.	2 MD/per %	15,000.00
9.	Reopening of Pits twice (250x2)/cft/pit	500 cft.	2 MD/per %	15,000.00
10.	Unforeseen			5750.00
Total				200,000.00

SECOND YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Cost of Plants 20% Restocking	50 No.	Rs.100/- plant	5,000.00
2.	Cost of planting	50 No.	Rs. 25/- plant	1250.00
3.	Carriage of plants	50 No.	Rs. 10/- plant	500.00
4.	H/watering 50 times with water bowser, one driver and one coolie	12500 no.	5MD/per %0	100,000.00
5.	Reopening of Pits twice (250x2)	500 cft.	2 MD/per %	1,5000.00
6.	Weeding twice 250x2	500 no.	2 MD/per %	1,5000.00
7.	Unforeseen			1250.00
Total				1,38,000.00

THIRD YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Cost of Plants 10% Restocking 25 No.	25 No.	Rs.100/- plant	2500.00
2.	Cost of planting	25 No.	Rs. 25/- plant	625.00
3.	Carriage of plants	25 No.	Rs. 10/- plant	250.00
4.	H/watering 40 times x250 no.	10,000 no.	5MD/per %0	75000.00
5.	Reopening of Pits twice (250x2)	500	5MD/per %0	3750.00
6.	Unforeseen			2875.00
Total				85,000.00

FOURTH YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	H/watering 30 times	7500 no.	5MD/per %0	56250.00
5.	Pruning and cleaning of plants	250 no.	5MD/per %0	1875.00
6.	Unforeseen			1875.00
Total				60,000.00

*Cost for raising 1 Av. Km and 04 years Maintenance of 250 plants in single row: = **Rs. 483,000/-**

Cost for above activities = 19,320,000 **(Cost-A)**

Cost for Purchasing One Plant = 2,000 PKR

Total Plants Need to be Purchased = 10,000 Numbers

Total Cost of Purchasing 1000 Plants = 2,000 x 10,000

Cost-B = **20,000,000/- PKR**

Grand Total Cost (A+B) = **A** 19,320,000+ **B** 20,000,000 = **39,320,000/- or**

Say 40 Million PKR/-

***The above calculations and standards are approximate and tentative provided on the basis of available data which may be updated by the implementing agency as per actual, during implementation.*

ANNEX-XI
BREAKUP OF HEALTH AND SAFETY COST

Annex-XII

BREAKUP OF HEALTH AND SAFETY COST

Items	Quantity	Cost / Item (Rs.)	Total Cost (Rs.)	Rationale
(A) Personal Protective Equipments PPEs				
Dust masks	19,200	20	384,000	One dust mask to be used in a week by each labourer for 24 months and for 96 weeks.
Safety Shoes	400	2,000	800,000	Two safety shoes are supposed to be used for 24 months by each labourer and for 200 labourers for 24 months construction period .
Gloves	2,000	200	400,000	ten pairs of gloves is to be used by each labourer for 24 months and 2,000 gloves are estimated to be used by 200 labourers.
First Aid Box	8	3,000	24,000	One First Aid Box is proposed for 25 labourers and for 200 labourers 08 aid boxes are estimated.
Ear Plugs	19,200	30	576,000	One set of ear plug to be used for a week by each labourer and for 96 weeks (24 months) it is estimated to be 19,200 for 200 labourers.
Safety Helmets	600	1,000	600,000	Four safety helmets are to be used by each labourer for 36 months and for 150 labourers 600 safety helmets are estimated.
Safety Jackets (Hi Vis)	400	800	320,000	Two safety Jacket (Hi Vis) to be used by each labourer for 24 months to be used by 200 labourers.
Sub-Total (A)			***3,104,000***	
(B) Others				
Provision of Dust Bins	10	500	5,000	Ten dust bins are proposed to be placed at construction site for the whole construction period.
Warning Tape	20	500	10,000	---
Safety Cones	20	1,000	20,000	20 safety cones are estimated to be placed at active construction sites.
Safety Sign Boards	15	1,500	22,500	20 safety sign boards are proposed to be placed at active construction sites.
Sub-Total (B)			***57,500***	
Grand Total (A + B)			***3,161,500***	

Time required for Construction = 24 Months
No. of labour required during construction = 200