Public Disclosure Authorized

Environmental and Social Management Plan (ESMP)

Weather Surveillance Radar

Regional Meteorological Center

Punjab Lahore

Pakistan Hydro-Meteorological and DRM Services Project

Executive Summary

Exposure to hydrological and meteorological (hydromet) hazards including storms, floods, and droughts has caused tremendous damage to the economy of Pakistan. The country suffered a loss of US$18 billion between 2005 and 2014 (US$10.5 billion from the 2010 floods alone), equivalent to around 6 percent of the federal budget. Ranked among 7th on the climate risk index, the severity of these hazards is likely to be exacerbated due to climate change. Annual average flood damages are projected to increase five-fold by 2030.[1] In addition, these extreme weather events create vulnerabilities in major natural asset-based sectors like agriculture, forestry, livestock, food security and water. Agriculture sector being severely exposed to climate and weather-related risks that accounts for 95 percent of total national water use. To maximize the economic value of its relatively scarce water resources, Pakistan needs to greatly improve water management. Climate-resilient development also requires stronger institutions and a higher level of observation, forecasting, and service delivery capacity; these could make a significant contribution to safety, security, and economic well-being.[2]

Pakistan Hydro-meteorological and DRM Services Project is initiated to strengthen the delivery of reliable and timely hydro-meteorological and disaster risk management services to user departments and communities. Co-financed by the World Bank and Government of Pakistan, the project beneficiaries include people who are at risk from climate, weather and water-related disasters and line departments. Installation of a Weather Surveillance Radar (WSR) is part of a greater effort to improve the hydro-meteorological infrastructure. An Environmental and Social Management Framework (ESMF) has been prepared to assess the impacts of the project on environmental and social environment and propose the mitigation measures. This document provides the Environmental and Social Management Plan (ESMP) for installation of the WSR, consistent with the identified requirement of the ESMF.

Description of Sub-Project

Installation of the Weather Surveillance Radar is proposed under sub-component 1.2.A: 'Technical modernization of the observation networks'. With an aim to upgrade the observation infrastructure, data management systems and forecasting, the sub-project proponent is the Pakistan Meteorological Department (PMD). The sub-project scope includes installation of a Weather Surveillance Radar (WSR), Automatic Weather Station (AWS) and Wind Profiler at the premises of the existing Flood Forecasting Division, Regional Meteorological Center at Jail Road Lahore. The sub-project aims to upgrade the observation infrastructure, data management systems and forecasting thus enabling delivery of hydro-meteorological information services and early warnings. In particular, it will extend the forecasting for flash floods, analysis and service delivery capabilities to provide guidance to agriculture, water resources and irrigation, disaster risk management, media, civil aviation, health and energy. It is expected to help in reduction of economic losses caused by floods and droughts especially in most vulnerable southern Punjab and supplement the efficiency of

1 http://floods.wri.org/#/country/170/Pakistan

2Upgrading all hydro-meteorological information and early-warning systems in developing countries has been estimated to have the potential to save 23,000 lives annually and provide US$3–30 billion per year in economic benefits—see Hallegatte (2012). "A Cost Effective Solution to Reduce Disaster Losses in Developing Countries: Hydro-meteorological Services, Early Warning, and Evacuation." Policy Research Working Paper 6058, World Bank, Washington, DC.

disaster risk management and food security interventions due to enhanced preparedness of targeted vulnerable communities.

Regulatory Framework

Punjab Environmental Protection Act applicable for Lahore along with the NEQS and guidelines for Environmental and Social Assessment have been used for the sub-project. In addition, applicable national and provincial laws have also been taken into consideration while formulating the ESMP. World Bank Operational Policy OP 4.01 Environmental Assessment is applicable to this sub-project. Moreover the applicable World Bank Environmental Code of Practices has been referred to in the ESMP to enable environmental protection and social safety. OP 4.12 has been triggered for the overall project but is not relevant for this subproject as there is no land acquisition or displacement involved.

Assessment of Environmental and Social Baselines

The environmental baseline of the sub-project location and surroundings has been collected using field surveys and literature review. The sub-project site is entirely surrounded by built-up area including small businesses, houses and educational institutes in Lahore. Assessment of baselines reveal that the noise levels, air quality and ground water quality of the site are well within the limits defined by NEQS and World Bank guidelines. Topography of the sub-project area is plain with no land features that may be impacted by construction. Lahore has distinct seasons marked by wide variation in temperature with hot summers, spring and mild winters. Mean maximum and minimum temperature range between 42.4 ºC and 5.9 ºC . The surface water drain closest to the sub-project site in Lahore is Shadman 14/A at a distance of 1km and Lahore Canal at a distance of 1.5 km from. The ground water quality at the sub-project site is within the limits of WHO and NEQS. Atmospheric pollution, particularly in urban areas of Lahore, has a strong impact on daily life. Air quality results reveal higher concentration of particulate matter exceeding WHO standards but within NEQS. As climate of Lahore is semi-arid and subtropical, the vegetation of the area falls under scrub, dry, tropical thorn forest type as per phyto-geographical classification of the area. Due to the extensive urbanization of the area and construction all around it, there is absence of wildlife near the sub-project location. No wildlife sanctuary or Game Reserve is located in the vicinity of the study area. Domestic animals, small mammals and birds can be encountered various parts of Lahore.

According to the 2017 population census, the population of Lahore is approximately 11.5 million with a literacy rate of 64%. The sub-project site is surrounded by a number of educational institutions that include Lahore College for Women, Kinnaird College and APWA College. The health care of Lahore is better in comparison with other districts of Punjab. A network of government hospitals and basic health units is operational with Services Hospital and Punjab Institute of Cardiology in close vicinity of the sub-project site. In addition, there are a number of private hospital and clinics on the main access road to the site. The nearest health care facility to reach in case of emergency is Services Hospital at a distance of 500 meters.

Stakeholder Consultations and Disclosure

Consultations were carried out with primary stakeholder within the vicinity of the sub-project site and with PMD. The major concerns raised were regarding emissions, noise, waste and increase in traffic congestion from the construction site. Similarly, electromagnetic field from the sub-project site is also a major concern for the residing population. In order to address the concerns, a traffic management plan along with solid waste and emission controls is proposed in the mitigation measures. EMF monitoring is proposed and design changes with increase in

tower height are included. A third party testing of EMF, air, water and noise in compliance with NEQS and World Bank requirements is also made part of the mitigation measures. Overall stakeholders provided a positive feedback in support of the sub-project.

Impact Assessment and Mitigation

Detailed assessment of potential impacts associated with the sub-project on environmental and social receptors is carried out for design, construction and operation phase. Mitigation measures have been proposed for associated impacts. Implementation is ensured through Environmental Management and Monitoring Plan (ESMMP) along with a checklist of monitoring of, and for, construction contractor and PMD. Design phase mitigations such as identification and preparation of energy and water conservation, emissions, solid waste and traffic management plans are included to address the adverse environmental impacts at an early stage. Building Codes of Pakistan with seismic provision for Zone 2 and international best practices are proposed to avoid damage caused by earthquakes. International design guidelines for flood protection are simulated to avoid damages in case of monsoon flooding.

The major potential adverse impacts associated with construction of the WSR are localized and temporary in nature and related to the soil, noise, air quality, solid waste, increased resource consumption, labor health and safety. Soil erosion and contamination by run-off from construction activities will be avoided through proper storage of construction materials and proper disposal of contaminated soil. There may also be an impact on air quality from dust and exhaust emissions from soil excavation and movement of heavy vehicles, which will be mitigated by following an Emissions Monitoring Plan. Debris and waste from construction activities may increase the sediment loads into the drainage channels, while accidental leaks/spills of oil/fuel from storage tanks or maintenance vehicles can also pollute surface waters. A Debris Management Plan and proper storage and disposal of construction materials will manage these impacts. Improper waste disposal from the construction site can lead to various public health concerns including worsened air quality due to waste burning, breeding grounds for vectors, and/or clogging of drains and pollution of subsurface water. A robust Solid Waste Management Plan is included for construction material as well as for domestic waste. Workers Health and Safety Plan will be prepared for labor, in order to safeguard them from any adverse impacts while handling heavy machinery and toxic material (if any). Construction activities and increased traffic of heavy vehicles may impact public safety of surrounding communities. Mitigation measures including signage for road safety, training of construction staff and alternative routes are proposed during construction phase. The potential impacts of electromagnetic field from the tower are address through increase in tower height to avoid radiation towards ground. Increased consumption of energy and water during construction and operation phase will be managed by including resource efficient building designs and training construction staff on efficient use of water.

A training plan for the construction contractors, consultants, PMD and associated staff is defined to ensure that everyone working on the sub-project is acquired with required assistance to implement the ESMP in the field. Budgetary provision of the ESMP is calculated at PKR 5.8 million to meet the mitigation, training and monitoring requirements of the ESMP.

Institutional Arrangements

The implementation of the ESMP will fall under the overall supervision of the Project Director of the Project Implementation Unit (PIU), housed in the PMD. The PIU will be responsible for the implementation, monitoring and reporting of the ESMP through the Environment and Social Safeguards Specialists. The Project Management and Implementation Consultant (PMIC) will be responsible for ensuring ESMP requirements are being followed by the

construction contractor and provide support. The construction contractor will be responsible to implement the mitigation measures on ground, and a Contractor ESMMP will be a part of the contract. PMD through independent service providers will initiate the environmental monitoring of air, water and soil to monitor and report compliance. Detailed roles and responsibilities of the project implementation in accordance with ESMP are defined.

ESMP monitoring checklist will be used by PIU, PMIC and Construction Contractor to monitor the ESMP compliance. PMIC will provide monthly monitoring reports to the Environmental and Social Safeguards Specialists in the PIU. Monthly reports by the Specialists will be shared with the Project Director. Bi-Annual progress reports will be shared by the PIU with the World Bank. An annual Third Party Validation of the sub-project during construction phase will be conducted and the report shared with the World Bank. In case of non-compliance corrective action will be taken and construction work will be discontinued.

Grievance Redress

A Grievance Redress Mechanism (GRM) will record and address the complaints and concerns of stakeholders during sub-project execution. The GRM proposed in the ESMF will be followed for this subproject. GRM provisions and details will be displayed in the local language at the sub-project site and the PMD offices. The mechanism will not impede access to the Country's judicial or administrative remedies. Complaint Register (CR) will be maintained by the PIU to log all complaints and corrective action will be taken in case a grievance. If the grievance redress mechanism fails to satisfy the aggrieved affected person at all levels, she/he can submit the case to the appropriate court of law.

Disclosure

The ESMP will be disclosed on the websites of PMD, and on the World Bank Info Shop. Hard copies of this ESMP will also be shared with the Federal Environmental Protection Agency (EPA), and relevant project stakeholders, contractors, Civil Society Organizations etc. A copy of the ESMP will be placed in the Project Implementation Unit, PMD for public access. The Urdu translation of the Executive Summary of the ESMP will also be distributed to all relevant stakeholders, especially to the communities in the project areas.

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List of Acronyms

ESMP	Environmental and Social Management Plan
EPA	Environmental Protection Agency
GoP	Government of Pakistan
HSE	Health, Safety and Environment
IFC	International Finance Corporation
IEE	Initial Environmental Examination
NCS	National Conservation Strategy
NEAP	National Environmental Action Plan
NEP	National Environmental Policy
NEQS	National Environment Quality Standards
NGO	Non-Government Organization
NOC	No Objection Certificate
PEPA 97	Pakistan Environmental Protection Act, 1997
PEPC	Pakistan Environmental Protection Council
PNS	Pakistan National Committee
Pvt	Private
GDP	Gross Domestic Product
IEE	Initial Environmental Assessment
EIA	Environmental Impacts Assessment
PMD	Pakistan Meteorological Department
WAPDA	Water and Power Development Authority
PID	Provincial Irrigation Departments
NDMA	National Disaster Management Authority
PDMAs	Provincial Disaster Management Authorities
DRM	Disaster Risk Management
Radar	Radio Detection and Ranging
RMC	Regional Met Office Lahore
WSR	Weather Surveillance Radar
EMF	Electromagnetic Field
AWS	Automatic Weather Station
NIHL	Noise Induced Hearing Loss
RF	Radio Frequencies
SAR	Specific Absorption Rate

List of Units

°C	Degree Celsius
cm	Centimetre
db	Decibels
Kg	Kilogram
Km	Kilometer
m	Meter
µg/m3	Microgram per cubic meter
%	Percent
W/kg	watts per kilogram
mW/m^2	milliwatts per square metre

Chapter 1. Introduction

1.1 Background

Over the last two decades Pakistan has made considerable progress in reducing absolute poverty and improving shared prosperity, but most of the population remains poor or vulnerable. Between 1991 and 2011 the number of people with an income below $1.25 per day was more than halved;[3] and between 2002 and 2011 the percentage of the population below the national poverty level fell from 34.7 to 13.6 percent.[4] Nonetheless, nearly three-quarters of the population remain poor or vulnerable.

A key dimension of social vulnerability in South Asia is exposure to hydrological and meteorological (hydromet) hazards including storms, floods, and droughts. Across South Asia, the number of disasters has quadrupled over the past four decades, causing over 800,000 deaths and US$80 billion in damages[5]—equivalent to an estimated 2–6 percent of GDP—and slowing economic growth and poverty reduction.[6] Climate change is expected to have an adverse impact on Pakistan, as it ranks 7th on the climate risk index[7]. It continues to be one of the most flood-prone countries in the South Asia Region (SAR); it suffered US$18 billion in losses between 2005 and 2014 (US$10.5 billion from the 2010 floods alone), equivalent to around 6 percent of the federal budget.[8] Hydromet hazards have been coupled with rapid population growth and uncontrolled urbanization, leading to a disproportionate and growing impact on the poor. The frequency and quantity of precipitation in Pakistan is becoming increasingly unpredictable. The severity of these hazards is likely to be exacerbated due to climate change. By 2030, annual average flood damages are projected to increase five-fold relative to 2010.[9] In addition, these extreme weather events create vulnerabilities in major natural asset-based sectors.

To build on recent development gains, increase economic productivity, and improve climate resilience, it will be critical to improve the quality and accessibility of weather, water, and climate information services. Climate-resilient development requires stronger institutions and a higher level of observation, forecasting, and service delivery capacity; these could make a significant contribution to safety, security, and economic well-being.

Installation of Weather Surveillance Radar (WSR) is proposed to improve delivery of hydro-meteorological information services and early warnings. The proposed project can possibly make important contributions to economic productivity while also enhancing community resilience to natural hazards.

1.2 Pakistan Hydro-Meteorological and DRM Services Project

Government of Pakistan aims to implement the Pakistan Hydro-Meteorological and DRM Services Project (PHDSP) through Pakistan Meteorological Department (PMD) and National Disaster Management Authority (NDMA). Co-financed by the World Bank and Government of Pakistan, the Project is proposed to be implemented over the course of 5 years. The Project

[3] http://documents.worldbank.org/curated/en/886791468083329310/Pakistan-Country-partnership-strategy-for-the-period-FY2015-19
[4] Ibid.
[5] Not including indirect losses.
[6] World Bank Program Brief: South Asia Regional Program on Hydromet, Climate Services and Resilience (2017). http://www.worldbank.org/en/region/sar/brief/south-asia-hydrological-and-meteorological-hydromet-resilience-program
[7] Global Climate Risk Index 2017 https://germanwatch.org/en/download/16411.pdf
[8] World Bank (2015) *Fiscal Disaster Risk Assessment Options for Consideration: Pakistan*. Chapter 1, page 2. https://openknowledge.worldbank.org/handle/10986/21920
[9] http://floods.wri.org/#/country/170/Pakistan

expects to improve hydro-meteorological information and services, strengthen forecasting and early warning systems, and improve dissemination of meteorological and hydrological forecasts, warnings and advisory information to stakeholders and end-users and strengthen the existing disaster risk management (DRM) capacity and services of the National Disaster Management Authority (NDMA). The project has three main components:

1.2.1 Component 1: Hydro-meteorological and Climate Services

This component will improve the capacity and performance of the PMD to understand and make use of meteorological and hydrological information for decision making. The objective will be achieved, in line with international best practices, through investment in strengthening institutional setup and building capacity of human resources at the PMD.

1.2.2 Component 2: Disaster Risk Management

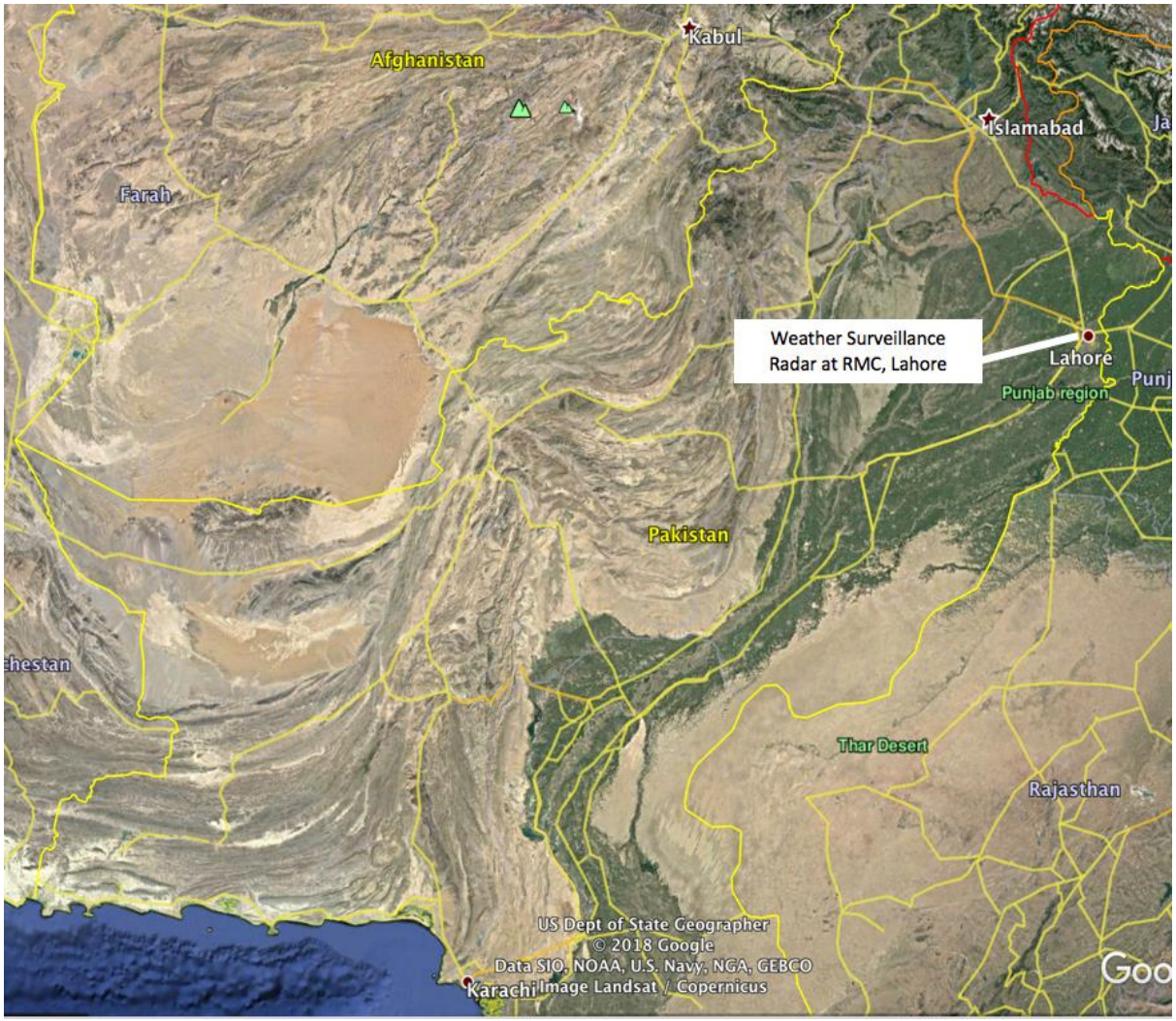
This component will support implementation of the priorities identified in the National Disaster Management Plan, NDMP Road-Map 2016-2030 and the Sendai Framework for Disaster Risk Reduction. Under this component, capacity enhancement of NDMA will be prioritized. NDMA will be responsible for implementation of the project and coordination with the key stakeholders, for project initiation and implementation of activities. Key stakeholder will be involved from the initial phase.

1.2.3 Component 3: Contingency Emergency Response Component

Component 3 of the project focuses on the enhancement of the PMD and NDMA service delivery and building partnerships with the private sector.

Pakistan Hydro-Meteorological and DRM Services Project is a national level project with interventions across Balochistan, KPK, Punjab and Sindh. This Environmental and Social Management Plan (ESMP) has been prepared for the construction of a Weather Surveillance Radar (WSR) in Lahore, Punjab under sub-component 1.2A – 'Technical Modernization of the Observation Networks'. This sub-component will support the expansion and upgrade of the prioritized stations of the network, expansion of Doppler radar network, restoration of upper air observations, installation of wind profilers, improvement of hydrological stations and systems, and expansion and re-equipment of agro-meteorological network. The sub-project includes installation of a Weather Surveillance Radar (WSR) along with an Automatic Weather Station and Wind Profiler at the Flood Forecasting Division of the Regional Meteorological Center in Lahore, Punjab. The installation is likely to improve delivery of hydro-meteorological information services and early warnings. The proposed sub-project will possibly make important contributions to economic productivity while also enhancing community resilience to natural hazards. The location of the sub-project with reference to Pakistan is marked on the map provided as **Figure 1.1**.

Figure 1.1: Map of Project Location



1.3 Environmental and Social Management Framework

As the Pakistan Hydro-Meteorological and DRM Services Project is a national level project with interventions at possible locations across Balochistan, KPK, Punjab and Sindh, a framework approach was adopted for environmental and social management. Based on this approach, Environmental and Social Management Framework (ESMF) and a Resettlement Policy Framework (RPF) was prepared to identify all potential but generic negative environmental and social impacts of project activities and propose mitigation measures. The ESMF provides basic screening criteria for selecting sub-projects and lists the instruments to be developed for each individual sub-project. Institutional arrangements, Grievance Redress Mechanism (GRM), reporting and documentation requirements regarding environmental and social safeguards are addressed in detail in the ESMF.

As per World Bank Operational Policy 4.01 on Environmental Assessment, the Pakistan Hydro-Meteorological and DRM Services Project is categorized as a 'Category B' project with site-specific, temporary impacts for which mitigation measures can be readily designed.

1.4 Preliminary Environmental and Social Impact Screening

Environmental and Social Impacts screening checklists provided in the ESMF and approved by the World Bank, were used for preliminary screening of the Weather Surveillance Radar (WSR) to help in identification of impacts. Checklists were filled during field visits of the WSR site by the environment, social and resettlement experts. The environmental and social assessment/screening checklist is attached as **Annexure 1.** The checklist identifies the proposed sub-project as an urban area infrastructure development and established that:

- There is no land acquisition required for construction and rehabilitation work of proposed sub-project site
- The associated environmental and social impacts of the proposed sub-project are confined to construction phase and are of temporary nature
- The residing population will get benefits in terms improved weather forecast thus reducing the impacts of future floods and decreasing threats to their assets and lives.

As no significant adverse impacts were identified, there is no need for further resettlement impact screening and development of Resettlement Action Plans. Environmental and other social concerns associated with the construction phase of proposed sub-project will be minimized and mitigated by adapting best practices for environmental protection proposed in this Environmental and Social Management Plan (ESMP).

1.5 Environmental and Social Management Plan (ESMP)

This ESMP of the Weather Surveillance Radar (WSR) in Lahore is in compliance with and consistent to the identified requirements in the ESMF. It entails a set of responses to potentially adverse impacts of the sub-project on physical, ecological and social environment, thus ensuring the effective implementation of mitigation measures in a timely manner. The primary objectives of the ESMP are to:

- Identify the potential environmental and social impact of the project activities
- Propose site specific measures to mitigate environmental and social impacts and facilitate the implementation of the identified mitigation measures
- Propose and institutional structure and define responsibilities of the project proponents, contractor, and other members of the project team.
- Define a monitoring mechanism and identify monitoring parameters in order to ensure implementation and effectiveness of the mitigation measures.
- Describe the capacity building and training requirements, along with a budget, for the implementation of the ESMP.

1.6 Sub-Project Justification

Climate change is expected to have an adverse impact on Pakistan, as it ranks 7th on the climate risk index. It continues to be one of the most flood-prone countries in the South Asia Region (SAR); suffering US$18 billion in losses between 2005 and 2014 (US$10.5 billion from the 2010 floods alone), equivalent to around 6% of the federal budget. Hydromet hazards have been coupled with rapid population growth and uncontrolled urbanization, leading to a disproportionate and growing impact on the poor. By 2030, annual average flood damages are projected to increase five-fold relative to 2010[10]. In addition, these extreme weather events

10 http://floods.wri.org/#/country/170/Pakistan

create vulnerabilities in major natural asset-based sectors. Agriculture in Pakistan is severely exposed to climate and weather-related risks. The sector contributes 22 percent of GDP and 13 percent of national exports, employs 45 percent of the labour force, and is hugely reliant on irrigation—accounting for 95 percent of total national water use. The installation of the WSR in Lahore is likely to enhance the capacity of PMD by providing a higher level of observation, forecasting, and service delivery and contribute to the following:

- Reduction in economic losses caused by floods;
- Reduction in losses due to droughts and increased agricultural productivity; and
- Increased efficiency of disaster risk management and food security interventions due to enhanced preparedness of targeted vulnerable communities.

Chapter 2. Sub-Project Description

This chapter provides a brief description of nature, size and location of the project. A defined scope of study, the magnitude of efforts and concise description of project proponent is also included in this chapter

2.1 Sub-Project Proponent

The project proponent in this document refers to the organization which will invest and be responsible for the project initiation, construction and safe operation. The project proponent for the Monsoon Monitoring Center is the Pakistan Meteorological Department. The PMD also known as Pakistan Met Office is an autonomous and independent institution tasked with providing weather forecasts and public warnings concerning weather for protection, safety, and general information. Apart from meteorology, it is also involved in monitoring as well as investigating weather phenomenon, astronomical events, hydrology, and research in astrophysics, climate changes, and studies on aeronautical engineering, renewable energy resources across various parts of the country. Headquartered in Islamabad, it has offices and research facilities in all provinces and territories of the country.

2.2 Sub-Project Installation of WSR

Installation of WSR is proposed under sub-component 1.2.A: 'Technical modernization of the observation networks' that aims to upgrade the observation infrastructure, data management systems and forecasting thus enabling delivery of hydro-meteorological information services and early warnings. The sub-project is likely to construct a multi-story building with Radar installed at a height of approximately 72 meters at the current location of the Regional Meteorological Center in Lahore. The construction is likely to last 2 years. The objective of the sub-project is to strengthen the capacity of the Pakistan Meteorological Department (PMD) to deliver reliable and timely weather, hydrological and climate information and services to user departments and communities. Installation of WSR aims to upgrade and expand the meteorological, agro-meteorological and hydrological observations networks and ensuring that these networks are well functioning and interoperable.

2.3 Sub-Project Location

The Weather Surveillance Radar (WSR), Automatic Weather station (AWS) and Wind Profiler will be installed within the premises of existing Flood Forecasting Division, Regional Meteorological Center at Jail Road Lahore, Punjab. Lahore is located in the north-eastern end of Pakistan's Punjab province, near the border with the Indian state of Punjab. The location of the sub-project is provided as **Figure 2.1**. Towards the north-east of the sub-project site across the main Jail Road is Lahore College for Women. The Shadman Market is located towards the east of the sub-project site. Towards the west and south of the proposed site are non-demarcated commercial and residential areas. Since Lahore is an old city, the major part of the city does not define commercial and residential zones separately; however, the recent planned housing societies have zoned their commercial areas distinctively.

Figure 2.1: Proposed Site for Weather Surveillance Radar (WSR)

2.4 Sub-Project Need

The meteorological services of PMD fall into a category of delivering fundamental public information related to natural hazards. Despite maintenance, the installed radars at various sites of PMD are losing their relevance to modern technology. In the wake of imminent challenges such as changing climate patterns and unpredictable weather phenomenon, it is pertinent to shift from this analogue system to a modern digital Doppler Mode Radar. The new radar will have a 650 km radius of information processing for consumption of the PMD. This will help the PMD to monitor the movement and development of severe weather systems to prepare more accurate and timely weather forecasts. The Doppler mode is essential in achieving more accurate forecasting and longer forecast prediction times. The meteorological service equipped with state-of-the-art technology would effectively respond the strains on natural resources due to disasters and insufficient prediction systems. In an initial assessment by PMD at various offices across the country, it emerged that there is a need for:

1. Upgrading weather and flood forecasting in the country;
2. Reducing damages due to disasters and protection of public lives and property;
3. Promotion of safe operation of civil aviation, marine and land transport.
4. Dissemination of meteorological information to general public, government organizations and mass-media (TV, radio, newspaper);
5. Upgrading living standards of general public in Pakistan;
6. Increasing the degree of agricultural self-sufficiency through better weather forecasting techniques;
7. Reduction of extensive damages to agricultural produce thus contributing to socio-economic growth in agriculture sector;
8. Sharing of data with World Meteorological Organization as an effective member.

2.5 Sub-Project Scope and Description

In an initial need assessment, the installation of the WSR was proposed due to lack of modern forecasting equipment and methods in the existing facility. The sub project activities covered under this ESMP include following:

i. Tower Construction
ii. Installation of Weather Surveillance Radar
iii. Installation of AWS
iv. Installation of Wind Profiler

2.6 Tower and Base Construction

The civil works of the proposed sub-project include the construction of a multi-story tower of height 72 meters. The WSR will be installed at the top of the tower to avoid electromagnetic field (EMF) impacts. The construction of the tower will follow the regime provided in **Table 2.1**. The construction duration will be 18 months. Similarly, a concrete base will be constructed for the Automatic Weather Station and Wind Profiler which involves minimum civil works of approximately 2 months duration. The construction will be carried out considering weather conditions to avoid environmental damage, as monsoon rains in Lahore often cause blockage to the drainage system. The construction will take into account season to avoid nuisance to the general public.

The tower construction will have following activities

1. Site clearing and preparation for construction of the tower building;
2. Civil work including laying of foundation and construction of tower and concrete base of AWS and Wind Profiler;
3. Mechanical work including plumbing and equipment installation for the water, electricity and natural gas supply and distribution. It will ensure that the equipment is installed, pre-commissioned, tested (if required) and commissioned in accordance with agreed contracts. Coordination with equipment suppliers will be an important task during construction.The water supply and distribution will be in compliance with water conservation techniques;;
4. Electrical layout including installation equipment and supply of electricity designed to ensure energy conservation;
5. Backup Generator for the machinery and Solar Panel Installation.

The construction work doesn't require excavation or use of heavy machinery such as cranes. Construction vehicles will be parked in designated parking areas for machinery, stores and workshops at an appropriate distance from sensitive receptors such as residential buildings and schools in the vicinity. Final locations will be selected by the contractor away from populated areas with consent of supervision consultant. The construction machinery to be used includes:

1. Earth moving equipment
2. Construction vehicles
3. Material handling equipment
4. Construction equipment

As the sub-project site is located in the city of Lahore, labour will be hired from surrounding areas and communities. Hence a labour camp will not be established at the sub-project site.**Table 2.1: Construction Regime**

Phase	Requirement	Activities
Design Phase	Site Survey	Soil tests and hydrology for foundation and input to civil design
	Civil Design	Formulation of conceptual, detailed and final designs
Construction Phase	Site Establishment and Earthworks	Site clearance, laying of foundation, filling earth, anti-termite soil treatment, surface finish
	Concrete Work	Building construction using bricks, cement and concrete, steel reinforcement, curing and protecting concrete.
	Mechanical Work	Galvanised steel structures, cable trays, steel support structures, roofing.
	Drainage system	Waste water sewage system, surface water drainage system.
	Electrical Work	Power cable trenches and ducts, electricity connection, backup generator, lift and solar panel installation
	Finishing	Earth mats, testing/inspection of building
Post Contruction		WSR intallation AWS installation Wind Profiler Installation

2.6.1 Construction Materials

The materials used in construction of the building would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement, cement. Fine aggregates are locally available in the area, while the cement and steel will be procured from approved local vendors. The use of hazardous material like asbestos and those identified in the list of Hazardous chemical Rules 2003 will be banned. Special care will be taken for inflammable materials and fuel.

2.6.2 Manpower Requirements

The manpower requirement during construction and operation of the project will be approximately 50-60 persons including managerial staff, skilled and unskilled labour. The labour for construction activities will be hired from Lahore, hence there will be no requirement for setting up a labour camp at the sub-project site.

2.6.3 Water Requirement

The estimated water consumption of urban centers of Pakistan calculated by WASA is 72 gallon per person per day[11]. There will be an increase in water consumption during construction, specifically during civil works which are water intensive. The RMC has a ground water source and municipal supply of water. The requirements will be met from existing sources.

[11] Water and Sanitation Authority Report 2015

2.6.4 Waste Generation

There will be an increase of waste generation during construction, including debris, excavated earth and unused construction materials, especially during site clearing and landscaping.

2.6.5 Electricity

The electricity supply for the existing RMC offices is from the national grid, therefore, the additional increase in the usage during construction will be met from the same source. However, installation of Solar Panels is proposed to meet the electricity demand during operations.

2.7 Installation of Weather Surveillance Radar (WSR)

After the completion of construction work, the WSR will be installed on the top of the tower. WSR is a type of radar used to locate precipitation, calculate its motion, and estimate its type (rain, snow, hail etc.). The data can be analyzed to determine the intensity of storms and their potential to cause severe weather. The proposed WSR to be installed at Lahore will improve weather forecasting through the following functions

2.7.1 Improved Sensitivity

This is basically a result of a greater amount of power transmitted and a greater ability to distinguish smaller returns. The proposed WSR ability to detect lighter amounts of precipitation has allowed for the detection of very light precipitation and even subtle clear air boundaries.

2.7.2 Improved Resolution

This is primarily a function of angular beam width. The narrower the beam, the smaller is the width at a given distance. This will allow the WSR to differentiate between objects, thereby increasing the resolution.

2.7.3 Volume Scanning

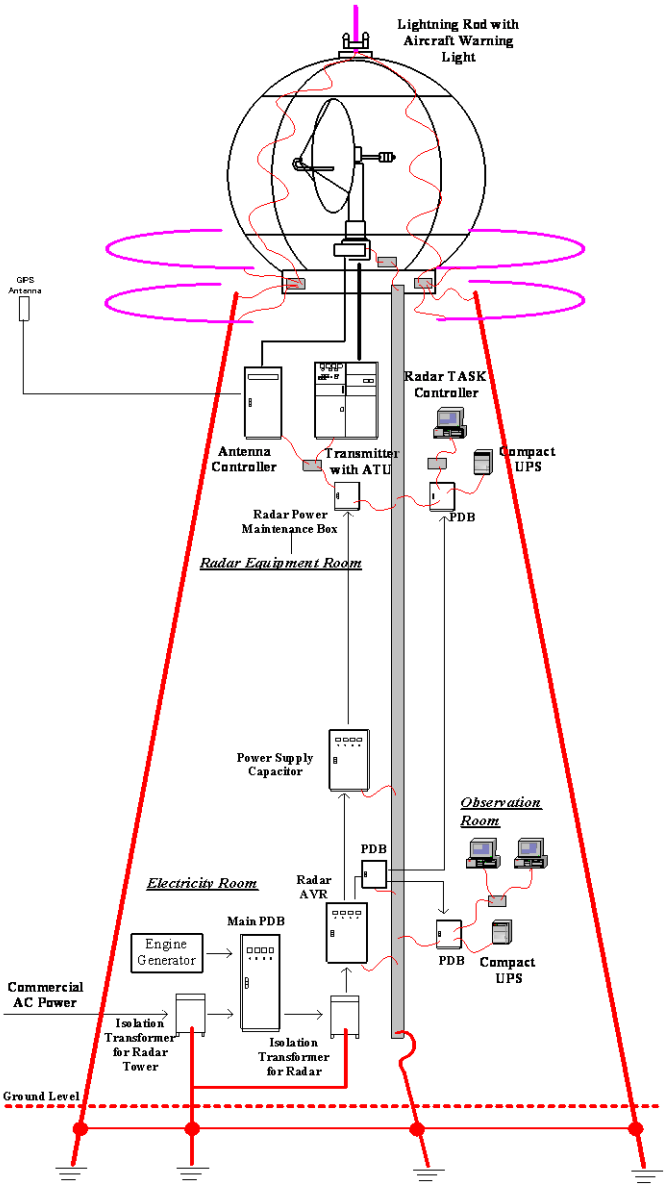
Rather than scanning along varying azimuth angles (PPI) then stopping to scan vertically (RHI), the radar will automatically scan various elevation angels while spinning around 360° of azimuth. Computers will generate products based on this volume scan.

2.7.4 Enhanced Capabilities and Algorithms

Sophisticated computer programs will assist the radar operator to detect various phenomena such as cyclones, thunder storms, cloud formation and tornadoes. The radar will also have a greater range of reflectivity operating in severe and non-precipitation modes.

Figure 2.2: Types of WSRs

Figure 2.3: WSR Design



2.8 Installation of Automatic Weather Station

The propose AWS will consist of a weather-proof enclosure containing the data logger, rechargeable battery, telemetry (optional) and the meteorological sensors with an attached solar panel upon a mast. The specific configuration may vary due to the purpose of the system. The AWS will measure weather parameters with following sensors:

- Thermometer for measuring temperature;
- Anemometer for measuring wind speed;
- Wind vane for measuring wind direction;
- Hygrometer for measuring humidity;
- Barometer for measuring atmospheric pressure.

Figure 2.4: Automatic Weather Station

2.9 Installation of Wind Profiler

The wind profiler system consists of an array of Doppler radar systems oriented to point upward. The "phased array" of 13 x 13 meter (40 ft by 40 ft) antennae is arranged in an array that looks like a chain link fence stretched out horizontally on stilts. This radar array operating at 404.37 MHz is used to sense the atmospheric wind profile from the surface up to an altitude of 16 km above the array on a nearly continuous basis. A three-beam pattern in a sequence are generated, with one beam oriented vertically and the other two beams are oblique (that is, one is pointed to the north and one to the east).The aim for the installation is to attain data on wind direction and vertical velocity at various elevations above the ground level (agl). At higher altitudes there is inadequate water vapor present to produce a radar "bounce." The data synthesized from wind direction and speed is very useful to meteorological forecasting and timely reporting for flight planning.

Figure 2.5: Types of Wind Profilers

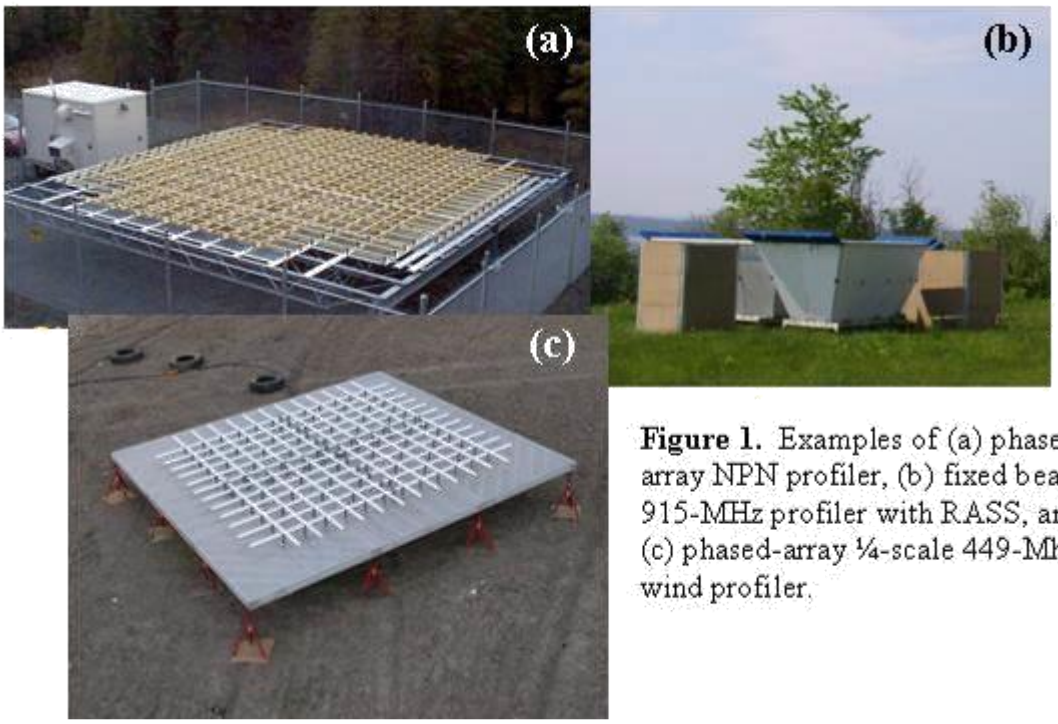
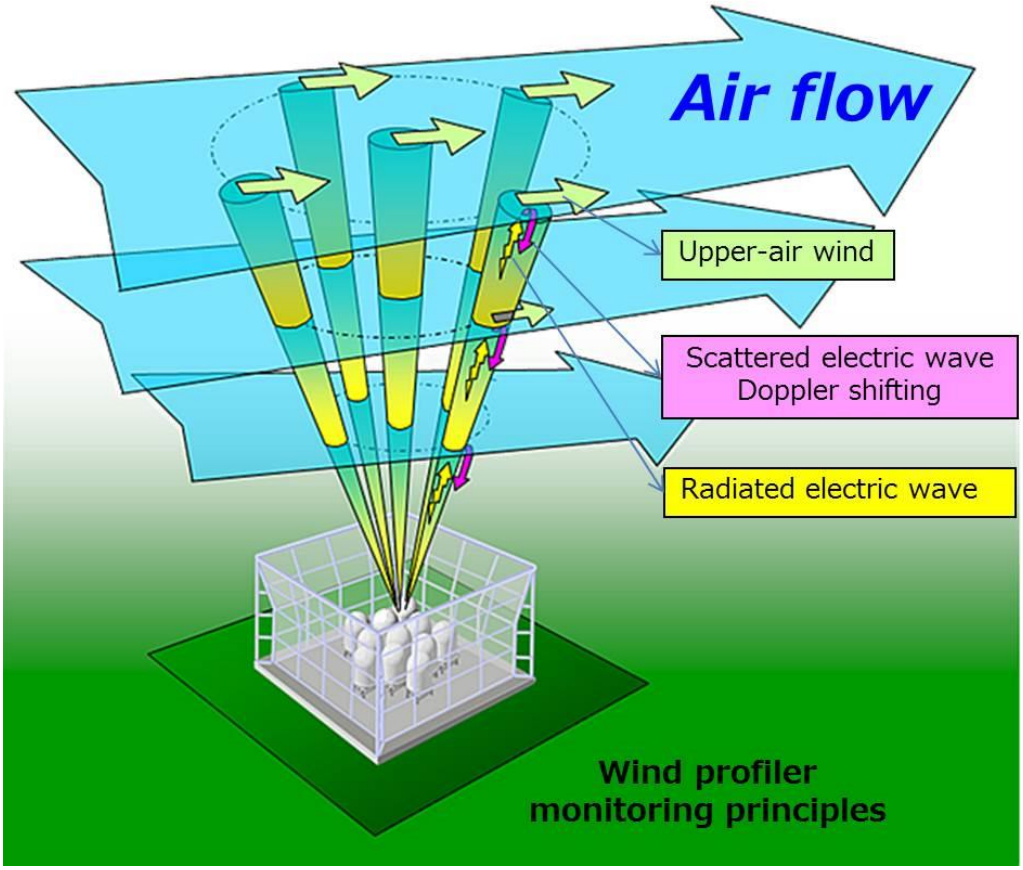


Figure 1. Examples of (a) phased-array NPN profiler, (b) fixed beam 915-MHz profiler with RASS, and (c) phased-array ¼-scale 449-Mhz wind profiler.

Figure 2.6: Wind Profilers Monitoring Principles



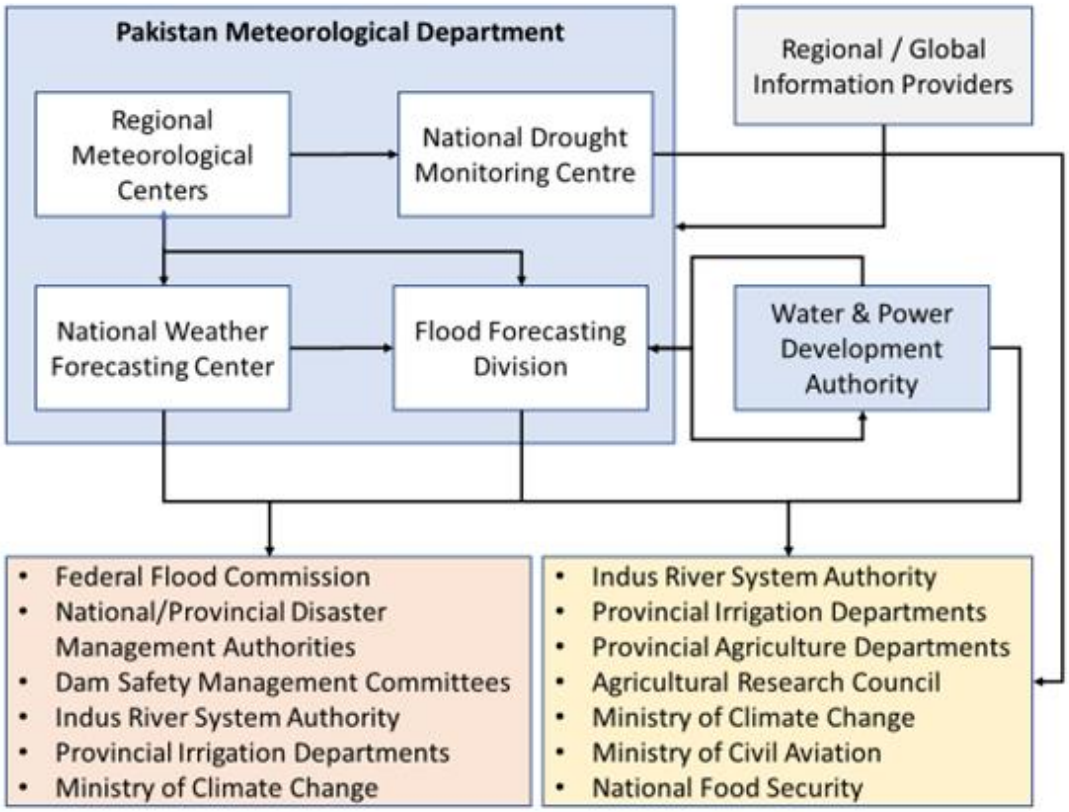
2.10 Analysis of Project Alternatives

Project alternatives are considered to evaluate the technological and site alternatives that may reduce the impacts on the environment.

2.10.1 No project Option

In view of the vulnerability of the country to multiple disasters and climate-related risks, strengthening of Disaster Risk Management system in Pakistan is considered strategic in assisting the Government to achieve its national and global commitments, especially the Five-Year Development Plan of the Government of Pakistan (GoP), SDGs, Nationally Determined Contributions (NDCs) and the Sendai Framework for Disaster Risk Reduction (SFDRR) which among many other things, emphasize upon disaster-specific resilience in light of risk-informed development. The sub-project, by enhancing the capacity of PMD is likely to contribute to a reduction in economic losses caused by floods and droughts, increase agricultural productivity, and increase efficiency of disaster risk management and food security interventions due to enhanced preparedness of targeted vulnerable communities. The interdependency of various departments and organization on weather data is given in **Figure 3.1**. Similarly World Meteorological Organization is also dependent on Pakistan for country and regional specific climate data. If no project option is considered, Pakistan will remain exposed to the risk of extreme climate events with continued loss to the lives and economy. Poor forecasting will impair major sectors of the economy.

Figure 2.7: Weather Forecast Interlinkage among GoP Departments



Following key sectors of the economy that are likely to sufferl are directly dependent on weather forecast:

Disaster Management

National Disaster Management Authority and Provincial Disaster Management Authorities (PDMAs), the country's early warning system will be enhanced with reliable information. At present manual and rudimentary support is available that leaves enormous scope for diminishing the loss of lives, livelihoods and assets.

Agriculture

The Provincial Agriculture Departments (PADs) will benefit by improved information flow. Different forecast timescales from short-range to seasonal forecasts and agro-meteorological advisories are expected to enhance the productivity of farmers (more optimal planting and harvesting dates, reduced crop failure and post-harvest losses, more optimal use of inputs) leading to significant improvement in food security system;

Energy

Water and Power Development Authority (WAPDA)/Ministry of Water and Power and Provincial Irrigation Departments (PIDs) will gain benefits from installation of Hydrological models applied for data analysis result in more efficient use of hydropower potential.

No project option sustains the status quo which is not beneficial for the economy, vulnerable communities, and the state. In case there is no project, the objective of strengthening Disaster Risk Management system in Pakistan to assist the Government to achieve its national and global commitments will not be accelerated, which will result in continued vulnerability and economic losses for the country.

2.10.2 Project Site Alternatives

Alternative project sites are considered when the project location is sensitive to environmental and/or social impacts associated either to the construction works or due to the operation of the facility constructed. This project currently suggests physical works to construct a tower for installation of WSR and installation of an Automatic Weather Station and Wind Profiler at the Flood Forecasting Division of the Regional Meteorological Center. This is the current location of the PMD in Lahore, with functioning offices. The land for the WSR is under ownership of the PMD. No site alternatives were considered due to:

- The land allocated to RMC is available for the sub-project
- The supporting infrastructure and technical equipment required for WSR operations exists at the present location.
- High cost of installation of associated equipment for WSR at another location and difficulty in data transferal was a major reason for site selection at the existing office.
- There are no environmental and/or social sensitivities within the identified area.

Chapter 3. Legal and Policy Framework

The present ESMP has been developed after reviewing the relevant promulgated environmental legislation and guidelines of Pakistan and the World Bank's safeguard policies. These legislations and safeguard policies, and their relevance to the proposed project, are briefly discussed below.

3.1 Constitutional Provision

Before 18th Amendment in the constitution of Pakistan, the legislative powers were with federal parliament and legislative assemblies of four provinces of Pakistan. If a particular legislation passed by the provincial assembly came into conflict with a law enacted by the national assembly, then according to constitution, the federal legislation will prevail over provincial legislation to extend the inconsistency. The subject of environmental pollution and ecology were in Concurrent Legislative List of the constitution thus allowing both federal and provincial government to enact laws on this subject. However only federal government has enacted laws on environment and the provincial environmental institutions derived their power from federal law.

Post 18th amendment in 2010, the concurrent list has been abolished and a limited number of subjects on the list have been included in the federal legislative list, whereas, the provincial governments have been given powers to legislate on the subjects transferred to provinces. The provision of the 18th Amendment which has a direct impact on the subject of 'Environment' is section 101(3), whereby the Concurrent Legislative List and the entries thereto from 1 to 47 (both inclusive) have been omitted from the Fourth Schedule. The power to legislate and decide on the subject of "environmental pollution and ecology" now lies with the provincial government, however, climate change remains under federal jurisdiction.

3.2 National and Provincial Laws

3.2.1 Punjab Environmental Protection Act, 1997 (Amendment 2012)

The Pakistan Environmental Protection Act (PEPA) is the apex environmental law in the country, and provides for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution, and for promotion of sustainable development. Section 12 of the Act requires preparation of Environmental Impact Assessment (EIA) or Initial Environmental Examination (IEE) before commencement of projects likely to cause adverse environmental effects.

3.2.2 Pakistan Environmental Protection Agency Review of IEE & EIA Regulations, 2000

These Regulations define procedures for preparation, review and approval of environmental assessments. The projects falling under any of the categories listed in Schedule-I require preparation of Initial Environmental Examination (IEE) report, whereas those falling under categories listed in Schedule-II require preparation of detailed study, the Environmental Impact Assessment (EIA).

The project falls in urban development category I of IEE/EIA regulation thus requiring an IEE for Installation of WSR. Therefore, disclosure requirements of both bank and local regulatory

requirement will be fulfilled. Apart from that information about different projects under progress are monitored by the M&E Directorate and they publish some data on their website. The sub-project requires construction and refurbishment of office building in urban area therefore the project falls in urban development category I of IEE/EIA regulation thus requiring an IEE for WSR Station in Lahore. If an IEE is conducted and submitted to the EPAs, it is shared with public by virtue of law. Therefore, disclosure requirements of both bank and local regulatory requirement will be fulfilled. Apart from that information about different projects under progress are monitored by the M&E Directorate and they publish some data on their website. The IEE/EIA Regulation 2000 is attached as **Annexure 2**.

3.2.3 National Environmental Quality Standards, 2000

The National Environmental Quality Standards (NEQS) will be followed. According to the World Bank policy compliance to all local statutory requirements is compulsory during project execution. NEQS first promulgated in 1993 and have been amended in 1995 and 2000. They have been revised and the latest NEQS were issued in 2010.These standards are also stringent with the International NEQs Regulation.

- NEQS for Ambient Air – November, 2010 state the Maximum allowable concentration of pollutants (9 parameters) in gaseous emissions from vehicle exhaust.
- NEQS for Drinking Water Quality – 2010 describe the drinking water properties by outlining the defined physical and chemical parameters.
- NEQS for Noise – November 2010 states the maximum allowable limit of noise arising from vehicles in decibels (dB) separately for day and night times.
- NEQS for Waste Effluents –2000 states the Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea.

These standards apply to the gaseous emissions and liquid effluents discharged by construction and post construction activities. The standards for vehicles will apply only during the construction phase of the sub-project. Standards for ambient air quality have also been prescribed. The detailed NEQS are included in **Annexure 3**.

3.2.4 Punjab Environmental Protection Agency's Environmental and Social Guidelines

Punjab EPA adopted the set of guidelines for conducting environmental and social assessments by Federal EPA after 18th amendment. The guidelines derive from much of the existing work done by international donor agencies and NGOs. The package of regulations, of which the environmental and social guidelines form a part, includes the PEPA 1997 and the NEQS. These guidelines are listed below followed by comments on their relevance to proposed project:

Policy and Procedures for Filing, Review and Approval of Environmental Assessments, Pakistan Environmental Protection Agency, September 1997: These guidelines define the policy context and the administrative procedures that govern the environmental assessment process from the project pre-feasibility stage to the approval of the environmental report. The section on administrative procedures has been superseded by the IEE-EIA Regulations, 2000.

Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997: The guidelines on the preparation and review of environmental reports target project proponents and specify:

- The nature of the information to be included in environmental reports
- The minimum qualifications of the study consultants appointed
- The need to incorporate suitable mitigation measures at every stage of project implementation
- The need to specify monitoring procedures.

The terms of reference for the reports are to be prepared by the project proponents themselves. The report must contain baseline data on the Study Area, detailed assessment thereof, and mitigation measures.

Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May, 1997: These guidelines support the two guidelines mentioned above. They deal with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures the incorporation of their concerns in any impact assessment study.

3.2.5 The Antiquities Act (1975)

It ensures the protection of Pakistan's cultural resources. 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 GOP to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the project proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, GOP, any archaeological discovery made during the course of the project.

3.2.6 The Public Health (Emergency Provision) Act 1954 read with West Pakistan Epidemic Control Act 1958

These two laws cover the presentation and spread of human diseases, safeguarding the public health and providing and maintaining adequate medical services and other services essential to the health of the communities in the project area.

3.2.7 Explosives Act 1884

Under the Explosives Act 1884, the project contractors are bound by regulation on properly and securely handling, transporting and using explosive quarrying, blasting and other purposes.

3.2.8 Labour Law Constitutional Provision

The Constitution of Pakistan contains a range of provisions with regards to labour rights found in Part II: Fundamental Rights and Principles of Policy.

- Article 11 of the Constitution prohibits all forms of slavery, forced labour and child labour;

- Article 17 provides for a fundamental right to exercise the freedom of association and the right to form unions;
- Article 18 proscribes the right of its citizens to enter upon any lawful profession or occupation and to conduct any lawful trade or business;
- Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone;
- Article 37(e) makes provision for securing just and humane 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.

3.2.9 Employment of Child Act, 1991

Article 11(3) of the constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mine, or any other hazardous employment. In accordance with this article, the ECA 1991 disallows such child labor in the country. The ECA defines a child to mean a person who has not completed his/her fourteenth year of age. The ECA states that no child shall be employed or permitted to work in any of the occupations set forth in the ECA (such as transport sector, railways, construction, and ports) or in any workshop wherein any of the processes defined in the act is carried out

3.2.10 Motor Vehicles Ordinance, 1965, and Rules, 1969

The Motor Vehicles Ordinance, 1965, was extended in 1978, to the whole of Pakistan. The ordinance deals with the powers of motor vehicle licensing authorities and empowers the Road Transport Corporation to regulate traffic rules, vehicle speed and weight limits, and vehicle use; to erect traffic signs; and to identify the specific duties of drivers in the case of accidents. It also describes the powers of police officers to check and penalize traffic offenders at the provincial level. At the same time, the ordinance also empowers the Regional Transport Authority to operate as a quasi-judicial body at the district level to monitor road transport, licensing requirements, and compensations for death or injury to passengers on public carriers.

3.2.11 Pakistan Penal Code, 1860

The Pakistan Penal Code deals with offences where public or private property and/or human lives are affected due to the intentional or accidental misconduct of an individual or body of people. In the context of environment, the Penal Code empowers the local authorities to control noise, noxious emissions and disposal of effluents. Chapter XIV, Section 268 to 291 of PPC deals with the offences affecting the public health, safety, convenience, decency and morals. A Person may be guilty of public nuisance if his act or omission causes common injury, danger or annoyance to the public or results in spread of diseases dangerous to life. The section also deals with environmental pollution. Provisions under this Act relating to environment are no longer being enforced after promulgation of the Pakistan Environmental Protection Act, 1997. The NEQS enforced by the EPAs supersede the application of this legislation on industries and municipalities. The Penal Code, however, can provide a basis for the client to coordinate its activities with the local authorities to ensure that its construction activities do not become a cause of public nuisance or inconvenience. Pollution offences can still be tried under the relevant sections of Pakistan Penal Code, 1860, as they have not been specifically repealed by a subsequent legislation.

3.2.12 Building Code of Pakistan (Seismic Provisions-2007)

The Pakistan Engineering Council governs the application of Building Code of Pakistan (Seismic Provisions-2007). Prior to the start of construction the proposed sub-project will take design approval from PEC. This obligates the following:

- 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 in violation of the Building Code (Seismic Provisions-2007) shall be considered as violation of professional engineering work as specified under clause (XXV) of section 2 of the Act.

The project will comply with the seismic provision during building design.

3.2.13 Provincial Local Government Ordinances, 2001

These ordinances, issued following the devolution process, establish regulations for land use, the conservation of natural vegetation, air, water, and land pollution, the disposal of solid waste and wastewater effluents, as well as matters related to public health and safety.

3.2.14 Factories Act, 1934

The clauses relevant to the project are those that concern the health, safety and welfare of workers, disposal of solid waste and effluent, and damage to private and public property. The Factories Act also provides regulations for handling and disposing of toxic and hazardous materials. Given that construction activity is classified as 'industry', these regulations will be applicable to the project contractors.

3.3 World Bank Safeguard Policies

The objective of the World Bank's environmental and social safeguard policies is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for the bank and borrowers in the identification, preparation, and implementation of programs and projects. Safeguard policies have often provided a platform for the participation of stakeholders in project design, and have been an important instrument for building ownership among local populations. This overall PHDSP Project is classified as "Category B" as per the World Bank OP 4.01 as the activities under the project would involve small scale constructions with temporary and reversible environmental and social impacts. OP 4.12 has been triggered for the overall project but is not relevant for this subproject as there is no land acquisition or displacement involved.

3.3.1 P /BP4.01 Environmental Assessment

WB requires environmental assessment (EA) of projects proposed for their financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision-making. The borrower is responsible for carrying out the EA. For Category A projects, the borrower retains independent EA experts not affiliated with the project to carry out the EA. For projects involving the preparation and implementation of annual investment plans or sub-projects, identified and developed over the course of the project period during the preparation of each proposed sub-project, the project coordinating entity or implementing institution carries out appropriate EA according to country requirements and the requirements of this policy. According to World Bank safeguards policies, projects shall be classified as one of the

following three categories, depending on the nature and extent of potential environmental and social impacts:

- Category A: Projects of this type would have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the physical works.
- Category B: A proposed project may have some adverse environmental impacts, but less adverse than those of Category A projects. These impacts are typically site-specific, few if any have irreversible impacts, and in most cases mitigation measures can be readily designed.
- Category C: Projects of this type are likely to have minimal or no adverse environmental impacts.

This project is classified as "Category B" as per the WB safeguards category. Under OP 4.01 this ESMF has been prepared which is defined in the OP as "An instrument that examines the issues and impacts associated when a project consists of a program and/or series of sub-projects, and the impacts cannot be determined until the program or sub-project details have been identified." This ESMP is prepared in line with the requirements of the World Bank and the Project ESMF.

OP 4.12 has been triggered for the overall project but is not relevant for this subproject as there is no land acquisition or displacement involved.

The World Bank policies are included as **Annexure 4** and screening checklist is included as **Annexure 5**.

3.3.2 World Bank Disclosure Policy

The Bank reaffirms its recognition and endorsement of the fundamental importance of transparency and accountability to the development process. Accordingly, it is the Bank's policy to be open about its activities and to welcome and seek out opportunities to explain its work to the widest possible audience.

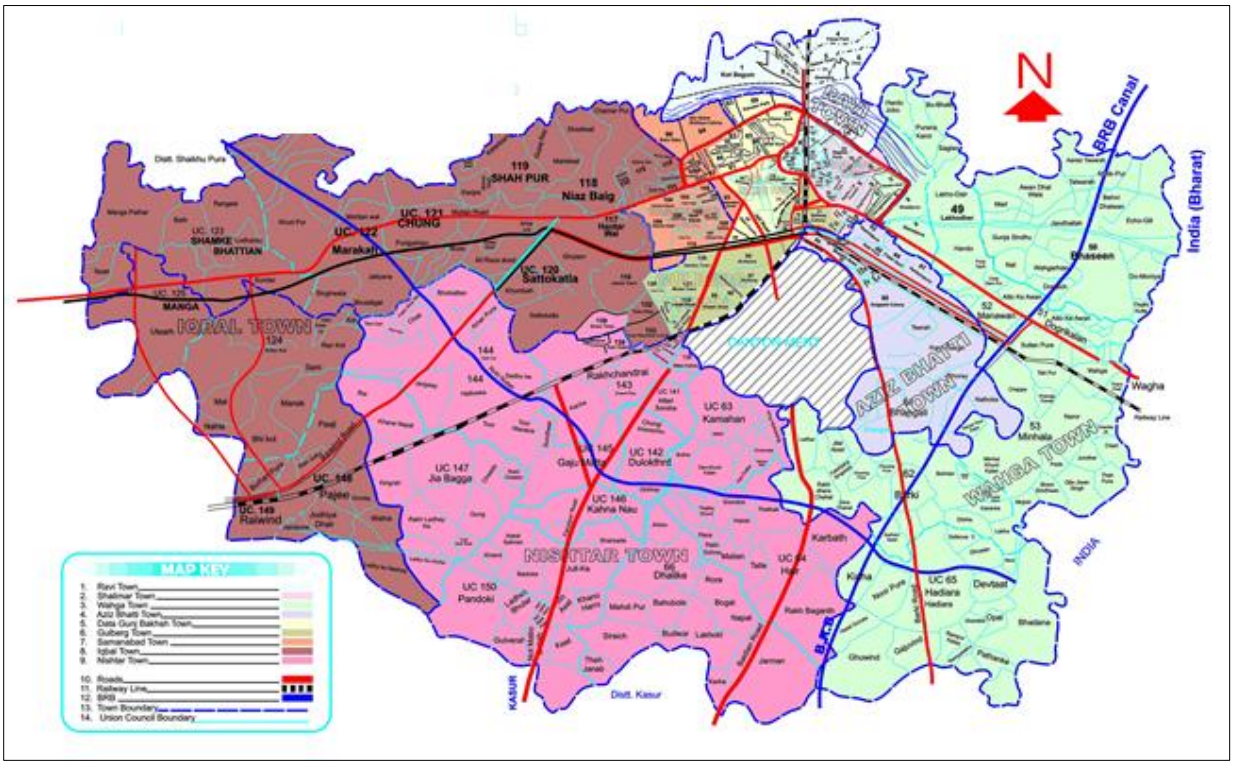
Chapter 4. Environmental and Social Baseline

4.1 Sub-Project Area

The area for the proposed sub-project is the city and district of Lahore where the construction and rehabilitation work will be carried out. Lahore is the capital city of Punjab province, and is the country's second-most populous city after Karachi, serving as an economic, political, transportation, entertainment, and educational hub for central and north Pakistan. With a rich history dating back over a millennium, Lahore is a major cultural center of Pakistan. The city is located in the north-eastern end of Pakistan's Punjab province, near the border with the Indian state of Punjab. Situated between 31°15′—31°45′ N and 74°01′—74°39′ E, Lahore is bounded by the Sheikhupura District towards north and west, by India towards east, by Kasur District towards south, and by Nankana Sahib towards west and southwest. The Ravi River flows on the northern side of Lahore.

The proposed WSR, AWS and wind profiler will be installed within the premises of the existing Flood Forecasting Division located in the Regional Meteorological Center on Jail Road, Lahore (**Figure 5.1**). Towards the north-east of the sub-project site, across the main Jail Road is Lahore College for Women. The Shadman Market lies towards the east. Towards the west and south of the proposed site are non-demarcated commercial and residential areas. Since Lahore is an old city, the major part of the city does not define commercial and residential zones separately; however, the recent planned housing societies have zoned their commercial areas distinctively.

Figure 4.1: Map of Lahore



4.2 Physical Environment

4.2.1 Topography

Lahore is located in the upper part of the plains of Punjab, which are a part of the Indo- Gangetic synclinal depression. The district is divided into two parts; the low lying alluvial soils along the Ravi River, and the uplands in the east. The lowlands are generally inundated during the monsoon season by Ravi River, flowing through the western part of the district along its boundary with district Sheikhupura. The city of Lahore lies on extremely flat land. The highest point within the city is about 700 ft above sea level. In the south-west, abutting the actual flood plain of Ravi river, the land falls to 682 ft. Gradients are extremely flat and falls of only 0.3 to 0.4 m per km are experienced in many areas of the city. The sub-project area lies in the upland plain slope. The topography of the sub-project area is flat.[12]

4.2.1 Climate

Lahore features a five-season semi-arid climate with temperatures varying from 5.9 ºC to 40.4 ºC. Summer season lasts from April till September, with June and July being the hottest months with mean maximum and minimum temperatures of 42.4 ºC and 27.3 ºC. The winter seasons lasts from November to March. December, January and February are the coldest months with mean maximum and minimum temperatures of 19.8ºC to 5.9ºC in January. Rains are encountered in all the seasons but monsoon rain is pronounced and constitutes a definite rainy season from June to September. The average rainfall is about 629 millimeters per year.

4.2.2 Regional Geology and Soil

Thick alluvial and older fluvial deposits (Recent to Miocene) are present in Lahore. The soils underlying this area are alluvial in nature, consisting of silts and sands with lenses of clay. The bearing capacity varies, a minimum allowable bearing pressure of 80 km/sq.m (0.75 tons/ sq. ft) can be safely assumed.[13] Due to rich surface irrigation, the fertile soils of the floodplains give a good per unit yield. The major mineral composition for Lahore soil is Quartz, Muscovite and Clinochlore, which shows that the alluvial deposit received sediments from metamorphic origin. In general, subsurface stratigraphy at the site consists of three basic lithological units as given below:

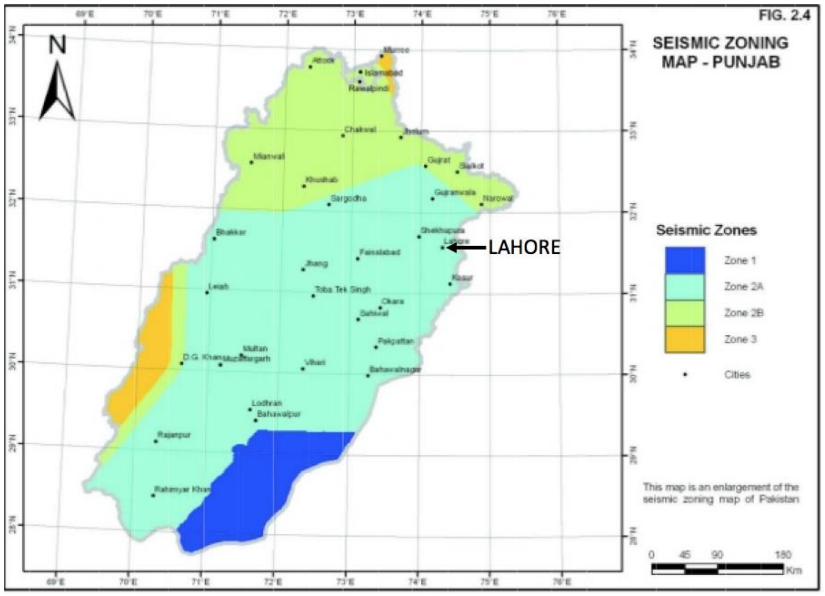
- Lean Clay/Silty Clay
- Sandy Silt/Silt
- Silty fine Sand/fine Sand

4.2.3 Natural Hazard Vulnerability

The sub-project site for the Weather Surveillance Radar is located in Seismic Zone-2A (**Figure 5.2)**, prone to minor to moderate damage from earthquakes.[14] It is a tectonic zone of down wrap and platform slope in the seismic zone that may encounter an earthquake from 3.1 to 4.9 on Richter scale.[15] Given the location of the sub-project in Zone-2A there is a possibility that distant earthquakes with fundamental periods greater than one second may

[12] Sources: Punjab Sustainable Development Strategy, Environment Department, Punjab, 2008
[13] Sources: Punjab Sustainable Development Strategy, Environment Department, Punjab, 2008
[14] National Seismic Monitoring Center, Pakistan Meteorological Department (PMD)
[15] Atlas for Pakistan

cause minor to moderate damage to structures. Therefore, the structural design of the buildings will follow the applicable building codes with seismic provisions specific to Zone-2A. **Figure 4.2: Seimic Zones of Punjab**



4.2.4 Surface Water and Drainage

The surface water resources of Lahore include the River Ravi fed by 76 minor drains which fall in eight major drains namely Satto Kattle drain, Lakshimi Drain, Suk Neher Drain, Upper Chota Ravi Drain, Siddique Pura Drain and Shahdara Drain. Most of the wastewater discharge enters River Ravi in the 60km stretch between Bulloki and Lahore. These wastewater discharges, along with reduction in available water in River Ravi for dilution, has greatly deteriorated the quality of the river water. River Ravi runs merely as a sullage carrier near Lahore during low flow season. During the monsoon season, the lowlands of Lahore are generally inundated by the river. The drain closest to the project site in Lahore is Shadman 14/A at a distance of 1km and Lahore Canal at a distance of 1.5km from the sub-project site. The canal is a 60km long extension that originates from Bambawali Ravi-Bedian (BRB) towards the west of the city. No surface drainage problems are foreseen as surface water can be disposed in the existing primary and secondary drainage network.

4.2.5 Ground Water

The only source of water supply to the inhabitants of Lahore city for domestic as well as industrial purposes is ground water. Although, the aquifer under Lahore is a part of the huge groundwater reservoir underlying the Indus Plain, extensive groundwater withdrawal has formed a trough in groundwater levels which is gradually expanding. The water table, which was about 5 m deep in 1960, has declined now to more than 40 m in central part of the city due to over abstraction of groundwater by public and private tube wells and reduction of recharge.[16] The aquifer underlying the sub-project area comprises unconfined alluvium with a thickness of about 1050 feet (rock has been encountered at depth 1050 ft in the deepest test bore hole drilled near Thokhar Niaz Baig in Punjab) as a part of regional groundwater investigation. The sources of water to the sub-project site include municipal supply and a ground water bore. Ground

[16] Source: Groundwater Extraction and Waste Water Disposal Regulation – is Lahore aquifer at stake with as usual approach? Basharat, M., and Rizvi A.S,2011

water quality testing from the sub-project site show that the water quality is within NEQs and WHO limits. The detailed test reports are given in **Annexure 7**.

4.2.6 Ambient Air Quality and Noise

A 2014 World Bank report on air quality in Pakistan found the air quality in Lahore to be between 4-14 times WHO limits, with air quality getting worse in the winter.[17] Atmospheric pollution, particularly in urban areas of Lahore, has a strong impact on daily life. Motor vehicles exhaust and industrial emissions are a major source of air pollution. Statistics for 2007 show that there were approximately 1,944,709 vehicles on the roads of the Lahore, a number which has likely grown.[18] Factories and cottage industry inside the Lahore City are also contributing to air pollution. The air quality monitoring of the sub-project site is given in **Table 5.1**. The monitoring period was 24 hours at sampling point. The air quality results reveal higher concentration of particulate matter exceeding World Bank OHS and WHO standards but within NEQS. All other parameters are within permissible limits.

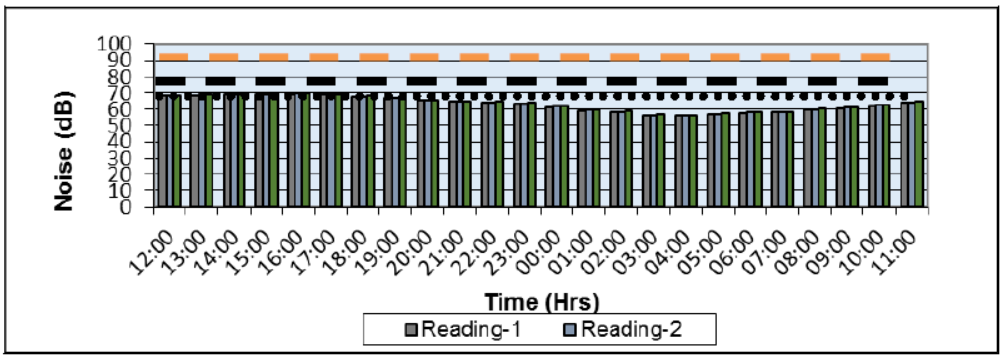
Noise pollution in Lahore city is very common due to vehicle horns and low maintenance of vehicles. Lahore Metropolitan City's vehicle population consists largely of trucks, buses, vans, and three wheel vehicles which are mostly driven by two stroke engines. Results of the noise testing at the sub-project level are shown in **Figure 4.3**. The photographs and monitoring reports of air quality and noise with atmospheric conditions are attached as **Annexure 8**.

[17] Sánchez-Triana, Ernesto, Santiago Enriquez, Javaid Afzal, Akiko Nakagawa, and Asif Shuja Khan. 2014. *Cleaning Pakistan's Air: Policy Options to Address the Cost of Outdoor Air Pollution*. Washington, DC: World Bank.
[18] Source: Punjab Development Statistics, 2009

Table 4.1: Ambient Air Quality Monitoring RMC Lahore

Parameter	Methodology	Unit	Monitoring Duration	LDL	Average Obtained Concentration	Limits As Per NEQS	WHO Guideline
Nitrogen Dioxide (NO_2)	ISO 6768	µg/m³	24 Hrs	1.00	14.35	80 (µg/m³) For 24 Hours	200 (guideline) 1-Hrs
Sulfur Dioxide (SO_2)	40 CFR 50 App. C (US EPA)	(µg/ m³)	24 Hrs	1.00	5.96	120 (µg/ m³) For 24 Hrs	20 (guideline) 24-Hrs
Carbon Monoxide (CO)	40 CFR 50 App. C (US EPA)	(mg/m³)	24 Hrs	0.01	7.09	5 (mg/m³) For 8 Hours	-
Particulate Matter (PM_{10})	US EPA / ISO 21501-4:2007	(µg/m³)	24 Hrs	2.00	133.15	150 µg/m³ For 24 Hrs	50 (guideline) 24-Hrs
Particulate Matter ($PM_{2.5}$)	US EPA / ISO 21501-4:2007	(µg/m³)	24 Hrs	2.00	26.08	35 µg/m³ For 24 Hrs	25 (guideline) 24-Hrs
Total Suspended Particles (TSP)	US EPA / ISO 21501-4:2007	(µg/m³)	24 Hrs	1.00	276.97	500 µg/m³ For 24 Hrs	-
O_3	GSS	(µg/m³)	24 Hrs	1.00	3.89	130 µg/m³ For 01 Hrs	100 (guideline) 8-Hrs
Lead (Pb)	40 CFR 50 APP.B	µg/m³	24 Hrs	0.01	<0.01	1.5 (µg/ m³) For 24 Hours	-

Figure 4.3: Noise level Monitoring at RMC Lahore



OSHA Limits:

PEQS Limits: for Day Time

PEQS Limits: for Night Time

4.2.7 Solid Waste

Lahore with a population of approximately 11 million according to the recent 2017 Population Census is experiencing rapid urban growth and industrialization leading to increasing generation of solid waste from households, commercial areas, industries, hospitals and animal

waste. Waste collection and disposal in Lahore city is the responsibility of the Lahore Waste Management Company (LWMC). According to LWMC estimates, the per capita per day waste generated in the city is 0.65kg, putting the total daily waste generated in Lahore at approximately 7000 tons. LWMC is currently collecting about 70% the solid waste generated in Lahore, and disposing it at allocated landfill sites at Mehmood Booti and Lakhodair, which is Pakistan's only sanitary landfill site.[19] The remaining waste is either collected by informal waste pickers or remains uncollected, lying along roadsides, streets, railway lines, depressions, vacant plots, drains, storm drains, in or around waste containers (where available), open heaps at road sides, informal collection points and open sewers.

4.3 Assessment of Ecological Environment

As the climate of Lahore is semi-arid and subtropical, the vegetation of the area falls under scrub, dry, tropical thorn forest type as per phyto-geographical classification of the area. The alignment, in which the sub-project area stands was once covered with native vegetation consisting, of trees like Karir *(Capparisdeciduas*), Wan (*Salvadoraoleoides*) and Jand (*Prosopisspicigera*). This vegetation was cleared for creating agricultural lands, which were then transformed into residential, commercial and industrial areas to meet the demands of the rapidly urbanizing city.Lahore has a number of parks and recreational spots with some ecological importance. These include Badami Bagh, Bagh-e-Jinnah, Gulistan-e-Zehra, Race Course Park, Gulshan-e-Iqbal Park, Hazuri Bagh, Iqbal Park and Model Town Park amongst others. The sub-project will not affect the environment of any of these parks.

4.3.1 Flora

There are a number of plant species in the gardens, parks and roadways of Lahore. Amongst these, Fabaceae is the dominating family with 15 members (16.5%), followed by Moraceae and Rosaceae with 8 and 5 species respectively. Most of these are present in the Model Town Park which is one of the largest parks in the city. The presence of 94 species of plants and 43 families indicates a fairly diverse vegetation cover which should be taken under protection for sustainability (**Table 5.2**). Due to rapid rate of urbanization, deforestation and a growing preference for alien species in place of native flora in urban areas add stresses on the ecological environment. There are no endangered species of flora in the sub-project site and surroundings. The common trees found in Lahore are included in **Table 5.3**[20].

Table 4.2: Flora List of Lahore

#	Local Name	Botanical Name	#	Local Name	Botanical Name
1	Aam	*Magnifera indica*	48	Kafoor	*Cinnammomum camphora*
2	Aaroo/Peach	*Prunus persica*	49	Kaghzi Tut	*Broussonetia papyrifera*
3	Akhrot	*Juglans regia*	50	Kamila	*Mallotus philippinensis*
4	Almond	*Prunus dulcis*	51	Khair	*Acacia catechu*
5	Amaltas	*Cassia fistula*	52	Kharak e	*Celtis australis*
6	Amla	*Phyllanthus emblica*	53	Kiker	*Acacia nilotica*
7	Arjun	*Terminalia arjuna*	54	Kunk Champa	*Ptrospermum acrofluim*
8	Ashoka	*Saraca indica*	55	Kussum	*Schleichera oleosa*
9	Avocado L	*Persea americana*	56	Lasura	*Cordia oblique*
10	Baid-e-Majnun	*Salix babylonica*	57	Litchi	*Naphelium litchi*
11	Bakain	*Melia azedarach*	58	Locat	*Eriobotrya japonica*
12	Bamboo	*Dandroclamus citratus*	59	Magnolia	*Magnolia grandiflora*

[19] Lahore Waste Management Company (LWMC); www.lwmc.com.pk

[20] A Floristic Analysis Of Selected Parks In Lahore Pakistan Saima Siddiqui, Safdar Ali Shirazi, Ayesha Ali, *JPUHS, Vol.29, No.2, July - December, 2016*

#	Local Name	Botanical Name	#	Local Name	Botanical Name
13	Banyan	*Ficus macrophylla*	60	Mahogoni Tree	*Swietenia mahogoni*
14	Bel	*Aegle marmelos*	61	Mahwa e	*Bassia latifolia*
15	Ber	*Zizyphus jujube*	62	Maple	*Acer negundo*
16	Bhera	*Terminalia bellirica*	63	Molsari	*Mimusops elengi*
17	Bootle Neck	*Sterculia rupestris*	64	Mulbery	*Morus alba*
18	Bottle Brush M	*Callistemon citrinus*	65	Nag Phali	*Heterophargama adenopyllum*
19	Budha Tree	*Chorisia apeciosa*	66	Najor	*Bursera serrata*
20	Burghud	*Ficus benghalensis*	67	Nashpati/Pear	*Pyrus communis*
21	Burna	*Crataeeva religiosa*	68	Neem	*Azadirachta indica*
23	Cassia Tree	*Cassia javanica*	69	Oncoba	*Oncoba sipnosa*
24	Cherry	*Prunus serotina*	70	Palm Trees	*Arecaceae*
25	Chhiku	*Achras sapota*	71	Papaya	*Carica papaya*
26	Chinar	*Platanus orientalis*	72	Paper Bark	*Melaleuca leucadendron*
27	Chir	*Pinus roxburghii*	73	Parkinsonia	*Parkinsonia aculeate*
28	Cypress	*Cupressus funebris*	74	Phulai	*Acacia modesta*
29	Darris	*Darris robusta*	75	Pilkhan	*Ficus virens*
30	Dhaak	*Butea frondosa*	76	Popular	*Populas alba*
31	Dheu	*Artocarpus lakoocha*	77	Putajan	*Putranjiva roxburghii*
32	Dhokra	*Anogeissus acuminate*	78	Rubber	*Ficus elastic*
33	Ditabark/Devil	*Alstonia scholaris*	79	Rukh-e-Zard	*Acacia retinodes*
34	Gab	*Diospyros peregrina*	80	Samundar Phal	*Barringtonia acutangula*
35	Gamhar	*Trewia nudiflora*	81	Shah balut	*Grevillea robusta*
36	Gold Mohr	*Delonix regia*	82	Shahtut	*Morus macroura*
37	Gul Nishter	*Erythrina suberosa*	83	Shareen	*Prosopis julifera*
38	Gul-e-Cheen	*Plumeria rubra*	84	Shisham	*Dalbergia sisso*
39	Gul-e-	*Kigelia pinnata*	85	Simal	*Salmalia malabarica*
40	Gul-e-Must	*Dillenia indica*	86	Sohanjana	*Moringa oleifera*
41	Gul-e-Neelam	*Jacaranda mimosifolia*	87	Sufaida	*Eucalyptus amaldulensis*
42	Gulhar	*Benjaminia comosa*	88	Sumbul	*Bombax malabaricum*
43	Imli	*Tarmindus indica*	89	Talwar Phali	*Oroxylum indicum*
44	Jamun	*Syzygium cumini*	90	Taxodium	*Taxodium mucronatium*
45	Jand	*Prosopis spicigera*	91	Teak	*Tectona grandis*
46	Jungli Badam	*Terminalia catappa*	92	Toon	*Cedrela toona*
47	Kachnar	*Bauhinia alba*	93	Ulta Ashok	*Polyalthia longifolia*
			94	White Siris	*Albizia procera*

Table 4.3: Common Tree Species found in Lahore

#	Scientific Names	Common Names
1	*Alstonia scholaris*	**ditabark**- native to South Asia
2	*Bombax malabaricum*	**sunbal** or **silk cotton tree** - native to Himalayas
3	*Callistemon citrinus*	**bottle brush** - native to Australia
4	*Dalbergia sissoo*	**shisham** - native to South Asia
5	*Delonix regia*	**gulmohar**- native to Madagascar
6	*Erythrina suberosa*	**coral** or **gul nister** - native to Burma
7	*Ficus benghalensis*	**banyan** - native to Bangladesh
8	*Ficus religiosa*	**pipal** - native to South Asia
9	*Ficus retusa*	**bobari** - native to Malaysia
10	*Kigelia pinnata*	**gul-e-fanoos** or **sausage** - native to Africa
11	*Livistona chinensis*	**bottle palm** - native to China
12	*Mangifera indica*	**aam** - native to South Asia
13	*Mimusops elengi*	**molsery** - native to South Asia
14	*Pongamia pinnata*	**sukh chayn** or **Indian beech** - native to Himalayas
15	*Syzygium cumini*	**jamu** - native to South Asia
16	*Ziziphus zizyphus*	**jujube** - native to Himalayas

4.3.2 Fauna

The sub-project lies in the middle of a heavily built up and urbanized area. Hence there is an absence of wildlife near the sub-project location. No wildlife sanctuary or Game Reserve is located in the vicinity of the sub-project area. Domestic animals, small mammals and birds can be encountered in various parts of Lahore. According to a study conducted in 1965 there were 240 bird species; in another study conducted in 1992, only 101 bird species from the parks of Lahore were recorded[21]. With an increase in the rate of urbanization, the ecology of Lahore has been considerably affected and bird population reduced to 85 species in 2007, including both resident as well as migratory birds[22]. Resident species include the Indian grey hornbill, yellow-footed green pigeon, parakeets, bulbuls, doves, spotted owlet, Old World babblers, Old World flycatchers, mynas, woodpeckers, crows, black kites, ashy prinia, redstarts, warblers, red-wattled lapwing, kingfishers, and the Oriental white-eye[23]. The list of birds of Lahore is given in **Table 5.4.**[24]

Three types of migratory birds are regular visitors to Lahore, these are winter visitors, summer visitors and transit migrants. The winter visitors come in September and stay until May. They come from northern latitudes and higher altitudes and include the yellow-browed warbler, common starling, white wagtail, yellow wagtail and white-browed wagtail in search of food. The wagtails eat small insects, spiders, mollusks and soft seeds from moist soil. They roost in tall *Typha* and reed growth on the banks of ponds and lakes. Summer visitors arrive from southern parts of the country; these include Asian koel, purple sunbird, golden oriole and cuckoos. They also come here in search of food and for breeding, they stay in urban Lahore from March until September. The sub-project area does not encounter migratory birds from Siberia as they prefer to stay at major wetlands in Sindh or Southern Punjab.

Table 4.4: [25]Common Birds of Lahore

Scientific Names	Common Names
Egretta intermedia	Intermediate Egret
Ardeola grayii	Indian-Pond Heron
Hoplopterus indicus	Red-Wattled Lapwing
Actitis hypoleucos	Common Sandpiper
Motacilla alba	White Wagtail
Motacilla flava	Yellow Wagtail
Pycnonotus cafer	Red-vented Bulbul
Passer domesticus	House Sparrow
Acridotheres tristis	Common Myna
Cridotheres ginginianus	Bank Myna
Corvus splendens	House Crow
Nectarinia asiatica	Purple sunbird
Dicrurus macrocersus vieillot	Black Drongo
Milvus migrans migrans	Black kite
Columba livia Blue	rocky pigeon
Streptopelia senegalensis	Little brown dove
Halcyon smyrnensis	White-breasted Kingfisher

[21] Roberts, T. J., (1992). The birds of Pakistan. Vol. 2.Passeriformes. Oxford University Press.
[22] Masood, N., (2008). The Study of Ecology and Ecological Linkages of the Lahore Canal Bank from Mustafaabad Bridge to Thokar Niaz Baig.
[23] Mirza, Z.B., (2007). A field Guide to Birds of Pakistan. WWF Pakistan.
[24] NEC Consultant (2008), National Environmental Sustainable Development Indicators Study, Lahore
[25] Bird Ecology from the Ravi river of Lahore, Habitat degradation , The Journal of Animal & Plant Sciences, 21(4): 2011, Page: 817-821 M. Iqbal, I. Saleem, Z. Ali*, M. A. Khan** and M. Akhtar*

Merops orientalis	Little Green Bee eater
Dinopium benghalense	Golden-backed woodpecker
Upopa epops	Hoopoe
Hydrophasianus chirurgus	Pheasant-tailed jacana

4.3.3 Protected Areas

There are no protected areas present in Lahore. Changa Manga, a forest planted in 1866 is located at a distance of 85km from Lahore. Once known as one of the largest hand planted forests in the world, it has suffered deforestation from illegal logging. However, the forest is still a hotspot for wildlife in Punjab. Wildlife within the borders of the plantation includes a small remnant population of nilgai *Boselaphus tragocamelus*, hog deer *Axis porcinus*, wild boar *Sus scrofa* and possibly axis deer *Axis axis*. Jackal *Canis aureus* and Asiatic wild cat *Felis silvestris ornata* can be found there as well. It also serves as a wildlife breeding center. Changa Manga plantation is an important place for restocking projects of Asiatic vultures in Pakistan. A Gyps Vulture Restoration Program was started in 2006 by WWF-Pakistan to conserve and breed endangered species of Gyps, especially the white-rumped vulture.

4.4 Socioeconomic Profile

4.4.1 Administrative Setup

The sub-project area falls in the Lahore District. District Co-ordination Officer is the highest ranked administrator of the district. For the collection of revenue and administration, the districts are subdivided into Tehsils and Union Councils. The total area of district Lahore is 2,300 square kilometers.

4.4.2 Demography

Lahore is the capital of Punjab with a population of 11.13 million and an annual growth rate of 4.07% according to the 2017 Population Census. It is the second-most populous city of Pakistan with 52.35% male, 47.64% female and 0.01% transgender population[26]. It is one of wealthiest cities of Pakistan with an estimated GDP of $58.14 billion (PPP) as of 2014.[27] The sub-project site at Shadman Lahore is located in a thickly populated area at the center of the city. Lahore has a majority Muslim population of 94%, followed by Christians at 5.8% and other religions.[28] Due to the presence of holy sites of Sikhism, a large number of Sikh pilgrims pay a visit to the city annually.

4.4.3 Literacy and Educational Facilities

Literacy is defined as percentage of population that can read and write at the age of 10 or above. The overall literacy rate of Lahore district is 64.7% and it is ranked number two among 36 districts of Punjab.[29] Of the total literate persons 9.3% have intermediate education, 7.2% have a bachelors or equivalent degree, while 2.6 % have a Master's degree or higher. A number of government schools system exist in Lahore that provide free of cost education to the residents. The system is divided into five levels including primary, high, intermediate and university programs leading to graduate and advanced degrees. All academic education institutions are the responsibility of the provincial governments. The federal government mostly assists in

[26] Pakistan Bureau of Statistics- Pakistan population census
[27] "GaWC – The World According to GaWC 2016". lboro.ac.uk. 24 April 2017.
[28] 1998 Population Census of Pakistan
[29] Pakistan Social & Living Measurement Survey- PSLM 2006-07; Pakistan Bureau of Statistics

curriculum development, accreditation and some financing of research. Lahore hosts some of Pakistan's oldest educational institutes: Government College Lahore established in 1864; Forman Christian College, a chartered university established in 1864; University of the Punjab, established in 1882; Kinnaird College, established in 1913;Lahore College for Women University, established in 1922, Queen Mary College, Lahore, established in 1908 and University of Engineering and Technology, Lahore(UET Lahore), established in 1921.Most of these reputable universities are public, but in recent years there has also been an upsurge in the number of private universities and schools. Educational facilities located near the sub-project site include Lahore College for Women University, Kinnaird College and Beaconhouse School Shadman.

4.4.4 Migration

The total number of life time in-migrants in Lahore district was 1,034,848 or 16.4 percent of the total population according to the 1998 population census. 71.7 percent of the migrants came from other districts of Punjab province, 10.1 percent were from Sindh, Khyber Pakhtunkhwa and Balochistan, 1.3 percent from Federally Administered Areas while remaining 16.9 percent were Pakistanis who repatriated from other countries. The main reason of migration is economic opportunities, presence of better education and health facilities and, availability of basic amenities in Lahore.

4.4.5 Occupation

The 1998 population census shows that of the total employed persons, 44.7 percent had elementary occupations, followed by service workers, shop and market sale workers at 17.5 percent, and professionals at 9.2 percent. The unemployment rate was 20.7 percent, which was mainly due to unemployment amongst males representing 21.4 percent, while female unemployment rate was just 2.2 percent. This is because of their small proportion in total economically active population.

4.4.6 Industry

After Karachi, Lahore is the biggest industrial area in Pakistan. There has been a steady expansion of industries in and around Lahore since independence. There are many large industrial units in the district. These units manufacture cotton, woolen and silk cloths, carpets and rugs, textile products, leather and rubber foot wears, wearing apparel, pharmaceutical goods, soap, iron and steel products, heating, plumbing and lighting equipment, hardware, miscellaneous fabricated products, agriculture machinery, engines and turbines, textile machinery, printing machinery, metal working machinery, pumps and compressors, household machinery, water generators, motor generators, transformers, electric fans, communication equipment, cycles and rickshaws. There are also a good number of printing and publishing units and body building workshops. 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. The government has built underpasses to ease congestion and prevent traffic jams.

4.4.7 Health

The government is active in the health care sector in all districts of the Punjab. The provinces in line with federal ministry of health are making efforts to provide quality health care services to the general public. A network of government hospitals and basic health units is operational

but limited services are available due lack of resources. Other than government hospitals, private hospitals and clinics are present to fulfill the needs of the public.

There are a number of health care facilities available in Lahore city and its suburbs. The most prominent health care facilities provided by the government include General Hospital, Lady Wellington Hospital, Mayo Hospital, Fatima Jinnah Hospital, The Children's Hospital, Services Hospital and Ganga Ram Hospital amongst others. There are also a large number of private hospitals and clinics, as well as those run by charitable organizations. Shaukat Khanam Cancer Hospital is the only cancer hospital in Punjab. Health facilities located near the sub-project location at RMC Lahore are Punjab Institute of Cardiology and Services Hospital.

4.4.8 Archaeological and Cultural Property/ Places of Interest

Having served as the seat of the Mughal and Sikh Empires, Lahore has a rich historical and cultural history with a number of historic monuments. The Lahore Fort and Shalimar Gardens constructed by the Mughal Empire are on the UNESCO World Heritage List, while the Badshahi Mosque, Wazir Khan Mosque, and Tombs of Jahangir, Asif Khan and Akbari Sarai are on the tentative list for UNESCO World Heritage sites. These places of archaeological importance are at a safe distance from the sub-project site. However, the Race Course Park, Jinnah Park, Lahore College for Women University, Kinnaird College and APWA College are located within 5km radius of the sub-project site. The sub-project physical activities, being low scale are not expected to have any impacts on these sites.

Chapter 5. Stakeholder Consultations

The participation of project stakeholders in project planning, design and implementation is now universally recognized as an integral part of environmental impact assessment. The World Bank guidelines on disclosure of information and stakeholder participation lay emphasis on enforcing the mechanism in every stage of project execution. The Pakistan Environmental Protection Act 1997 Section 12(3) highlights that "every review of an environmental impact assessment shall be carried out with public participation." United Nations Conference on Environment and Development (UNCED) in 1992 endorsed the process of stakeholder participation and consultation as one of the key documents of the conference Agenda 21.

Stakeholders are groups and individuals that are affected by or can affect the outcome of a project. As part of the Environmental Assessment (EA) process, stakeholder consultations are undertaken with primary as well as secondary stakeholders.

5.1 Purpose

The purpose of stakeholder consultations is to ensure meaningful and adequate consultation with all affected or interested stakeholders in project planning processes. The ESMP preparation followed a participatory planning process with local inputs on decision–making and mitigation measures to ensure that stakeholders concerns are addressed at the project design stage.

In accordance with World Bank Guidelines, public consultations are essential to fulfill the following objectives:

- Exchange of information related to the project and its possible utilization in the project designing/planning and implementation;
- Ascertaining the most acceptable solutions and mitigation measures for possible issues which could arise during implementation of the project activities;
- Eliciting community comments and feedback on the proposed project;
- Facilitate and maintain dialogue with the stakeholders to gain consent on carrying out project activities in the area;
- Encourage transparency and inculcate trust among various stakeholders to gain cooperation and partnership from the communities, local leadership, and NGOs.
- Record concerns regarding the various aspects of the project, including the existing situation, project area/area of influence, construction works and the potential impacts of the construction-related activities and operation of the project.
- Incorporate mitigations measures to address concerns rose with project design and implementation.

5.2 Consultation Process

The consultation process followed for the project is detailed below:

5.2.1 Identification and Classification of Stakeholders

The identification of stakeholders is important for the sustainability of a development project and helps to evaluate and envisage the role of stakeholders. The Stakeholders Analysis refers to the Project Affected Personal (PAPs)/ local community, associated departments/agencies, Non-Governmental Organizations (NGOs) and others, whose assets/land, business, structures, installations, interests may be impacted due to the project activities. The influence or impact of stakeholders on the project is elaborated in the form of a matrix and the mitigation measures are proposed accordingly. The stakeholders that are likely to be influenced by the project activities or would like to participate in the project will include:

Government Organizations:

- Civil Aviation Authority
- WAPDA
- Provincial Irrigation Department
- Provincial Agriculture Department
- Provincial Agriculture Departments

Inhabitants of the sub-project surrounding areas:

- Black Box Concepts
- Households close to the project site
- A.K Motors
- Pakistan State Oil Fuel Station
- M.I Traders

Project beneficiaries

- Pakistan Meteorological Department, Islamabad
- Regional Meteorological Center, Lahore
- People of Pakistan

5.2.2 Classification of Stakeholders

Project Stakeholders are classified as primary and secondary stakeholders depending on the influence of the sub-project activities:

- Primary Stakeholders: People, groups or institutions directly affected by the project and can influence the project outcome.
- Secondary Stakeholders: People, groups, or institutions that are indirectly affected by the project and can influence project delivery process.

The list of stakeholders compiled according to the categories is shown in **Table 6.1.**

Table 5.1: List of Stakeholders

Primary Stakeholder	**Secondary Stakeholder**
Pakistan Meteorological Department, Islamabad	Civil Aviation Authority

Primary Stakeholder	Secondary Stakeholder
Regional Meteorological Center, Lahore	WAPDA
Black Box Concepts	Provincial Irrigation Department
Households close to the project site	Provincial Agriculture Departments
A.K Motors	Provincial Agriculture Department
Pakistan State Oil Fuel Station	
M.I Traders	

5.2.3 Consultation Methodology

One to one meetings were conducted with the primary stakeholders. Sessions were informal to encourage friendly environment, comfortable enough for participants to express their concerns, questions and opinions about the project activities in addition to seeking clarification regarding the project. Survey team highlighted the potential benefits of sub-project implementation and documented any aspects, which need to be covered in detail during the execution stage. The meetings progressed in the following manner:

- A brief sub-project description was provided to the stakeholders.
- Stakeholders were given the opportunity to raise queries or concerns regarding the sub-project.
- Queries were responded to and concerns were documented.

5.2.4 Consultation Findings/ Concerns

Consultations were carried out with primary stakeholders in Lahore. As the construction activities will be carried out on government owned land, stakeholders did not express any major concerns. The sub-project site in Lahore is located in the Flood Forecasting Division (FFD) of the Regional Meteorological Center which already has weather radar and other observation instruments. The area is mostly commercial and hence the project does not pose any major environmental and social implications. More than 5 houses and businesses residing in the 500 meters of the proposed site were consulted. They were briefed about the proposed development and asked about their concerns, views and suggestions. Consultation record and photographs are presented in **Annexure 9** and concerns are summarized in **Table 6.2**.

Table 5.2: Stakeholder Concerns

Stakeholders Consulted	Concerns	Response
Pakistan Meteorological Department PMD Location: Islamabad Respondents: Hazrat Mir, Deputy Director General/ Chief Meteorologist	Pakistan Hydro-Meteorological and DRM Project has several components managed by various partners. There is high risk that incompletion or non-performance at one component will impact the other components. Thus affecting the sustainability of the project. It is suggested to provide PMD autonomy for completion of project components.	Concerns to be addressed by project management
	No separate funds should be allocated for equipment training; the provision should be made in the	

Stakeholders Consulted	Concerns	Response
Mr Jan Muhammad Khan, Director Planning Mr Aleem ul Hassan, Deputy Director Pakistan Meteorological Department	contractual requirement of manufacturer installing the equipment for the whole project.	
	Required experts for various components of the project should be hired locally. If international consultant is needed, there should be open competition among local and international experts.	
	The project budget has more than 40% budget for experts needed from the World Bank. The budget estimation should take in to account	Concerns to be addressed by project management
	The provision of climate specific data needed for climate change assessments should be included in the project.	Component has been included in the project
	Height of the radar for Lahore should be taken into consideration in the presence of population nearby.	Tower height has been designed at 72 meters
	NOC from CDA, LDA, CAA, NDMA and local authorities should be taken prior to construction work.	Provision made in ESMP
	The AWS should be installed on government owned land in a guarded locality to avoid damage to the equipment.	It will be installed inside the RMC
	Cost of land acquisition (if required) should be made part of the project.	Addresed in ESMF with RPF
Regional Meteorological Center Location: Lahore Respondents: Muhammad Riaz (Chief Meteorologist) Fayaz Nazir (Senior Electronic Engineer) Sahibzad Khan (Director) Organization: Regional Meteorological Center, FFD Lahore	Currently, there is no space available at the FFD center for new radar installation; however, a possible solution is to shift the Pilot Balloon Observatory (PBO) building to the Regional Meteorological Center building which is right across the road and has ample space to house PBO. This scenario would have the following benefits: The new radar building would be located right next to the existing one. It would not hamper the efficiency of the observation instruments in the front yard as it would be built behind the existing radar.	Existing Site will be considered
	Height of the tower should be elevated above 100 ft to increase efficiency.	It is kept at 72 meters to improve efficiency
	Latest and most sustainable building standards should be followed to increase the life of the infrastructure for long term benefits.	The design mitigation includes sustainibility component
	Power backup system should be up to the mark keeping in view the current load shedding scenario in the city.	Solar Panels are proposed

Stakeholders Consulted	Concerns	Response
	New radar technology uses less power, so a possibility of hybrid systems should be considered	The design mitigation includes energy conservation technology
	Auto Calibration rain gauges should be installed at different ranges i.e. 50, 100, 200, 240 and 480 kilometers. This would increase the efficiency of current and proposed systems.	Taken into account at technology selection
	The maintenance schedule after the project implementation must be included. The provision of spares must be guaranteed for at least 10 years.	Implementation mitigations
	Additional staff must be hired for the new system, which should include at least 5 meteorologists and 4 sub-engineers.	Staff needs are included in PAD and PC-1
	Vehicles should be provided for remote sensing.	Budgetary provision
	The staff should all be given trainings on radar meteorology.	Radar Installation team will provide training
	Coordination for the project implementation should be improved with timely information dissemination.	Management
	High resolution output systems should be used.	Taken into account at technology selection
Regional Meteorological Center Location: Lahore Stakeholders 500m radius of sub-project site at RMC Stakeholders M.I Traders Household Black Box Concepts Households A.K Motors PSO Pump	Majority of the stakeholders showed that they have no direct or indirect concerns or issues and they all appreciated the proposed development.	
	Some participants said that rays generated by radars may affect humans especially infants that's why it should be installed outside of the residential areas.	Radar height is designed to be 72 metres to avoid impacts
	Some participants expressed about employment opportunities will be available in result of proposed development.	Locals will be given preference for hiring

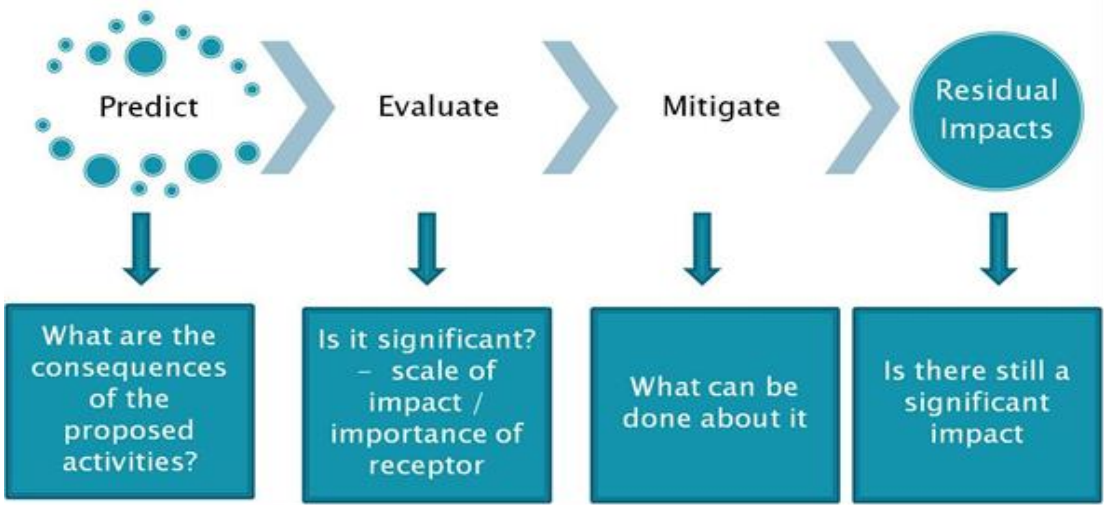
Chapter 6. Environmental and Social Impact Assessment and Mitigation

This section discusses the potential and localized environmental impacts that may arise from the project activities and the mitigation measures proposed to avoid, minimize and reduce these impacts.

6.1 Impact Assessment Approach

To screen, identify and evaluate the impacts, the nature, extent, duration, scale and other parameters of the sub-project activities are to be studied along with conditions of the environmental and social baselines. The following approach has been adopted for impacts identification, assessment and mitigation.

Figure 6.1: Approach to Identify, Assess and Mitigate Impacts



The installation of the WSR is likely to improve the current infrastructure of PMD leading to improvement disaster management capability. It is a small scale construction project with low to moderate impacts on environmental and social receptors. The potential environmental and social impacts during construction and operation phases were identified and evaluated in accordance with the impact assessment framework.

6.2 Sub-Project Area of Impact

The sub-project area of impact includes the immediate area and wider area surrounding the construction location.

6.2.1 Immediate Area of Impact

This includes the area surrounding the construction site that may suffer impacts due to the sub-project activities. The immediate area of impact may include but is not limited to the following:

- Project Site and 5km radial distance including residential and commercial establishments as well as educational institutes
- Access roads

The project construction is likely to impact the immediate area. The identified critical receptors within a 5km radial distance are as follows:

- Rehmania Park Shadman
- Lahore College Women University
- Shadman Market
- Shadman Colony
- Race Course Park

Figure 6.2: Critical Receptors Near Sub-project Site

6.3 Impact Assessment Approach

The construction of the WSR tower involves various activities which may temporarily impair various components of the physical and ecological environment of the area. Proposed mitigation measures will reduce the impacts to negligible by enabling offsets and pollution abatement technologies. The proposed mitigation measures are based on the magnitude of the impact, sensitivity and behavior of the environmental and social receptors at the project site, regulatory requirements, and best management practices. The potential impacts have been analyzed in **Table 7.1** impact assessment framework, and mitigation measures are proposed in the following sections.

Table 6.1: Impact Assessment Framework

Project Activities		**Impacts on Physical Environmental**									**Impacts on Ecological Environmen**			**Impacts on Social Environment**							
	Soil Erosion	**Land use**	**Ambient Air Quality**	**Surface Water Quality**	**Groundwater Quality**	**Water/ Electricity /Gas / Fuel Consumption**	**Solid Waste**	**Ambient Noise level**	**Electromagnetic Field**	**Climate**	**Flora**	**Fauna**	**Biodiversity /Ecology**	**Traffic Management**	**Public Health, Safety and**	**Health and Safety of Workers**	**Economy**	**Employment**	**Drinking Water**	**Loss of land holdings and livelihood**	**Cultural/religious and**
Design Phase (Installation of WSR)																					
Technology selection	M-		M-	M-		M-	M-	M-		M-			M-								
Building design		M-	M-	M-		M-															
Construction Phase (Installation of WSR)																					
Site clearing and preparation	H-		M-	M-		M-	M-	M-		M-	M-	M-		M-	M-	M-	M-	H+			
Civil work including laying of foundation	M-		M-	M-		M-	M-	M-		M-	M-	M-		M-	M-	M-	M-	H+			
Mechanical work for the water and natural gas supply, distribution and drainage.						M-	M-	M-						M-	M-	M-		H+			
Electrical Layout							M-	M-		M-				M-	M-	M-		H+			
Backup generator for the machinery			M-					M-						M-	M-	M-		H+			
Solar panel installation at roof top			H+			M-	H+	H-		H+								H+			
Installation of Weather Radar							M-	M-	M-					M-	M-	M-	H+	H+			
Cleaning and Restoration	H+	H+	H+	H+	H+		H+											H+			
Operations/ Post Construction Phase																					
WSR, AWS and Wind Profiler			M-	M-	M-	L-	M-		M-								H+	H+			

Note:
H- = High Negative Impact; M- = Moderate Negative Impact; L- = Low Negative Impact
H+ = High Positive Impact; M+ = Moderate Positive Impact; L+ = Low Positive Impact. Blank=None

6.4 Mitigation Guidelines and Best Practices

Mitigation measures proposed in this section are based on international best practices and guidelines.

The principal World Bank publications that contain environmental and social guidelines are listed below.

- Environment, Health, and Safety (EHS) Guidelines prepared by International Finance Corporation and World Bank in 2007[30].
- Pollution Prevention and Abatement Handbook 1998: Towards Cleaner Production[31].
- Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues.[32]
- Social Analysis Sourcebook[33].

6.4.1 Environmental, Health, and Safety (EHS) IFC General Guidelines[6]

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary. The proposed sub project does not fall in sector specific guidelines therefore EHS general guidelines will be applicable to the pre-construction, construction and post construction activities are given in **Table 6.2.** The construction contractor will follow the applicable guidelines including 1.1 to 1.8, 2.1to 2.9 and 3.1 to 3.7.

[30] http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

[31] http://documents.worldbank.org/curated/en/758631468314701365/Pollution-prevention-and-abatement-handbook-1998-toward-cleaner-production

[32] http://documents.worldbank.org/curated/en/223391468174870007/Environmental-assessment-sourcebook-volume-1-policies-procedures-and-cross-sectoral-issues

[33] http://web.worldbank.org/archive/website01028/WEB/0__CO-15.HTM

Table 6.2: IFC/World Bank General EHS Guidelines

6.4.2 World Bank Environmental Code of Practices

The World Bank Environmental Code of Practices (ECoPs) is to address less significant environmental impacts and all general construction related impacts of the proposed project implementation. The ECoPs provide guidelines for best operating practices and environmental management guidelines to be followed by the contractors for sustainable management of all

environmental issues. The list of ECoPs is provided below. Detailed ECoPs can be found in **Annexure 6**.

- ECP 1: Waste Management
- ECP 2: Fuels and Hazardous Substances Management
- ECP 3: Water Resources Management
- ECP 4: Drainage Management
- ECP 5: Soil Quality Management
- ECP 6: Erosion and Sediment Control
- ECP 8: Air Quality Management
- ECP 9: Noise and Vibration Management
- ECP 10: Protection of Flora
- ECP 11: Protection of Fauna
- ECP 13: Road Transport and Road Traffic Management
- ECP 15: Cultural and Religious Issues
- ECP 16: Workers Health and Safety

6.5 Potential Environmental and Social Impacts and Mitigation-Design Phase

The design phase activities of the sub-project include the infrastructure design, site selection and preparation for civil works. The associated impact of installation of WSR, AWS and Wind Profiler on the ecological, physical and human environment is given below.

6.5.1 Biodiversity and Natural Resources

None of the sub-project activities will be of a harmful nature to biodiversity and natural resources as the sub-project site is not located in an environmentally sensitive location. The project site for WSR is within a urban location with negligible wildlife, and is at a reasonable distance from critical and sensitive receptors including reserve forests, national parks, wetlands, marine protected areas and wildlife sanctuaries. Similarly, there are no sensitive habitats present within the project site that support endangered mammal or bird species. Hence impact on flora and fauna is negligible. Sub-project site may require tree cutting and vegetative clearing therefore mitigations are proposed in the design phase to avoid maximum damage. Mitigation measures in line with ECP 10 Protection of Flora are:

Mitigation Measures

- Incorporate technical design measures to minimize unnecessary removal of trees and vegetative cover;
- Plan for compensatory planting of eight trees against each fallen tree of similar floral function;
- Disallow introduction of invasive/ exotic species; and recommend native species for plantation.

6.5.2 Natural Disasters

The sub-project site is in Zone 2A of seismic zonation prone to minor to moderate damage from earthquakes. The impact is likely to be moderate in case of earthquakes. There is also a minor chance of flooding due to blocked drainage during Monsoon rains.

Mitigation Measure

- The building design will be earthquake resistant according to Building Codes of Pakistan with Seismic provisions for Zone 2 and international best practices to avoid damage caused by earthquake;
- Variety of structural engineering measures or structural components like shear walls, braced frames, moment resisting frames, and diaphragms, base isolation, energy dissipating devices and bracing of non-structural components are proposed. Simpler techniques include avoiding soft stories and bolting the sill plate of houses to the foundation;
- Primary focus of earthquake design is initial life safety and getting people out of the building safely, not necessarily the ability of a building to withstand the effects of an earthquake, or to ensure occupancy or functionality following an event. Therefore building design will include emergency exits and alarm system;
- Planning, designing and constructing the building to minimize any potential flood damages using guidelines of **Annexure 10**. Following are proposed:
  - □ elevating as much of the building as possible above the design flood level;
  - □ designing the building foundation and any portions subject to flooding to withstand design flood conditions and loads;
  - □ using flood-damage-resistant materials for any portions of the building below the design flood level;
  - □ where flood proofing is permitted, employing appropriate methods and materials to either dry-flood proof or wet-flood proof those portions of the building below the design flood level.

6.5.3 Water /Electricity/ Natural Gas/ Fuel Consumption

There will be an increase in resource consumption, especially water during civil works and energy during operations of the WSR.

Mitigation Measures

- Prepare an **Energy and Water Conservation Plan** for construction
- Design of buildings will include installation of Solar Panels;
- Provision of Low Voltage electrical appliances will be made in procurement procedures;

6.5.4 Air Quality and Noise Levels

Sub-project activities associated with construction may increase the ambient air quality and noise levels of the at the sub-project sites. The noise and air pollution sources include site clearing, construction machinery, generators, civil and mechanical work. The impacts are likely to be moderate, especially on the surrounding residential areas and educational institutes.

Mitigation measures in line with ECP 8 Air Quality Management and ECP 9 Noise and Vibration Management will include:

Mitigation Measures

- Air quality and noise level baselines will be established to enable monitoring during construction phase;
- Provision of compliance to NEQS of vehicular emission will be made in the contract of construction contractor and SOP's of PMD vehicles;;
- Locations of Batching Plant, concrete mixers and other noise generating equipment will be identified away from residents;
- Contractor shall prepare an **Emissions Monitoring Plan** to ensure constant checking of emissions by construction machinery and vehicles with operations and maintenance plan for the same;
- **Traffic Management Plan** for construction will be formulated during design phase that enable continuous traffic flow and avoid congestions which result in increased vehicle smoke density at a given area;
- Plan to neutralize dust emissions from construction activity, such as regular watering of sub-project sites to settle dust;
- Use of Hazardous material list will be strictly prohibited in construction and provision will be made part of the contract.

6.5.5 Solid Waste Management

Improper solid waste disposal can result in increased air pollution through burning of waste, vector borne diseases, contamination of water sources and ambient aesthetics for surrounding communities. Impact is likely to be moderate. Mitigation measures in line with ECP 1 Waste Management and ECP 2 Fuel and Hazardous Substances Management will include:

Mitigation Measures

- Prepare a detailed **Solid Waste Management Plan** for construction site minimising use of plastics and encourage recycling
- Identify current municipal systems of waste management or private waste disposal services;
- Placement of waste collection containers throughout the project area;
- Disallow the burning of any of type of waste;
- Prepare plans for the safe handling, storage and disposal of harmful materials and hazardous waste.

6.5.6 Workers Health and Safety

Use of heavy machinery and handling of chemicals by workers can result in health impacts and accidents. Mitigation measures in line with ECP 16 include:

Mitigation Measures

- Prepare a **Workers Health and Safety Plan** for the construction phase.

6.6 Potential Environmental and Social Impacts and Mitigation-Construction Phase

The potential impacts associated with the construction of the WSR tower are elaborated below:

6.6.1 Landscape/Soil

Existing land use of the WSR sub-project site is an open space adjacent to the RMC office building used for landscaping. There will be no drastic change in the landscape during construction as the sub-project site is a plain terrain. Construction at site is likely to carry out site clearance, vehicular, labour and machinery movement causing soil erosion and compaction. There is also a potential for contamination of soil via runoff from construction activities including oil spills, construction material, dredged / spoil materials and construction waste. The impact is likely to be moderate, however, it be will be confined to construction site and phase. Mitigation measures in line with ECP 4 Drainage Management, ECP 5 Soil Quality Management and ECP 6 Erosion and Sediment Control will include:

Mitigation Measures

- Removal of vegetation and trees will be avoided to the extent possible;
- Safe drainage of run-off from construction activities will be ensured;
- Removal of vegetation and trees will be avoided to the extent possible;
- Water will be sprinkled during construction to avoid soil erosion and dust pollution;
- Construction materials will be stored in proper stores on impervious sheets to avoid any soil contamination;
- Machinery and vehicles will be operated at designated routes to avoid erosion and compaction of un-impacted soils;
- Visual Inspection will be carried out for land contamination and dust emissions;
- The soil contaminated from minor and moderate spills will be removed and will be handed over to waste contractor for treatment at nearest incineration facility or waste disposal and treatment at Mehmood Boti;
- Major spills may require specialized treatment such as incineration, bioremediation and biodegradation. The biological agents will be introduced to the spill to hasten biodegradation. Most of the components of oil will be broken down by bacteria and other microorganisms into harmless substances such as fatty acids and carbon dioxide. To stimulate the growth of the microorganisms, fertilizing nutrients like nitrogen and phosphorous will be placed near the oil tanks.

6.6.2 Ambient Air Quality and Climate

The construction activities will cause adverse impacts on air quality. Cement mixers (Batch Plant), movement of the machinery and soil excavation may release particulate matter 2.5/10 and fugitive dust which will deteriorate ambient air quality in the vicinity of the sub-project site. Construction vehicles and generators are likely to generate dust and exhaust emissions such as oxides of Carbon (COx) Oxides of Sulphur (SOx), Oxides of Nitrogen (NOx). Impact on local air quality is high as a result of gaseous emissions and particulate matter. The construction work is not likely to impact the climate of the area, however, there will be minimal increase in GHG emission from above mentioned sources. The impact is likely to be moderate.

Mitigation Measures

Following NEQS and ECP 8 Air Quality Management as performance indicators;

- Contractor shall execute the **Emissions Monitoring Plan** to ensure constant checking of emissions by construction machinery and vehicles with operations and maintenance plan for the same;
- Water will be sprinkled twice a day to avoid fugitive dust emissions;
- Contractor shall execute the **Traffic Management Plan** to enable continuous traffic flow and avoid congestions which result in increased vehicle smoke density;
- Construction machinery and vehicles will be kept in good conditions to avoid vehicular emissions. Vehicular and generator exhaust emissions will be monitored to ensure compliance;
- Unnecessary movement of vehicles will be avoided at the construction location;
- Open burning of solid waste from the Contractor's work areas should be strictly banned;
- Wind breaks /barriers (either natural or constructed) will be deployed to reduce the possibility of suspended particles in air;
- Raw materials such as cement, gravels and sand will be kept under sheet covers to prevent air flow;
- In order to further reduce the environmental impact of Cement Works (Concrete Batching Plant), the concrete batching plant will incorporate the following design and practices:
  - Cement will be transferred directly from Trucks to the construction site
  - All mixing will be in the enclosed electric motor driven plant mixer, NOT in trucks.
  - Truck loaded with concrete will be in wet form.
  - All washing water used by the batch plant and storm water will be collected and stored and recycled for re-use.
  - No water will be discharged outside the construction boundary.
  - Concrete recycling machine be used to recycle waste material to slurry water and aggregates for reuse.

6.6.3 Surface/Ground Water Resources

Drainage channel in close vicinity of sub-project site is a Shadman storm water drain leading to River Ravi. Construction activities may encourage soil erosion and increase the sediment load into the city drainage, while accidental leaks/spills of oil/fuel from storage tanks or maintenance vehicles can also pollute surface waters. Construction waste and oil spills, if left unattended will result in forming leachate that will percolate through the soil strata and may contaminate the groundwater table. The sources of contamination and wastewater may likely be from the following sources:

- Disposal of construction waste and solid waste into the water channel;
- Possible oil spills from fuel storage area;
- Surface runoff due to rainfall causing blockage of drainage;

- Used oil, paints, cleaning solvents and other chemicals may generate liquid hazardous wastes.
- Wastewater from temporary sanitation facilities for the workers may also result in contamination of subsoil water.

The impact is likely to be low as the construction site is 1km away from the drainage channel. Mitigation measures in line with ECP 3 Water Resources Management and ECP 4 Drainage Management include:

Mitigation Measures

- **Debris Management Plan**; the contractor will ensure that construction debris does not find its way into the drainage or water channels which may get clogged;
- Prohibit washing of machinery and vehicles in surface waters;
- All fuel storage will be properly marked to highlight their contents with a concrete pad underneath to prevent contamination in case of leaks or spills. Daily monitoring will be carried out for leaks. Shovels, plastic bags, and absorbent material will be placed near fuel and oil storage or handling areas to attend spills and leaks;
- Used oil and vehicle related waste will be transported to local contractors for recycling or reuse;
- Proper disposal of solid and sewage waste from workers sanitation facilities to ensure it is not disposed in the drainage channel.

6.6.4 Water /Electricity/ Natural Gas and Fuel Consumption

There will be an increase in water, electricity, natural gas and fuel consumption from the baseline during construction. Preparation of sand, cement mortar, curing of walls before and after plastering require a large amount of water that may get extracted from the groundwater bore at the sub-project area. The impact is likely to be moderate.

Mitigation Measures

- Contractor will execute the **Energy and Water Conservation Plan**
- Water meters will be installed at sub-project site to monitor water consumption;
- Construction staff will be trained on water conservation practices to avoid excessive loss;
- Water required for construction should be obtained in a way so that water availability and supply to residing area remains unaffected;
- Approval will be attained from local authorities prior to construction work.

6.6.5 Solid Waste Generation

During construction phase, solid waste can be generated from discarded equipment parts, scrap metals, equipment boxes, wood parts, empty bags, and leftover construction debris. The excavated material may also be considered as solid waste as it would require disposal. Solid waste will also be generated from workers facilities at the construction sites. The sub-project location in Lahore is already under the management of the Lahore Waste Management Company (LWMC) for solid waste. Waste collection and disposal mechanism is in place will be used for the maximum allowable waste. The construction material and waste may contain

hazardous/toxic chemical materials banned as per international best practices. The impact is likely to be moderate as the material may include:

- Asbestos (pipe covers flooring and building material)
- Lead (Roofing material and pipes)
- Cadmium (used as corrosion resistant agent in steel)
- Polyvinyl Chloride (pipes)
- VOCs (formaldehyde in form solvents, paints, synthetic coating)
- Silica (in various building material-exposure causes lung cancer)
- Wood preservatives (Creosotes and Arsenic)
- Halogenated flame Retardants (mixed in concrete construction material)

Mitigation measures in line with ECP 1 Solid Waste Management and ECP 2 Fuels and Hazardous Substances Management include

Mitigation Measures

- **Solid Waste Management Plan** will be executed by Construction Contractor. In case of the occurrence of toxic/hazardous chemical materials, it will be handled according to hazardous waste management best international practices. The plan will be prepared with following provisions:
    - Solid waste collection, segregation, storage and disposal will be carried out for waste generated. For at source segregation separate waste bins will be placed at sub-project sites. Recyclable material will be segregated whereas non-hazardous waste will be disposed-off at approved disposal site;
    - Private contractors will be hired for responsible disposal of construction waste
    - Labeling of containers will be carried out including the identification and quantity of the contents, hazard information;
    - Marking of Hazardous/toxic waste ‘if generated’ separately and disposal using international best practices through registered contractor;
    - Used oil will be collected in separate containers stored on impervious platform with restricted access and must be sold to licensed contractor;
    - Burning of solid and waste oil should be strictly prohibited
    - Training of workers will be carried out in the storage and handling of materials and chemicals that can potentially cause soil contamination;
    - **Emergency Response Plan** will be prepared to address the accidental spillage of fuels and hazardous/toxic material, fire, vandalism and natural hazards;
- On completion of the construction phase of the project, the contractor will be required to rehabilitate the site. Rehabilitation will include removal of all construction materials and wastes, and the grading and landscaping of all exposed sites that may be prone to erosion. Where natural erosion protection measures may not be possible or practical, suitable physical erosion protection methods will be used. The purposes of site rehabilitation will be to minimize the potential for soil erosion, enhance the aesthetic appearance of the site and restore safe public access to the surrounding area.

6.6.6 Noise Levels

Noise is one of the aspects which may cause hearing impacts on workers and communities in immediate vicinity especially during morning office/school hours and at night time. The construction activities are likely to generate high noise levels. The sources of noise in construction are provided as follows:

- Asphalt Plant
- Construction and excavation work such as heavy earth moving equipment/ machinery, pilling work, welding, cuttings, drilling, grinding.
- Material loading/offloading vehicles and other transport used by construction contractor.

The sub-project construction activities are restricted to a confined area within the site. Impact of noise is likely to be moderate from baseline noise levels (60-70dB). The impact will be high to the workers and moderate to the residents not causing hearing loss. **Table 7.2** details the impact of noise at various levels. Mitigation measures in line with ECP 9 Noise and Vibration Management will include:

Table 6.3: Noise Impact[34]

No	Noise level dB	Impact
1	60	Hearing damage in 8 hours
2	80	Hearing damage in 8 hours
3	85	Hearing damage in 2 hours
4	100	Hearing damage in 2 hours
5	110	Hearing damage in 30 min
6	120	Hearing damage in 7.5 min
7	130	Pain threshold
8	150	Hearing damage in 30 sec
9	300	Complete hearing loss

Mitigation Measures

- The location for stationary noise sources like asphalt plant, grinding, drilling and welding machinery will be selected at a reasonable distance from residing population. The cement tankers will be working inside enclosure with cladding to reduce noise;
- ;
- The construction material loaders will only operate during night time as per rules of traffic police in Islamabad. Working hours will be allocated for the use of batching plant, equipment and other machinery;
- School time and late night construction activities will be avoided;
- Use of noise barriers in locations next to schools;
- Blowing of horn will be strictly prohibited;

[34]Source: Urbanization and Sustainable Cities 100: Environmental Science, International Science, 5th edition (1991) Cunningham Saigo

- Noise monitoring will be carried out at various locations using noise meters. Site labour working in high noise areas including asphalt plant, grinding and welding machinery, where noise level exceeds 85 dB (A), will wear earplugs and ear muffs;
- Measures will be taken to maintain noise level of 55 dB at day and 45 dB at night time will be maintained.

6.6.7 Biodiversity and Ecology

Since the sub-project location is in urban areas, there are no potential impacts on local flora and fauna. It is entirely build up area with no evidence of sensitive fauna or flora. However, the construction may require clearing of vegetation. The ecological impacts of the project are not likely to be beyond the immediate footprint of the construction site.

Mitigation

- Planting of eight trees for every tree cut during construction;
- Do not introduce invasive or exotic species through plantation.

6.6.8 Public Health and Safety

Construction activities and movement of heavy vehicles at construction sites and access service roads may result in road side accidents, particularly with the residents who may not be familiar with the presence of heavy equipment. Roads and streets, particularly in urban areas may also be blocked during construction. The sub-project is located near a college. There will be a movement of students in the vicinity during certain hours of the day. The impact is likely to be moderate.

Mitigation Measures

- Use signage to inform general public of construction area and its limits
- Train drivers operating heavy vehicles in road and pedestrian safety;
- Set appropriate speed limits to avoid accidents;
- Use of heavy vehicles on public roads will be avoided during hours when students are coming to school or leaving school;
- Placement of construction and diversion signage, particularly at urban areas and at sensitive/accident-prone spots, in accordance to a **Public Safety Plan**;
- Provision of alternate routes for use by the public will be planned.

6.6.9 Workers Health and Safety

Use of heavy machinery and handling of hazardous waste and chemicals may result in health impacts for workers on the construction site. Presence of asbestos in old and new building material is hazardous to health.

Mitigation Measures

In accordance to the **Workers Health and Safety Plan** and ECP 16 Workers Health and Safety, ensure:

- The workers have full access to health facilities and emergency response centers (fire, earthquake and floods) and police station. In case of emergency, the injured will be taken to the nearest medical facility.
- Provision of clean drinking water will be ensured for the construction crew;
- Hygiene inspections will be carried out to avoid disease epidemic;
- In case of unlikely incidents (fire, vandalism) the workers will be evacuated and emergency response and law enforcement agencies will be engaged;
- Fire safety alarms will be installed at various locations;
- Fire extinguishers will be placed at various locations including a water hose installation at ground level;
- Fire safety and emergency response trainings will be conducted;
- Hazards indicator signs and firefighting equipment will be installed;
- The construction crew will be trained on important aspects of workplace safety;
- Construction machinery operators and drivers will be trained to avoid associated accidents using machines and vehicles;
- Flammables and other toxic materials will be marked and stored at secured sites;
- Onsite first aid kits will be kept at construction sites and randomly moving vehicles\machinery.
- Do not allow workers with inadequate training to operate heavy machinery;
- Provision of appropriate and high quality Personal Protective Equipment (PPE) to workers such as gloves, vests, hard-hats, masks etc.;
- Train workers in the use of PPE and safety measures while using heavy machinery and handling chemicals.
- Follow guidelines for Asbestos and Asbestos based product use in construction (**Annexure 11)**

6.6.10 Physical /Cultural/ Archeological Resources

The sub-project site includes religiously and culturally important sites at a reasonable distance. Excavation work during construction may result in the uncovering of ancient sites or artifacts. Impact is likely to be low. In line with ECP 15, mitigation measures include:

Mitigation Measures

Construction staff will be trained and informed on identifying the evidence of archaeological/historic remains. In case evidence of archaeological remains is found during construction activities, the actions listed below will be undertaken.

- Excavation work in the vicinity of the find will be stopped;
- Assistance will be sought from the nearest office of the Department of Archaeology and Museums to identify the remains;
- If the department decides to salvage the find, PMD will provide assistance.
- Detailed procedure for Archaeological Chance Finds included in **Annexure 12**.

6.6.11 Traffic Management

The sub-project site is in urban area close to social sensitive receptors like houses, markets, schools, colleges and offices. The construction work may likely impact the traffic flow. Increase in the traffic flow will occur as a result of:

- Use of trucks for movement of construction material to project site;
- Mobilization and use heavy equipment for construction;

This slight increase in traffic may also cause accidental injuries, deteriorate ambient air quality and generate noise. It may also cause restrictions to access, traffic congestion and nuisance to the general public. Mitigation measures in line with ECP 13 Road Transport and Road Traffic Management will include:

Mitigation Measures

- Contractor will execute the **Traffic Management Plan.**
- Vehicles will be inspected prior to start of construction work.
- Alternate routes will be created to avoid disturbance to schools and hospital;
- Movement of construction equipment will be limited to specific duration when there is least disturbance to the residing offices and nearby schools;
- Adequate road signs will be erected to warn general public;
- The contractor will be advised to follow vehicular maintenance to reduce engine noise;
- Drivers will be trained to follow the designated routes and avoid honking;
- The construction trucks will be adequately covered with tarpaulin covers to avoid flow into air.

6.6.12 Positive Socioeconomic Impacts

The proposed project will have following positive socioeconomic impacts:

- The forecasting monitoring center will evaluate the data covering North and south Punjab which is an area of agricultural productivity. It is likely to enhance rainfall forecasting which will eventually improve the agriculture sector by providing information on the rainfall pattern.
- Tremendous loss of lives and livelihoods occurred in 2010 flooding. Improved rainfall forecasting can minimize the loss caused by flash flooding and excessive rainfall. The objective of the center is to provide the users with a better forecast to plan ahead and disseminate the information to avoid loss of lives.
- The data will be used by with ministry of defense, disaster management authorities, civil aviation and Pakistan air force. Enhanced weather forecasting will help them in smooth operation reducing the damages due to unpredicted weather changes.
- Proposed project will create jobs in addition to providing desired data to various sectors.

6.7 Potential Environmental and Social Impacts and Mitigation-Operations Phase

6.7.1 Air Quality and Climate

The new installations are likely to hire additional staff subsequently there will be an increase in number of vehicles entering the project area. This will lead to increased vehicular emissions during project operation that may pose potentially negative impacts on the air quality of the area if not mitigated properly. Similarly, in absence of solar panel backup generators may cause emissions. Emissions may carry over long distances, depending on wind speed and direction, the temperature of the surrounding air, and atmospheric stability. The impact is likely to be low.

Mitigation Measures

- The project staff will be advised to car pool and use and local transport;
- Provision of pick and drop for staff to avoid additional load on air quality;
- Vehicles with excessive smoke emissions should not be allowed to enter the sub-project locations.

6.7.2 Solid Waste

There will be an increase in solid waste generation due to additional building maintenance and staff employed for the sub-projects. Sub-project site is located in areas where solid waste collection is provided by the LWMC. Hazardous waste will include rechargeable batteries from the AWS and solar panels.

Mitigation Measures

The mitigation measures include:

- Decrease solid waste going to landfills by segregating at source with labeled dust bins for biodegradable, non- biodegradable and recyclable products;
- Disposal of biodegradable to the municipality for treatment;
- Clearance of reusable and recyclable waste to certified recycling companies;
- Recycle rechargeable batteries through certified companies.

6.7.3 Electromagnetic Field (EMF)

There may be radiation impacts of EMF related to the Weather Surveillance Radar. People who live or routinely work around radars have expressed concerns about long-term adverse effects of these systems on health, including cancer, reproductive malfunction, cataracts and changes in behaviour or development of children. Radars usually operate at radio frequencies (RF) between 300 MHz and 15 GHz. They generate EMFs that are called RF fields. RF fields within this part of the electromagnetic spectrum are known to interact differently with human body.

RF fields below 10 GHz (to 1 MHz) penetrate exposed tissues and produce heating due to energy absorption. The depth of penetration depends on the frequency of the field and is greater for lower frequencies. Absorption of RF fields in tissues is measured as a Specific Absorption Rate (SAR) within a given tissue mass. The unit of SAR is watts per kilogram (W/kg). SAR is the quantity used to measure the "dose" of RF fields between about 1 MHz and 10 GHz. An

SAR of at least 4 W/kg is needed to produce known adverse health effects in people exposed to RF fields in this frequency range. [35]

RF fields above 10 GHz are absorbed at the skin surface, with very little of the energy penetrating into the underlying tissues. The basic dosimetric quantity for RF fields above 10 GHz is the intensity of the field measured as power density in watts per square metre (W/m2) or for weak fields in milliwatts per square metre (mW/m^2) or microwatts per square metre ($\mu W/m^2$).

Weather radars operate at higher frequencies but generally have lower average and peak powers. Under normal conditions, if radar is installed at a higher elevation, they pose no hazard to the general public.[36] An extensive program of measurement surveys, hazard communication, coupled with effective protective measures, is required around all radar installations for safety of workers. Monitoring should be performed to quantify RF field levels in the area. While extremely high RF field levels can be measured directly in front of radar to assess the levels of EMF.[37] World Health Organisation Standards will be used for compliance. According to WHO guidance documents, to produce any adverse health effect, RF exposure above a threshold level must occur. The known threshold level is the exposure needed to increase tissue temperature by at least 1^oC. The very low RF environmental field levels from radar systems cannot cause any significant temperature rise. Exposure to RF fields above 10 GHz at power densities over 1000 W/m^2 are known to produce adverse health effects, such as eye cataracts and skin burns.

Mitigation Measures

- Engineering controls for EMF include interlocks, electronic means to exclude the radar pointing within office complex in the tower building, and shielding;
- Administrative controls include audible and visible alarms, warning signs, and restriction of access through barriers, locked doors, or limiting access time to radar;
- Workers will use personal protective equipment to ensure compliance with exposure standards. Conductive suits, gloves, safety shoes and other types of personal protective equipment for RF fields are now commercially available. PPEs should be used with great care, since the attenuation properties of the material used to make this protective equipment can vary dramatically with frequency;
- RF safety glasses will be used near the radar operating area. Special care will be taken in buying the glasses since any metal may enhance local fields by acting as a receiving antenna;
- There are no exposure situations where members of the general public need to use protective equipment for RF fields from weather radars;
- Radar will be installed at a specified height.

[35] Electronic Warfare and Radar Systems Engineering Handbook- Radiation Hazards -
[36] WHO **Electromagnetic fields and public health: radars and human health publications**
[37] To date, researchers have not found evidence that multiple exposures to RF fields below threshold levels cause any adverse health effects. No accumulation of damage occurs to tissues from repeated low level RF exposure. At present, there is no substantive evidence that adverse health effects, including cancer, can occur in people exposed to RF levels at or below the limits set by international standards. However, more research is needed to fill certain gaps in knowledge.

6.7.4 Flora and Fauna

Scientific literature was screened for articles on ecological effects of RF-EMF. According to a review of the ecological effects of radiofrequency electromagnetic fields [38] , RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms and plants in 70% of the studies. Development and reproduction of birds and insects are the most strongly affected endpoints. An uncertainty exists on the effects of EMR exposure on birds due to lack of studies. Most studies indicate the possibilities of the changes in the behaviour, physiology, breeding success and mortality. The effects of EMF exposure may be examined in light of multiple intensities are not conducted.

Mitigation Measures

The possible biological effects of electromagnetic fields on avian biology are inconclusive and uncertain. Since the EMF will not be directed towards ground, therefore, it is unlikely to impact vegetation including trees, grass, and shrubs and ground animals. Moreover the influence of EMF with other environmental factors on birds is not available that may provide important information for conservation of birds.

6.8 Environmental and Social Mitigation and Management Plan (ESMMP)

ESMMP is a tool to manage and monitor environmental impacts and specifically focuses on implementation of mitigation measures on ground against likely environmental and social impacts. The activities related to the sub-project will be managed and monitored according to the management plan elaborated in this chapter.

The primary objectives of the ESMMP with respect to project activities are to:

- Define the responsibilities of the sub-project proponent and sub-project partners during design, construction and operations phase (institutional and organizational arrangements) to ensure effective communication of environmental and social issues;
- Define the responsibilities of the sub-project proponent and contractors to comply with the mitigation measures against every potential impact discuss in the ESMP.
- Define a monitoring mechanism, identify monitoring parameters and training requirements in order to ensure the effectiveness of the mitigation measures and provide a plan for implementation of training session and monitoring plan;
- Provide a mechanism for taking timely action against any unanticipated environmental situations;
- Identify the resources required to implement the ESMP and outline the required budget.

The environmental monitoring and mitigation plan is summarized in **Table 7.3**.

[38] S.Cucurachietal W.L.M.Tamis, M.G.Vijver, W.J.G.M.Peijnenburg, and G.R.de Snoo

Table 6.4: Environmental and Social Mitigation and Management Plan

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
Design Phase							
Biodiversity and Natural Resources	The project sites WSR and AWS may require tree cutting for site clearing.	1. Incorporate technical design measures to minimize unnecessary removal of trees and vegetative cover; 2. Plan for compensatory planting of eight trees against each fallen tree of similar floral function; 3. Disallow introduction of invasive/ exotic species; and recommend native species for plantation.	Project Implementation Units (PIU) Design Contractors	Construction designs Tree count Compensatory Tree Plantation Plans Tree Species	At the time of design preparation At the time of design finalization	Environmental Safeguards Specialist – PIU, Design Contractor,	ESMP
Natural Disasters	The Sub-project site is in Zone 2- minor to moderate in case of earthquakes. There is also some seasonal flooding during Monsoor rains due to blocked drains	1. The building design will be earthquake resistant according to Building Codes of Pakistan with Seismic provision and international best practices to avoid damage caused by earthquake; 2. Variety of structural engineering measures or structural components like shear walls, braced frames, moment resisting frames, and diaphragms, base isolation, energy dissipating devices and bracing of non-structural components are proposed. Simpler techniques include avoiding soft stories and bolting the sill plate of houses to the foundation; 3. Primary focus of earthquake design is initial life safety and getting people out of the building safely, not necessarily the ability of a building to withstand the effects of an earthquake, or to ensure occupancy or functionality following an event. Therefore building design will include emergency exits and alarm system. 4. Planning, designing and constructing the building to minimize any potential flood damages using guidelines of **Annexure 10.** Following are proposed:	PIU Design Contractors	Sub-project design maps with incorporation of building codes for Zone 2 Construction contractor ToRs	At the time of design	Environmental Safeguards Specialist – PIU, Contractor, Project Directors PMD	ESMP Building Codes of Pakistan with Seismic Provision using earthquake Zone 3 standards for identified project sites

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
		▪ elevating as much of the building as possible above the design flood level, ▪ designing the building foundation and any portions subject to flooding to withstand design flood conditions and loads, ▪ using flood-damage-resistant materials for any portions of the building below the design flood level ▪ where flood proofing is permitted, employing appropriate methods and materials to either dry-flood proof or wet-flood proof those portions of the building below the design flood level					
Water /Electricity/ Natural Gas/ Fuel Consumption	There will be an increase in infrastructure utilities/ resource consumption due to construction work.	1. Prepare an Energy and Water Conservation Plan for construction 2. Design of buildings will include installation of Solar Panels; 3. Provision of Low Voltage electrical appliances will be made in procurement procedures.	PIU Design Contractors	Design provision for water, electricity, natural gas and fuel conservation	At the time of design	Environmental Safeguards Specialist – PIU, Contractor, Project Directors PMD	ESMP Green Building Council guidelines / international best Practices
Air Quality and Noise Levels	Project activities associated with construction may increase the ambient air quality and noise levels of the at the sub-project sites. The impacts are likely to be moderate.	1. Air quality and noise level baselines will be established to enable monitoring during construction phase; 2. Provision of compliance to NEQS of vehicular emission will be made in the contract of construction contractor and SOP's of PMD vehicles;; 3. Locations of Batching Plant, concrete mixers and other noise generating equipment will be identified away from residents; 4. Contractor shall prepare an Emissions Monitoring Plan to ensure constant checking of emissions by construction machinery and vehicles with operations and maintenance plan for the same; 5. Traffic Management Plan for construction will be formulated during design phase that enable	PIU/ Design contactor	Preparation of Emissions Monitoring Plan, Traffic Management Plan and Site Management Plan Construction contractor ToRs	At the time of design	Environmental Safeguards Specialist – PIU, Contractor, Project Directors PMD	ESMP ECP 8, 9 NEQS for Ambient Air Quality and Noise.

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
		continuous traffic flow and avoid congestions which result in increased vehicle smoke density at a given area; 6. Plan to neutralize dust emissions from construction activity, such as regular watering of sub-project sites to settle dust; 7. Use of Hazardous material list will be strictly prohibited in construction and provision will be made part of the contract. 8.					
Solid Waste Management	Improper solid waste disposal can result in increased air pollution through burning of waste, vector borne diseases, contamination of water sources and ambient aesthetics for surrounding communities. The impacts are likely to be moderate.	1. Prepare a detailed **Solid Waste Management Plan** for construction site minimising use of plastics and encourage recycling 2. Identify current municipal systems of waste management or private waste disposal services; 3. Placement of waste collection containers throughout the project area; 4. Disallow the burning of any of type of waste; 5. Prepare plans for the safe handling, storage and disposal of harmful materials and hazardous waste	PIU Design Contractors	Solid Waste Management Plan Contractual binding on prohibited use of Hazardous Material for construction contractor (CC) Construction contractor ToRs	At award of construction Contract	Environmental Safeguards Specialist – PIU,	ESMP ECP 1 Hazardous Substance Rules 2003 ToRs
Workers Health and Safety	Use of heavy machinery and handling of chemicals by workers can result in health impacts and accidents. The impacts are likely to be moderate.	1. Prepare a **Worker Health and Safety Plan** for the construction phase	PIU Design Contractors	Worker Health and Safety Plan	At award of Construction Contract	Social Safeguards Specialist – PIU,	ESMP ECP 16
Construction Phase							

Phase	**Implementation Plan**			**Monitoring Plan**			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
Landscape/Soil	Construction at sites is likely to carry out site clearance, vehicular, labour and machinery movement causing soil erosion and compaction. There is also a potential for contamination of soil via runoff from construction activities including oil spills, construction material, dredged / spoil materials and construction waste. Impact on soil quality is high in case of the spill.	1. Removal of vegetation and trees will be avoided to the extent possible; 2. Proper Safe drainage of run-off from construction activities will be ensured; 3. Removal of vegetation and trees will be avoided to the extent possible; 4. Water will be sprinkled during construction building of foundation to avoid soil erosion and dust pollution; 5. Construction materials will be stored in proper stores on impervious sheets to avoid any soil contamination; 6. Machinery and vehicles will be operated at designated routes to avoid erosion and compaction of un-impacted soils; 7. Visual Inspection will be carried out for land contamination and dust emissions; 8. The soil contaminated from minor and moderate spills will be removed and will be handed over to waste contractor for treatment at nearest incineration facility or waste disposal and treatment at Mehmood Boti; 9. Major spills may require specialized treatment such as incineration, bioremediation and biodegradation. The biological agents will be introduced to the spill to hasten biodegradation. Most of the components of oil will be broken down by bacteria and other microorganisms into harmless substances such as fatty acids and carbon dioxide. To stimulate the growth of the microorganisms, fertilizing nutrients like nitrogen and phosphorous will be placed near the oil tanks..	Construction Contractor	Visual inspections and photographic record of site clearing and oil spills. Water sprinkling	Daily	Environmental Safeguards Specialist – PIU, PMIC Construction Contractor	ESMP ECP 5,6,8
Ambient Air Quality and Climate	The construction activities at sub-project sites will cause impact on air quality, cement mixers (Batch Plant), movement of	1. Contractor shall provide an **Emissions Monitoring Plan** to ensure constant checking of emissions by construction machinery and vehicles; Contractor should provide an operations and maintenance plan for the same;	Construction Contractor	Ambient Air Quality monitoring for SOx, NOx and	Monthly	Environmental Safeguards Specialist -PIU PMIC	ESMP NEQS and ECP 8

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
	the machinery, generators soil excavation, construction vehicles, is likely to generate dust and exhaust emissions. Impact on local air quality is moderate	2. Water will be sprinkled twice a day to avoid fugitive dust emissions; 3. Construction machinery and vehicles will be kept in good conditions to avoid vehicular emissions. Vehicular and generator exhaust emissions will be monitored to ensure compliance; 4. Unnecessary movement of vehicles will be avoided at the construction location; 5. Open burning of solid waste from the Contractor's camps should be strictly banned; 6. Wind breaks /barriers (either natural or constructed) will be deployed to reduce the possibility of suspended particles in air; 7. Raw materials such as cement, gravels and sand will be kept under sheet covers to prevent air flow; 8. In order to further reduce the environmental impact Cement Works (Concrete Batching Plant), the concrete batching plant will incorporate the following design and practices: ▪ Cement will be transferred directly from barges to the plant. ▪ All mixing will be in the enclosed electric motor driven plant mixer, NOT in trucks. ▪ Truck loaded with concrete will be in wet form. ▪ All washing water used by the batch plant and storm water will be collected and stored and recycled for re-use. ▪ No water will be discharged outside the plant boundary. ▪ Concrete recycling machine be used to recycle waste material to slurry water and aggregates for reuse.		Particulate Matter PM2.5/10			

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
Surface/Ground Water Resources	Drainage channel in close vicinity of project site is a Shadman nullah leading to River Ravi. Construction activities may encourage soil erosion and waste may increase the sediment loads into the city drainage, while accidental leaks/spills of oil/fuel from storage tanks or maintenance vehicles can also pollute surface waters. The impact is likely to be low as the construction site is 1km meters away from the drainage channel.	1. Contractor shall execute the Emissions Monitoring Plan to ensure constant checking of emissions by construction machinery and vehicles with operations and maintenance plan for the same; 2. Water will be sprinkled twice a day to avoid fugitive dust emissions; 3. Contractor shall execute the Traffic Management Plan to enable continuous traffic flow and avoid congestions which result in increased vehicle smoke density; 4. Construction machinery and vehicles will be kept in good conditions to avoid vehicular emissions. Vehicular and generator exhaust emissions will be monitored to ensure compliance; 5. Unnecessary movement of vehicles will be avoided at the construction location; 6. Open burning of solid waste from the Contractor's camps work areas should be strictly banned; 7. Wind breaks /barriers (either natural or constructed) will be deployed to reduce the possibility of suspended particles in air; 8. Raw materials such as cement, gravels and sand will be kept under sheet covers to prevent air flow; 9. In order to further reduce the environmental impact of Cement Works (Concrete Batching Plant), the concrete batching plant will incorporate the following design and practices: 10. Cement will be transferred directly from barges to the plant 11. All mixing will be in the enclosed electric motor driven plant mixer, NOT in trucks. 12. Truck loaded with concrete will be in wet form.	Construction Contractor	Surface Water Quality	Monthly Quarterly	Environmental Safeguards Specialist -PIU PMIC	ESMP NEQS ECP 2, 4

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
		13. All washing water used by the batch plant and storm water will be collected and stored and recycled for re-use. 14. No water will be discharged outside the construction boundary. 15. Concrete recycling machine be used to recycle waste material to slurry water and aggregates for reuse. 16.					
Water /Electricity/ Natural Gas and Fuel Consumption	Construction activities require a large amount of water that may reduce the availability of water in residing area. It will add load to the electricity, natural gas fuel consumption increasing GHG emissions. The impact is likely to be high.	1. Contractor will execute the Energy and Water Conservation Plan 2. Water meters will be installed at sub-project site to monitor water consumption; 3. Construction staff will be trained on water conservation practices to avoid excessive loss; 4. Water required for construction should be obtained in a way so that water availability and supply to residing area remains unaffected; 5. Approval will be attained from local authorities prior to construction work. 6.	Construction Contractor	Water, Electricity and Natural Gas Consumption Energy Conservation Plan	Monthly/ Quarterly	Environmental Safeguards Specialist - PIU PMIC	ESMP
Solid Waste Generation	During construction phase, solid waste can be generated from discarded equipment parts, scrap metals, equipment boxes, wood parts, empty bags, and leftover construction debris. The construction material and waste may include	1. Solid Waste Management Plan will be executed by Construction Contractor. In case of the occurrence of toxic/hazardous chemical materials, it will be handled according to hazardous waste management best international practices. The plan will be prepared with following provisions: 2. Solid waste collection, segregation, storage and disposal will be carried out for waste generated. For at source segregation separate waste bins will be placed at sub-project sites. Recyclable material will be segregated whereas non-hazardous waste will be disposed-off at approved disposal site;	Construction Contractor	Solid Waste Management Plan Amount and type of solid waste generated from sub-project sites; List of hazardous chemical used for construction	Monthly	Environmental Safeguards Specialist – PIU PMIC	ECP 1,2 Hazardous Chemicals Rules, 2003

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
	toxic/hazardous chemical materials. If not contained the impact of solid waste is likely to be high.	3. Private contractors will be hired for responsible disposal of construction waste 4. Labeling of containers will be carried out including the identification and quantity of the contents, hazard information; 5. Marking of Hazardous/toxic waste 'if generated' separately and disposal using international best practices through registered contractor; 6. Used oil will be collected in separate containers stored on impervious platform with restricted access and must be sold to licensed contractor; 7. Burning of solid and waste oil should be strictly prohibited 8. Training of workers will be carried out in the storage and handling of materials and chemicals that can potentially cause soil contamination; 9. Emergency Response Plan will be prepared to address the accidental spillage of fuels and hazardous/toxic material, fire, vandalism and natural hazards; 10. On completion of the construction phase of the project, the contractor will be required to rehabilitate the site. Rehabilitation will include removal of all construction materials and wastes, and the grading and landscaping of all exposed sites that may be prone to erosion. Where natural erosion protection measures may not be possible or practical, suitable physical erosion protection methods will be used. The purposes of site rehabilitation will be to minimize the potential for soil erosion, enhance the aesthetic appearance of the site and restore safe public access to the surrounding area 11.					
Noise Levels	The construction activities are likely to generate high noise	1. The location for stationary noise sources like asphalt plant, grinding, drilling and welding machinery will be selected at a reasonable distance	Construction Contractor	Noise Monitoring	Monthly	Environmental Safeguards	NEQS, ECP 9

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
	levels. The sources of noise in construction include Asphalt Plant excavation work, heavy earth moving equipment/ machinery, pilling work, welding, cuttings, drilling, grinding and material loading/offloading vehicles. Impact is likely to be high.	from residing population. The cement tankers will be working inside enclosure with cladding to reduce noise; 2. ; 3. The construction material loaders will only operate during night time as per rules of traffic police in Islamabad. Working hours will be allocated for the use of batching plant, equipment and other machinery; 4. School time and late night construction activities will be avoided; 5. Use of noise barriers in locations next to schools; 6. Blowing of horn will be strictly prohibited; 7. Noise monitoring will be carried out at various locations using noise meters. Site labour working in high noise areas including asphalt plant, grinding and welding machinery, where noise level exceeds 85 dB (A), will wear earplugs and ear muffs; 8. Measures will be taken to maintain noise level of 55 dB at day and 45 dB at night time will be maintained. 9.		Residing Areas and Construction Site		Specialist - PIU PMIC	
Biodiversity and ecological resources (Flora and Fauna)	The impacts on ecology are negligible entirely build up and there are very few trees. However, if the construction requires cutting of trees and clearing of vegetation.	1. Eight trees will be planted for every tree cut during construction; 2. Invasive or exotic species will not be introduced through plantation.	Construction Contractor	Tree count Tree Plantation in designated area and count eight for one cut	Prior /Start/ Post construction	Environmental Safeguards Specialist -PIU PMIC	ESMP ECP 10

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
Public Health and Safety	Construction activities and movement of heavy vehicles may impact public safety. Similarly emissions and noise from the site may impact the health of residing communities	1. Use signage to inform general public of construction area and its limits; 2. Train drivers operating heavy vehicles in road and pedestrian safety; 3. Set appropriate speed limits to avoid accidents; 4. Use of heavy vehicles on public roads will be avoided during hours when students are coming to school or leaving school; 5. Placement of construction and diversion signage, particularly at urban areas and at sensitive/accident-prone spots, in accordance to a Public Safety Plan; 6. Provision of alternate routes for use by the public will be planned	Construction Contractor	Traffic Management Plan Public Safety Plan Complaint/ Accident Register	Monthly	Social Safeguards Specialist -PIU PMIC	ESMP
Workers Health and Safety	Use of heavy machinery and handling of hazardous waste and chemicals may result in health impacts for workers on the construction site.	In accordance to the **Solid Waste Management** and **Workers Health and Safety Plan**, ensure: 1. The workers have full access to health facilities and emergency response centers (fire, earthquake and floods) and police station. In case of emergency, the injured will be taken to the nearest medical facility. 2. Provision of clean drinking water will be ensured for the construction crew; 3. Hygiene inspections will be carried out to avoid disease epidemic; 4. In case of unlikely incidents (fire, vandalism) the workers will be evacuated and emergency response and law enforcement agencies will be engaged; 5. Fire safety alarms will be installed at various locations; 6. Fire extinguishers will be placed at various locations including a water hose installation at ground level;	Construction Contractor	Workers Health and Safety Plan and trainings Medical record of workers	Monthly	Social Safeguards Specialist -PIU Construction Contractor	ESMP ECP 16

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
		7. Fire safety and emergency response trainings will be conducted; 8. Hazards indicator signs and firefighting equipment will be installed; 9. The construction crew will be trained on important aspects of workplace safety; 10. Construction machinery operators and drivers will be trained to avoid associated accidents using machines and vehicles; 11. Flammables and other toxic materials will be marked and stored at secured sites; 12. Onsite first aid kits will be kept at construction sites and randomly moving vehicles\machinery. 13. Do not allow workers with inadequate training to operate heavy machinery; 14. Provision of appropriate and high quality Personal Protective Equipment (PPE) to workers such as gloves, vests, hard-hats, masks etc.; 15. Train workers in the use of PPE and safety measures while using heavy machinery and handling chemicals. 16. Follow guidelines for Asbestos and Asbestos based product use in construction (Annexure 11) 17.					
Physical /Cultural/ Archeological Resources	The sub-project area has religiously and culturally important sites at a reasonable distance. Excavation work during construction may result in the uncovering of ancient	Construction staff will be trained and informed on identifying the evidence of archaeological/historic remains. In case evidence of archaeological remains is found during construction activities, the actions listed below will be undertaken. 1. Excavation work in the vicinity of the find will be stopped;	PIUs	Consultation with the relevant departments Preparation of PCR Plan, if needed.	At the start of construction	Social Safeguards Specialist - PMD Construction Contractor	ESMP ECP 15

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
	sites or artifacts. Impact is likely to be low.	2. Assistance will be sought from the nearest office of the Department of Archaeology and Museums to identify the remains; 3. If the department decides to salvage the find, PMD will provide assistance. 4. Detailed procedure for Archaeological Chance Finds included in Annexure 12. 5.					
Traffic Management	The sub-project site is in an urban area close to social sensitive receptors like houses, schools, colleges and offices. The construction work may highly impact the traffic flow.	1. Contractor will execute the Traffic Management Plan. 2. Vehicles will be inspected prior to start of construction work. 3. Alternate routes will be created to avoid disturbance to schools and hospital; 4. Movement of construction equipment will be limited to specific duration when there is least disturbance to the residing offices and nearby schools; 5. Adequate road signs will be erected to warn general public; 6. The contractor will be advised to follow vehicular maintenance to reduce engine noise; 7. Drivers will be trained to follow the designated routes and avoid honking; 8. The construction trucks will be adequately covered with tarpaulin covers to avoid flow into air. 9.	Construction Contractor	Traffic Management PLan Construction vehicles trimmings Accident register	Continuous	Social Safeguards Specialist - PIU PMIC	ESMP
Operations Phase							
EMF	The danger of electromagnetic field occurs because	1. Engineering controls for EMF include interlocks, electronic means to exclude the radar pointing	RMC/PMD	Testing of EMF Use of protective gear	Continuous	RMC/PMD	

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
	the body absorbs radiation which has high impact on body tissues and cell.	within office complex in the tower building, and shielding; 2. Administrative controls include audible and visible alarms, warning signs, and restriction of access through barriers, locked doors, or limiting access time to radar; 3. Workers will use personal protective equipment to ensure compliance with exposure standards. Conductive suits, gloves, safety shoes and other types of personal protective equipment for RF fields are now commercially available. PPEs should be used with great care, since the attenuation properties of the material used to make this protective equipment can vary dramatically with frequency; 4. RF safety glasses will be used near the radar operating area. Special care will be taken in buying the glasses since any metal may enhance local fields by acting as a receiving antenna; 5. There are no exposure situations where members of the general public need to use protective equipment for RF fields from weather radars; 6. Radar will be installed at a specified height. 7.					
Air Quality and Climate	An increase in number of vehicles entering the offices may pose moderate negative impacts on the air quality of the area.	1. The project staff will be advised to car pool and use and local transport; 2. Provision of pick and drop for staff to avoid additional load on air quality;	RMC/PMD	Vehicular Emissions	Quarterly	RMC/PMD	NEQs Permissible limits of vehicular exhaust

Phase	Implementation Plan			Monitoring Plan			
Aspects	**Environmental and Social Impacts**	**Proposed Mitigation Measures**	**Responsibility**	**Monitoring Parameter(s)**	**Frequency**	**Responsibility**	**Compliance Criteria**
		3. Vehicles with excessive smoke emissions should not be allowed to enter the sub-project locations. 4.					
Solid Waste Generation	There will be an increase in solid waste generation due to additional staff and building maintenance. In the presence of waste disposal system in the area impact is Moderate Hazardous waste will include rechargeable batteries from the AWS and solar panels.	1. Decrease solid waste going to landfills by segregating at source with labeled dust bins for biodegradable, non- biodegradable and recyclable products; 2. Disposal of biodegradable to the municipality for treatment; 3. Clearance of reusable and recyclable waste to certified recycling companies; 4. Recycle rechargeable batteries through certified companies	RMC/PMD	Weight of waste generated and disposal	Monthly	RMC/PMD	Solid Waste Management Plan

Chapter 7. Institutional Arrangements

7.1 Project Implementation Unit

The activities and investments under the sub project will be implemented through Pakistan Meteorological Department (PMD). PMD would establish dedicated Project Implementation Unit (PIU) to assist in the implementation of the project activities. Implementing Agency (IA) PMD, will be responsible for appointing a Project Director (PD) and hiring of key staff and consultants for respective PIU as per project requirements.

The PIU would have responsibility for sub-project implementation including, but not limited to, reporting, monitoring and evaluation, social and environmental management, procurement, financial management, audit and disbursements, as well as coordination with the line agencies and the World Bank. The PIU will be adequately resourced with skillsets and competencies required for project implementation and monitoring. The PIU would be created and adequately staffed within one month of project effectiveness. To ensure overall guidance and coordination for project implementation, a dedicated Project Coordination Committee (PCC), comprising senior representatives from concerned federal and provincial departments, would be established as the apex forum.

The Environmental Safeguards Specialist and Social Safeguards Specialist at the PIU will be directly responsible for the compliance of ESMP and for the subproject screening, development sector specific ESMPs; and their effective implementation, internal monitoring and progress reporting. The Specialists will have close coordination with EPA and other line Departments to address their concerns regarding sub-project interventions. The ESMP will be implemented under the overall supervision of the PD. PIU will be responsible for hiring of Construction Contractor and supervision of contractors work on the sites in accordance with ESMMP.

Roles and responsibilities of the PIU have been detailed in **Table 8.1** below. In cases of overlapping roles by more than one Specialist, higher authority will have the authority to re-designate the roles and responsibilities of those officers in the best interest of the project and to ensure clarity of responsibilities for ESMP implementation.

Table 7.1: Roles and Responsibilities of PIU

Organization	Position	Responsibility
Project Implementation Unit (PIU)	Project Director	Ensure ESMP implementation
Project Implementation Unit (PIU)	Environmental Safeguards Specialist	▪ Ensure implementation of the ESMP during various stages of design and construction; ▪ Ensure that timely and robust environmental monitoring is carried out in the field; ▪ Ensure that the construction contracts include clauses for ESMP implementation; ▪ Ensure that environmental trainings are planned and implemented; ▪ Overall monitoring and reporting of ESMP; ▪ Conduct financial management of the ESMP;

Organization	Position	Responsibility
		▪ Coordinate and ensure development of awareness material; ▪ Commission annual third party validations of the project; ▪ Prepare Environmental Biannual Progress Reports (BPR) for the project
Project Implementation Unit (PIU)	Social Safeguards Specialist	▪ To carry out the screening of the sub-projects with respect to the social aspects as defined in the ESMF; ▪ Monitor and check the proper implementation of all social mitigation measures as suggested in ESMF/ESMP; ▪ Monitoring and evaluation of social related matters of the project and maintain a social complaint register to document social issues; ▪ Supervise the Contractor's activities and make sure that all the contractual obligations related to the social compliance are met; ▪ Review of periodic social reports being prepared by the investor/contractor and submitting the same to the Bank ▪ Ensure inclusion of ESMP guidelines in project designs. ▪ Remain the focal point for managing the project GRM, and maintain analysis and reports on types of complaints received, resolved, time taken to action, etc.
Project Implementation Unit (PIU)	Environment and Social Safeguard officer / Database/MIS Specialist	▪ Ensure that ESMP is being implemented by contractors at the site level; ▪ Monitor implementation of ESMP through regular site visits and report to PIU; ▪ Assist the Environmental and Social Safeguards Specialists

Sample TORs for Environmental and Social Specialists are given in **Annexure 13.**

7.2 Project Management and Implementation Consultant

The Project Management and Implementation Consultant (PMIC) will be hired for sub-project designing & resident supervision. PMIC will ensure compliance & implementation of ESMP at the sub-project site, through dedicated safeguards staff. The PMIC will carry out regular monitoring of the ESMP implementation at all working sites and will submit periodic reports to the PIU regarding ESMP implementation and compliance status.

7.3 Third Party Consultant

A third-party consultant will be hired to monitor the overall implementation process and compliance of sub-project's ESMP on an annual basis.

7.4 Construction Contractor

The sub-project Construction Contractor (CC) will be responsible for on-field implementation of the ESMP. All the required liabilities under the World Bank guidelines and applicable laws will be fulfilled by the construction contractor at the sub-project sites. Contractor ESMP will be an integral part of the contract documents and details will also be included in the bid to address the budget for environmental and social mitigation measures. Contractor will hire requisite staff to ensure compliance of ESMP. PIU and PMIC will ensure that the following plans have been prepared, while the contractor will ensure that these plans are being implemented:

- Energy and Water Conservation Plan
- Traffic Management Plan
- Solid Waste Management Plan
- Hazardous Waste Management Plan
- Workers Health and Safety Plan
- Emissions Monitoring Plan
- Debris Management Plan
- Emergency Response Plan
- Public Safety Plan
- Workers Health and Safety Plan
- Labour Training Plan
- Site Restoration Plan
- Old Buildings Demolishment Plan

Construction Contractor will ensure that the proposed sub-project activities are in compliance with the ESMP, NEQS and World Bank operational policies. Provision will be made in the agreement with the contractor to:

- Train staff on regular basis on Environment, Health and Safety compliance;
- Implement ESMP in the field;
- Ensure safe working conditions;
- Provide Provisions of PPEs to workers;
- Report every incident/accident to PMD;
- Monitor regular compliance with environmental mitigation measures as per ESMP.
- Execute onsite environmental testing

Specific roles and responsibilities are included in **Table 8.2**.

Table 7.2: Roles and Responsibilities for Environmental Monitoring

#	Aspect	PMD	Contractor's Responsibilities	Relevant Documentation
1	Contracting	Ensure mitigation and monitoring requirements to be included in the contract between PMD and construction contractor	Understand the requirements and estimating the required resources for implementation of the ESMP	Contract between the PMD and CC
2	Resources	Ensure the availability of finances required for environmental monitoring	Ensure the availability of resources required for environmental monitoring	ESMP budget
3	Environmental staff	Designate an environmental staff for the project	Appoint an officer dedicated to environment, health and safety	Job descriptions
4	Corrective Actions	Verify that the activities are carried out comply with the ESMP and identify corrective actions, if needed	Carry-out the required corrective actions	Corrective action record

7.5 ESMP Monitoring Plan

7.5.1 Internal Monitoring

The overall supervision of the ESMP will be with the PD, PIU. Project Management and Implementation Consultant (PMIC) will be responsible for supervision of the contractors and monitoring at the project site on a regular basis. The Environmental and Social Specialists will conduct regular monitoring of the sub-project site. Monitoring reports by PMIC will be submitted to the Environment and Social Safeguard Specialists in the PIU for necessary corrective action.

7.5.2 External Monitoring/Third Party Validation

External Monitoring will be used to ensure that both construction and the operation phase activities have been undertaken in line with the ESMP. Third Party Validation (TPV) exercises, conducted through an independent monitoring agency will be carried out on an annual basis to evaluate the overall ESMP compliance and implementation progress, and to ensure that the mitigation measures are implemented as per the mitigation plan. In case of any deviation, corrective actions will be taken where necessary. For the TPV, environmental and social consultants with relevant expertise and previous experience will be engaged. The PIUs may hire the services of an environment expert (consultant), if required, to address issues related to environmental impact mitigation or non- conformity that emerge from monitoring activities.

7.6 ESMP Reporting

Implementation monitoring reports regarding environment and social compliance will be prepared by PMIC on regular basis. Specialists in the PIU will also compile monthly and

quarterly ESMP implementation progress reports and the final report once the proposed sub-project is completed. **Table 8.3** below shows the periodic distribution of reports to be prepared for the proposed sub-project.

Table 7.3: Distribution of Sub-Project Reports

#	Report	Prepared by	Reviewed by	Distribution
1	Monthly	PMIC	Environmental and Social Safeguards Specialists	Project Director, PIU
2	Bi-annual	Environmental and Social Safeguards Specialists	Project Director, PIU	PMD, World Bank
3	Annual	Third Party Validator	n/a	PMD, World Bank
4	Final	Environmental and Social Safeguards Specialists	Project Director, PIU	PMD, World Bank

The Bi-Annual Progress Reports (QPRs) will provide progress on implementation of mitigation measures, safeguard monitoring, capacity building, and any other ESMP implementation activity carried out during the reporting quarter using monitoring checklist (**Annexure 14**). Format of the Bi-Annual Report is provided in **Annexure 15**. These reports will be shared with, among others, the World Bank within one month of the completion of each quarter. The Bi-Annual Report will include sub-sections including air quality monitoring, monitoring of emissions.

7.7 ESMP Capacity Development and Trainings

Capacity building and training of the staff and contractors associated with ESMP implementation will be required for effective environmental and social management. Specific trainings on environmental and social impacts and mitigation will be arranged for the Project Directors, Environment and Social Safeguards Specialists, PMIC and other members of the Project Implementation Units to deliver their monitoring responsibilities in an organized and effective manner as per requirement of the monitoring plan. The main objective of the trainings is to enhance the technical capacity of staff associated with ESMP implementation, keep the PIU aware of the emerging environmental and social issues, and enable them to resolve those issues through proposed mitigation measures. Trainings will also be held for contractors on implementation of the ESMP. **Table 8.4** gives a tentative program for capacity building and trainings. 9 workshops are to be held throughout the 2.5 years of the project. This includes annual refresher trainings. The workshops will focus on environmental and social issues arising during ESMP implementation, mitigation measures, and health & safety. They will also focus on sensitizing the participants about environmental and social responsibility, managing the on-ground problems, and assuring implementation of the ESMP. Each workshop will have no more than thirty participants. In case of extra participants, extra workshops will be conducted.

Table 7.4: Capacity Building and Training Plan

Description of Training	Training Module	Location	Frequency	Participation
Two-day Training Workshop	Objectives, need and use of ESMP; Legal requirements of the ESMP (Legislations and World Bank Operational Policies); Management of environmental and social issues and mitigation strategies as per ESMP; Monitoring Mechanism Documentation and reporting procedures.	RMC, Lahore	Launch workshop at the start of the project	PIU Staff including Project Director, Environment and Social Safeguards Specialists, PMIC, Infrastructure Specialists, Engineers, M&E Officer etc.
One Day Training Workshop	ESMP with special focus on mitigation measures during design stage	RMC, Lahore	One training workshop at design stage of project	All architects, contractors, sub-contractors, and supervision consultants
One Day Training Workshop	ESMP with special focus on mitigation measures during construction stage	RMC, Lahore	Two workshops every year during construction period of the project	All contractors, sub-contractors, and supervision consultants
One Day Training Workshop	ESMP with special focus on mitigation measures during operational phase	RMC, Lahore	One workshop at the end of the project	PMD staff
One Day Refresher Trainings	ESMP Implementation and Reporting	RMC, Lahore	One workshop every year	PIU Staff

Chapter 8. ESMP Estimated Budget

The implementation for environmental and social mitigation plan will be the responsibility of the contractor. Most of the mitigation measures are covered in the engineering costs of the respective works. However, cost for some of the mitigation and monitoring activities are estimated below in **Table 9.1.**

Table 8.1 : Estimated Budget for ESMP Compliance

#	*Description*	*Unit*	*Quantity*	*Unit Rate PKR*	*Total PKR*
1	Site specific ESMP Trainings (including materials, logistics, venue)	Workshops	9	80,000	720,000
6	PPE and Maintenance	Years	2	100,000	200,000
7	Third Party Validation (2 annual and 1 end of project report)	Reports	3	1,000,000	3,000,000
8	Environmental Testing Air, Water, Soil, Noise	Months	15	250,000	3750000
	Total				**7,670,000**

Chapter 9. Grievance Redress Mechanism

9.1 GRM at the Sub-Project Site

The sub-project will follow the Grievance Redress Mechanism in place for the entire PHDSP project and detailed in the ESMF. The GRM provisions and details will be translated into the local language and displayed at the sub-project site, RMC and PIU offices. The GRM as per the ESMF is detailed below.

9.2 Overview and Scope

The Grievance Redress Mechanism proposed here spans the entire project implementation and will cater to both the directly and indirectly affected population/beneficiaries. Though the GRM proposed here has been designed to address environmental and social problems identified during implementation, it will also cater to manage any disconnects that emerge from the field level and that has significant implications for effective implementation of the sub-project interventions.

The Project Implementation Unit (PIU) office will serve as the secretariat for the Grievance Redress Committee (GRC-Project) that will be responsible for providing oversight on the entire GRM process at a strategic level and monitoring of complaints management.

9.3 Objectives of the Grievance Redress Mechanism

The grievance redress mechanism (GRM) will be consistent with the requirements of the World Bank safeguard policies to ensure mitigation of community concerns, risk management, and maximization of environmental and social benefits. The overall objective of the GRM is therefore to provide a robust system of procedures and processes that provides for transparent and rapid resolution of concerns and complaints identified at the local level.

The GRM will be accessible to diverse members of the community, including women, senior citizens and other vulnerable groups. Culturally appropriate communication mechanisms will be used at all sub- project sites both to spread awareness regarding the GRM process as well as complaints management.

9.4 Communication & Awareness on GRM

The final processes and procedures for the GRM will be translated in to local language, if needed and disseminated at all sub-project locations. These shall be made available (in both leaflet and poster format) to all sub-project locations.

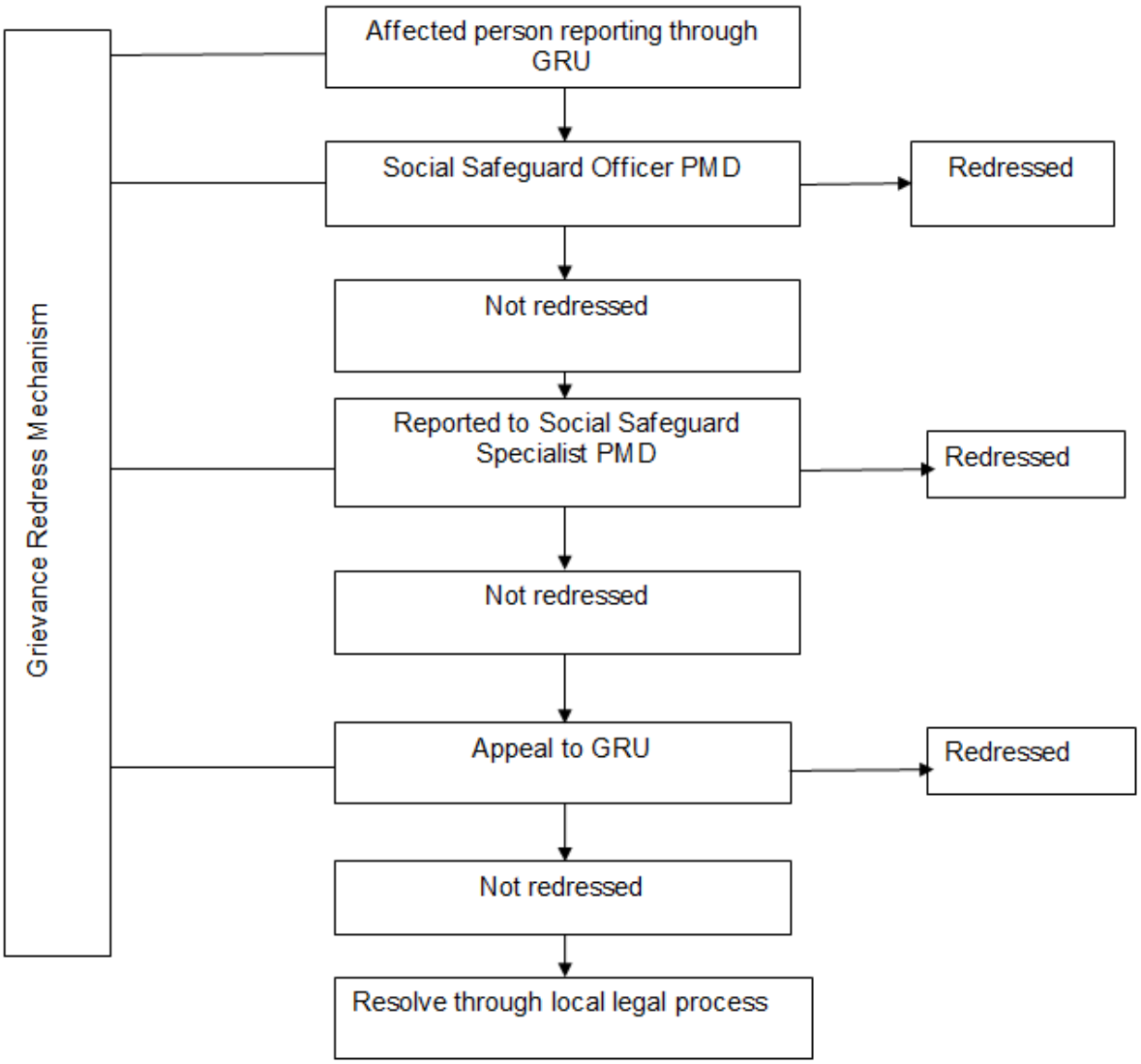
9.5 Proposed Mechanism

A grievance redress mechanism (GRM) will be operational at each subproject level to facilitate amicable and timely resolution of complaints and grievances of the stakeholders including communities and project affected personnel (PAPs) (male and female) regarding all environmental and social issues. Under the GRM, Grievance Redress Committees (GRCs) will be formed comprising of PIU's general manager (GM), PIU's Environment and Social Specialists, representative of ESMP/ESIA consultants, , member of PAP Committee (male and female). Owing to the nature of the project, a GRC will be formed at each subproject level.

Under the GRM, Complaint Register (CR) will be maintained by the PIU at each subproject level. All complaints and grievances will be logged in the register along with details including date of complaint, name and address of complainant, location, and description of complaint. The GRC will then fill additional details in the Register including the corrective action needed, timeframe for corrective action to be taken, and person/project entity responsible for corrective action. Once the corrective action is implemented, the GRC will document the associated details in the Register including the description of action take, date of action completion, views of the complainant regarding the corrective action, and any residual grievance. GRM procedures will be disseminated particularly among the local communities and PAPs. GRM will be gender responsive, culturally appropriate, and readily accessible to the PAPs at no cost and without retribution. A multi-tier GRM has been proposed for the project is described below.

1. Tier 1 (Community level): When a grievance arises, the PAP (male or female) may contact directly with the PAPC (male or female) Field implementation Unit (FIU) or PIU. PAPC may resolve the concern at field level. If the issue is successfully resolved, no further follow-up is required.
2. Tier 2 (GRC level): If no solution can be found at Tier 1, the PAP (male or female) may convey concern/grievance to the GRC, either verbally or in writing. The GRC will log the complaint along with relevant details in the complaint register (CR). For each complaint, the GRC will investigate and prepare a fact-finding report to assess its eligibility, and identify an appropriate solution. The GRC will, as appropriate, instruct the responsible entity to take corrective actions. The complaint will be redressed/appropriately responded within fifteen days. The GRC will review the responsible entity's response and undertake additional monitoring as needed. During the complaint investigation, the GRC will work in close consultation with the Contractors, Environment Specialist, Social Safeguards Specialists, FIU, and PIU.
3. Tier 3 (PIU level): If the complainant is not satisfied/issue not resolved at the Tier 2, then GRC will forward the complaint to PIU for remedial measures and decisions accordingly. The committee at PIU level will consist of GM, Environment specialist, Social Safeguards Specialist of PIU, and ESMP/ESIA. The complaint at the Tier 3 will be resolved within three weeks.
4. Tier 4: If the PAPs are still not satisfied with the decision of PIU, then the complainant(s) may enter the reference in the Court of law.

Figure 9.1: Flow Chart for Grievance Redress Mechanism



9.5.1 Procedures

5. Any grievance in written, verbal or digital form shall be recorded by the receiving office in CR which will be maintained at PIU and FIU;
6. A serial number will be assigned to it together with the date of receipt;
7. A written acknowledgement to a complainant shall be sent promptly and in any case within three working days;
8. The acknowledgement shall contain the name and designation of the officer who will deal with the grievance; information that necessary action will be taken within the specified working days from the date of receipt of the grievance by the officer concerned; name, address, email address and phone number of the authority which the complainant could approach if the matter is not redressed within the specified timeframe or if s/he is not satisfied with the action taken;

9. If the office receiving the grievance/complaint is not the one designated to consider and dispose it, the receiving office shall forward it to the designated office, but after having complied with the requirements at 1 to 3 above;
10. The office designated to consider the matter shall make every effort to ensure that grievances/appeals are considered and disposed-off within the stipulated period of fifteen days in case of Tier 2 and three weeks in case of Tier 3.
11. If the grievance redress mechanism fails to satisfy the aggrieved affected person at all levels, s/he can submit the case to the appropriate court of law.

9.5.2 Grievance Closure

The complaint shall be considered as disposed-off and closed when:

- The designated officer/authority has acceded to the request of the complainant fully;
- Where the complainant has indicated acceptance of the response in writing;
- Where the complainant has not responded to the concerned officer FIU/PIU within one month of being intimated about the final decision of the grievance officer on his grievance/complaint;
- Where the complainant fails to attend the proceedings of the concerned officer at FIU/PIU within the stipulated period of the disposal of the complaint; and
- Where the complainant withdraws his/her complaint.

Chapter 10. Disclosure

This ESMP will be disclosed on the websites of PMD, and on the World Bank Info Shop. Hard copies of this ESMP will also be shared with the Provincial EPA, project stakeholders, contractors, Civil Society Organizations etc. A copy of the ESMP will be placed in the Project Implementation Unit, PMD and regional PMD office for public access. The Urdu translation of the Executive Summary of the ESMP will also be distributed to all relevant stakeholders, especially to the communities in the project areas. The purpose will be to inform them about the project activities, negative environmental and social impacts expected from the project and proposed mitigation measures.

The Project office (PIU) and social safeguards specialist will keep the residing population informed about the environmental and social impacts and facilitate in addressing grievance (s). The ESMP study team has made an endeavor to hold consultative and scoping sessions with these stakeholders to evince their views on the proposed Project, *inter-alia*, their opinions, suggestions, understanding on various issues and concerns.

Annexure 1. Screening checklist

A.	Type of Activity- Will the sub-project	Yes	No
1.	Involve Solid Waste Management	✓	
2	Involve Community Forestry		✓
3	Build or Rehabilitate any structures or buildings?	✓	
4	Be located in or near an area where there is an important historical, archaeological or cultural heritage site?		✓
5	Be located within or adjacent to any areas that are or may be protected by the government (e.g. national park, national reserve world heritage site) or local tradition, or that might be a natural habitat?		✓
6	Depend on water supply from existing dam, weir or other water diversion structure		✓
B.	**Environment- Will be sub-project**		
7	Risk causing the contamination of drinking water?	✓	
8	Cause poor water drainage and increase the risk of water- related diseases such as malaria or bilharzias?	✓	
9	Harvest or exploit a significant amount of natural resources such as trees, fuel wood or water?		✓
10	Be located within or nearby environmentally sensitive areas (e.g.) intact natural forests, mangroves, wetlands) or threatened species?		✓
11	Create a risk of increased soil degradation or erosion?	✓	
12	Create a risk of increasing soil salinity?		✓
13	Produce, or increase the production of, solid or liquid wastes (e.g. water, medical, and domestic or construction wastes)?	✓	
14	Affect the quantity of surface waters (e.g. rivers, streams, wetlands), or groundwater (e.g. wells)?	✓	
15	Result in the production of solid or liquid waste, or result in an increase in waste production, during construction or operation	✓	
C.	**Land Acquisition and access to resources- will the sub-project:**		
16	Require that land (public or private) be acquired (temporarily or permanently) for its development?		✓
17	Displace individuals, families or businesses?		✓
18	Result in temporary or permanent loss of crops, fruit trees or household infrastructure such as granaries, outside toilets and kitchens?		✓
D	**Indigenous people- Are there:**		
19	Any indigenous groups living within the boundaries of, or nearby, the project		✓
20	Members of these indigenous groups in the area who could benefit from the project?		✓

Annexure 2. EE/EIA Regulation 2000

SCHEDULE I

(See Regulation 3)

List of projects requiring an IEE

A. Agriculture, Livestock and Fisheries

1. Poultry, livestock, stud and fish farms with total cost more than Rs.10 million
2. Projects involving repacking, formulation or warehousing of agricultural products

B. Energy

1. Hydroelectric power generation less than 50 MW
2. Thermal power generation less than 200 KW
3. Transmission lines less than 11 KV, and large distribution projects
4. Oil and gas transmission systems
5. Oil and gas extraction projects including exploration, production, gathering systems, separation and storage
6. Waste-to-energy generation projects

C. Manufacturing and processing

1. Ceramics and glass units with total cost more than Rs.50 million
2. Food processing industries including sugar mills, beverages, milk and dairy products, with total cost less than Rs.100 million
3. Man-made fibers and resin projects with total cost less than Rs.100 million
4. Manufacturing of apparel, including dyeing and printing, with total cost more than Rs.25 million
5. Wood products with total cost more than Rs.25 million

D. Mining and mineral processing

1. Commercial extraction of sand, gravel, limestone, clay, Sulphur and other minerals not included in Schedule II with total cost less than Rs.100 million
2. Crushing, grinding and separation processes 9
3. Smelting plants with total cost less than Rs.50 million

E. Transport

1. Federal or Provincial highways (except maintenance, rebuilding or reconstruction of existing metaled roads) with total cost less than Rs.50 million
2. Ports and harbor development for ships less than 500 gross tons

F. Water management, dams, irrigation and flood protection

1. Dams and reservoirs with storage volume less than 50 million cubic meters of surface area less than 8 square kilometers
2. Irrigation and drainage projects serving less than 15,000 hectares
3. Small-scale irrigation systems with total cost less than Rs.50 million

E. Water supply and treatment

Water supply schemes and treatment plants with total cost less than Rs.25 million

F. Waste disposal

Waste disposal facility for domestic or industrial wastes, with annual capacity less than 10,000 cubic meters

G. Urban development and tourism

1. Housing schemes
2. Public facilities with significant off-site impacts (e.g. hospital wastes)
3. Urban development projects

H. Other projects

Any other project for which filing of an IEE is required by the Federal Agency under sub-regulation (2) of Regulation 5

SCHEDULE II

(See Regulation 4) List of projects requiring an EIA

A. Energy

1. Hydroelectric power generation over 50 MW
2. Thermal power generation over 200 MW
3. Transmission lines (11 KV and above) and grid stations
4. Nuclear power plans
5. Petroleum refineries

B. Manufacturing and processing

6. Cement plants
7. Chemicals projects
8. Fertilizer plants
9. Food processing industries including sugar mills, beverages, milk and dairy products, with total cost of Rs.100 million and above
10. Industrial estates (including export processing zones)
11. Man-made fibers and resin projects with total cost of Rs.100 M and above
12. Pesticides (manufacture or formulation)
13. Petrochemicals complex
14. Synthetic resins, plastics and man-made fibers, paper and paperboard, paper pulping, plastic products, textiles (except apparel),printing and publishing, paints and dyes, oils and fats and vegetable ghee projects, with total cost more than Rs.10 million
15. Tanning and leather finishing projects

C. Mining and mineral processing

1. Mining and processing of coal, gold, copper, sulphur and precious stones
2. Mining and processing of major non-ferrous metals, iron and steel rolling
3. Smelting plants with total cost of Rs.50 million and above

D. Transport

1. Airports
2. Federal or Provincial highways or major roads (except maintenance, rebuilding or reconstruction of existing roads) with total cost of Rs.50 million and above
3. Ports and harbor development for ships of 500 gross tons and above
4. Railway works

E. Water management, dams, irrigation and flood protection

1. Dams and reservoirs with storage volume of 50 million cubic meters and above or surface area of 8 square kilometers and above
2. Irrigation and drainage projects serving 15,000 hectares and above
3. Water supply and treatment Water supply schemes and treatment plants with total cost of Rs.25 million and above

F. Waste Disposal

1. Waste disposal and/or storage of hazardous or toxic wastes (including landfill sites, incineration of hospital toxic waste)
2. Waste disposal facilities for domestic or industrial wastes, with annual capacity more than 10,000 cubic meters

G. Urban development and tourism

1. Land use studies and urban plans (large cities)
2. Large-scale tourism development projects with total cost more than Rs.50 million

H. Environmentally Sensitive Areas

All projects situated in environmentally sensitive areas

I. Other projects

1. Any other project for which filing of an EIA is required by the Federal Agency under sub-regulation (2) of Regulation 5.
2. Any other project likely to cause an adverse environmental effect

Annexure 3. NEQS

Table 1: Effluent Discharge Standards NEQS 2000) Applicable to the Works

#.	PARAMETRS	NEQS
1	Temperature	40 ^{o}C =≤3 deg.
2	pH	6 – 9
3	BOD5	80 mg/l
4	Chemical Oxygen Demand (COD)	150 mg/l
5	Total Suspended Solid (TSS)	200 mg/l
6	Total Dissolved Solids	3500 mg/l
7	Grease and Oil	10 mg/l
8	Phenolic compounds (as phenol)	0.1 mg/l
9	Ammonia	40 mg/l
10	Chlorine	1.0 mg/l
11	Chloride	1000.0 mg/l
12	Sulphate	600 mg/l
13	Manganese	1.5 mg/l
14	Fluoride	10 mg/l
15	Cyanide (as CN') total	1.0 mg/l
16	An-ionic detergents (as MB As)	20 mg/l
17	Sulphide (S-2)	1.0 mg/l
18	Pesticides	0.15 mg/l
19	Cadmium	0.1 mg/l
20	Chromium trivalent and hexavalent	1.0 mg/l
21	Copper	1.0 mg/l
22	Lead	0.5 mg/l
23	Mercury	0.01 mg/l
24	Selenium	0.5 mg/l
25	Nickel	1.0 mg/l
26	Silver	1.0 mg/l
27	Total Toxic metals	2.0 mg/l
28	Zinc	5.0 mg/l
29	Arsenic	1.0 mg/l
30	Barium	1.5 mg/l

31	Iron	8.0 mg/l
32	Boron	6.0 mg/l

Table 2: National Environmental Quality Standards (NEQS) for Gaseous Emission (mg/Nm³, Unless Otherwise Defined)

#	Parameter	Source of Emission	Existing Standards	Revised Standards
1.	Smoke	Smoke Opacity not to exceed	40% or 2 Ringlemann Scale	40% or 2 Ringlemann Scale or equivalent smoke number
2.	Particulate Matter (I)	(a) Boilers and Furnaces		
		(i) Oilfired		
		(ii) Coalfired	300	300
		(iii) CementKilns	500	500
			200	200
		(b) Grinding, crushing, clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas.	500	500
3.	Hydrogen Chloride	Any	400	400
4.	Chlorine	Any	150	150
5.	Hydrogen Fluoride	Any	150	150
6.	Hydrogen Sulphide	Any	10	10
7.	Sulphur Oxide (2) (3)	Sulfuric acid/ Sulphonic acid plants		
		Other plants except power plants operating on oil and coal	400	1700

#	Parameter	Source of Emission	Existing Standards	Revised Standards
8.	Carbon Monoxide	Any	800	800
9.	Lead	Any	50	50
10.	Mercury	Any	10	10
11.	Cadmium	Any	20	20
12.	Arsenic	Any	20	20
13.	Copper	Any	50	50
14.	Antimony	Any	20	20
15.	Zinc	Any	200	200
16.	Oxides of Nitrogen (3)	Nitric acid manufacturing unit.	400	400
		Other plants except power plants operating on oil or coal:		
		Gas fired	-	600
		Oil fired	-	1200
		Coal fired		

Explanations:-

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1 percent sulphur content in fuel. Higher content of Sulphur will case standards to bepro-rated.
3. In respect of emissions of sulphur dioxide Nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to National Environmental Quality Standards (NEQS) specified above, comply with the following standards.

Table 3: National Environmental Quality Standards (NEQS, 2009) for Vehicular Emission

#	Parameter	Standard (Maximum permissible Limit)	Measuring Method	Applicability
1	Smoke	40% or 2 on the Ringlemann Scale during engine acceleration mode.	To be compared with Ringlemann Chart at a distance of 6 meters or more	Immediate effect
2	Carbon Monoxide (CO)	6%	Under idling condition: Non-dispersive infrared detection through gas analyzer.	

3	Noise	85 dB(A)	Sound Meter at 7.5 meters from the source	

Table 4: National Environmental Quality Standards (NEQS, 2010) for Noise

#	Category of Area / Zone	Effective from 1st July, 2010		Effective from 1st July, 2013	
		Limit in dB (A) Leq*			
		Daytime	Night-time	Daytime	Night-time
1	Residential Area (A)	65	50	55	45
2	Commercial Area (B)	70	60	65	55
3	Industrial Area (C)	80	75	75	65
4	Silence Zone (D)	55	45	50	45

Note:

1. Daytime hours: 6:00 a.m. to 10:00p.m.
2. Night-time hours: 10:00 p.m. to 6:00a.m.
3. Silence Zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters round hospitals, educational institutions and courts.
4. Mixedcategoriesofareasmaybedecidedasoneofthefourabovementionedcategoriesbythecompetentauthority.

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

Table 5: National Environmental Quality Standards (NEQS, 2010) for Drinking Water

#	Properties/Parameters	Standard Values for Pakistan	WHO Standards	Remarks
BACTERIAL				
1	All water is intended for drinking (E.Coli or Thermotolerant Coliform bacteria)	Must not be detectable in any 100ml sample	Must not be detectable in any 100ml sample	Most Asian Countries also follow WHO Standards
2	Treated water entering the distribution system (E.Coli or Thermotolerant	Must not be detectable in any 100ml sample	Must not be detectable in any 100ml sample	Most Asian Countries also follow WHO Standards

#	Properties/Parameters	Standard Values for Pakistan	WHO Standards	Remarks
	Coliform and total Coliform bacteria)			
3	Treated water entering the distribution system (E.Coli or Thermo tolerant Coliform and total Coliform bacteria)	Must not be detectable in any 100ml sample. In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Must not be detectable in any 100ml sample. In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12- month period.	Most Asian Countries also follow WHO Standards
PHYSICAL				
4	Colour	≤15 TCU	≤15 TCU	
5	Taste	Non Objectionable/ Acceptable	Non Objectionable/ Acceptable	
6	dour	Non Objectionable/ Acceptable	Non Objectionable/ Acceptable	
7	Turbidity	<5 NTU	<5 NTU	
8	Total hardness as $CaCO_3$	<500mg/l	---	
9	TDS	<1000	<1000	
10	pH	6.5-8.5	6.5-8.5	
RADIOACTIVE				
11	Alpha Emitters bq/L or pCi	0.1	0.1	
12	Beta Emitters	01	01	

#	Properties/Parameters	Standard Values for Pakistan	WHO Standards	Remarks
CHEMICAL				
Essential Inorganics		**mg/litre**	**mg/litre**	
13	Aluminum (Al) mg/l	≤0.2	0.02	
14	Antimony (Sb)	≤0.005	0.02	
15	Arsenic (As)	≤0.05	0.01	Standard for Pakistan similar to most Asian developing Countries
16	Barium (Ba)	0.7	0.7	
17	Boron (B)	0.3	0.3	
18	Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing Countries
19	Chloride (Cl)	<250	250	
20	Chromium (Cr)	≤0.05	0.05	
21	Copper (Cu)	2	2	
Toxic Inorganics		**mg/litre**	**mg/litre**	
22	Cyanide (CN)	≤0.05	0.07	Standard for Pakistan similar to most Asian developing Countries
23	Fluoride (F)	≤1.5	1.5	
24	Lead (Pb)	≤0.05	0.01	Standard for Pakistan similar to most Asian developing Countries
25	Manganese (Mn)	≤0.5	0.5	
26	Mercury (Hg)	≤0.001	0.001	
27	Nickel (Ni)	≤0.02	0.02	

#	Properties/Parameters	Standard Values for Pakistan	WHO Standards	Remarks
28	Nitrate (NO_3)	≤50	50	
29	Nitrite (NO_2)	≤3	3	
30	Selenium (Se)	0.01	0.01	
31	Residual Chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	---	
32	Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing Countries
Organics				
33	Pesticides mg/L	---	PSQCA No. 4629-2004, Page No.4, Table No. 3, Serial No. 20-58 may be consulted	Annex-II
34	Phenolic Compounds (as Phenols) mg/L	---	≤0.002	
35	Poly nuclear aromatic hydrocarbons (as PAH) g/L		0.01 (By GC/MS method)	

****PSQCA: Pakistan Standards Quality Control Authority*

Table 6: National Environmental Quality Standards (NEQS, 2010) for Ambient Air

Pollutants	Time-weighted average	Concentration in Ambient Air		Method of Measurement
		Effective from 1st July 2010	Effective from 1st January 2013	
Sulphur Dioxide (SO_2)	Annual Average*	80µg/m^3	80µg/ m^3	Ultraviolet Fluorescence Method
	24 hours**	120µg/m^3	120µg/m^3	
Oxides of Nitrogen as (NO)	Annual Average*	40µg/m^3	40µg/m^3	Gas Phase Chemiluminescence
	24 hours**	40µg/m^3	40µg/m^3	
Oxides of Nitrogen as (NO_2)	Annual Average*	40µg/m^3	40µg/m^3	Gas Phase Chemiluminescence
	24 hours**	80µg/m^3	80µg/m^3	
Ozone (O_3)	1 hour	180µg/m^3	130µg/m^3	Non disperse UV absorption method
Suspended Particulate Matter (SPM)	Annual Average*	400µg/m^3	360µg/m^3	High Volume Sampling, (Average flow rate not less than 1.1m^3/minute)

Annexure 4. World Bank Environmental and Social Safeguard Policies

#	*Subject*	*Policy Reference*	*Triggered*	*Source Web*
1.	Environmental Assessment	OP/BP 4.01	Yes	https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=3900&ver=current
2.	Natural Habitats	OP/BP 4.04	No	https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1581&ver=current
3.	Pest Management	OP 4.09	No	https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1637&ver=current
4.	Forestry	OP 4.36	No	https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1585&ver=current
5.	Safety of Dams	OP 4.37	No	https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1576&ver=current
6.	Physical and Cultural Resources	OP/BP 4.11	No	https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1583&ver=current
7.	Involuntary Resettlement	OP/BP 4.12	Yes	https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1584&ver=current
8.	Indigenous Peoples	OP 4.10	No	https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1582&ver=current
9.	Disputed Areas	OP 7.60	No	https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1841&ver=current
10.	International Waterways	OP 7.50	No	https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=2660
11.	Bank Disclosure Policy	BP 17.50	Applicable	http://siteresources.worldbank.org/OPSMANUAL/Resources/DisclosurePolicy.pdf

Annexure 5. Screening Checklist

a. Brief Description of the Project:

b. Location:

c. Name of Proponent:

#	Questions to be Considered	Briefly Describe Yes/No?	Is this likely to result in a Significant effect? Yes/No- why
Environmental and cumulative Impacts			
1	Will construction or operation of the project use natural resources? Such as land, water, materials or energy, especially any resources which are non-renewable or in short supply**?**		
2	Will the project involve use, storage, transport, handling or production of substance or materials, which could be harmful to human health or the environment or concerns about actual or perceived risks to human health**?**		
3	Will the Project produce solid waste during construction, operation, or decommissioning**?**		
4	Will the Project release pollutants or any hazardous, toxic or noxious substances to air**?**		
5	Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation**?**		
6	Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters and groundwater**?**		
7	Will there is any risk of accidents during construction or operation of the project, which could affect human health or the environment**?**		
8	Are there any other factors, which should be considered such as consequential development that could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality**?**		
9	Are there any areas on or around the locations, which, are protected under international, national, or local legislation for their ecological, landscape, cultural, or other value, which could be affected by the project**?**		

10	Are there any other areas on or around the location, which are important or sensitive for reasons of their ecology e, g. wetlands, watercourses or other water bodies, mountains, forests or woodlands, which could be affected by the project**?**		
11	Are there any areas on or around the location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, over wintering, migration, which could be affected by the project**?**		
12	Are there any in land or underground water sonor around the location that could be affected by the project**?**		
13	Are there any areas or features of high landscape or scenic value on or around the location, which could be affected by the project**?**		
14	What kind of effluents can be discharged during operation of this project/ units**?**		
15	Is this project likely to affect the soil, water and air of the surrounding environment**?**		
16	Are there any transport routes passing through or around the		
	location which are susceptible to congestion or which cause environmental problem, which could be effected by the project**?**		
17	Is the project located in a previously undeveloped area where there is a loss of Greenfield land**?**		
18	Are there any areas on or around the locations which are occupied by the sensitive land-use e.g. hospitals, schools, worship places, community facilities which could be affected by the project**?**		
19	Are there any areas on or around the locations which contain important high quality or scarce resources e.g. ground & surface water forestry, agriculture, fisheries tourism, minerals which could be affected by the project**?**		

20	Are there any areas on or around the locations which that are already subject to pollution or environmental damage e.g. where existing legal environmental standers are exceeded which could be affected by the project**?**		
21	Is the project location is susceptible to earthquake, subsistence, landslide erosions flooding or extreme adverse climate conditions e.g. temperature inversion, fogs, severe winds, which could cause the project to present environmental problem**?**		
22	What would be the source of energy supply for this project**?**		
23	What would be the mechanism of solid waste disposal/management when this project would become functional?		
24	What would be the mechanism of waste water drainage/disposal / treatment when this project would become functional**?**		
25	What kind of effluents are expected /discharged when this project would become functional**?**		
Social and land use impacts			
1	Will the Project result in social changes, for example, in demography, traditional lifestyles, employment**?**		
2	Are there any routes or facilities on or around the locations, which are used by the public for access to recreation, or other facilities, which could be affected by the project**?**		
3	Are there any areas or features of historic or cultural importance on or around the location which could be effected by the project**?**		
4	Are there existing land uses on or around the location e.g. homes, gardens or other private property, industry, commerce, recreation, public open space, community facilities, agriculture, forestry, tourism, mining or quarrying which could be effected by the project**?**		

5	Are there any plans for future land uses on or around the location which could be effected by the project?		
6	Are there any areas on or around the location which are densely populated or built up, which could be affected by the project**?**		

Observations/Recommendation:-

1.
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10.

Survey Conducted by **Verified by**

Name and Designation **Name and designation**

Signatures

Signatures

Annexure 6. Environmental Code of Practices

Introduction

The objective of preparation of the Environmental Code of Practices (ECP) is to address less significant environmental impacts and all general construction related impacts of the proposed project implementation. The ECPs will provide guidelines for best operating practices and environmental management guidelines to be followed by the contractors for sustainable management of all environmental issues.

ECP 1: Waste Management

ECP 2: Fuels and Hazardous Substances Management

ECP 3: Water Resources Management

ECP 4: Drainage Management

ECP 5: Soil Quality Management

ECP 6: Erosion and Sediment Control

ECP 8: Air Quality Management

ECP 9: Noise and Vibration Management

ECP 10: Protection of Flora

ECP 11: Protection of Fauna

ECP 13: Road Transport and Road Traffic Management

ECP 15: Cultural and Religious Issues

ECP 16: Workers Health and Safety

The Contractor can also prepare a 'Construction Environmental Action Plan' (CEAP) demonstrating the manner in which the Contractor will comply with the requirements of ECPs and the mitigation measures proposed in the ESMMP of the ESA Report. The CEAP will form the part of the contract documents and will be used as monitoring tool for compliance. Violation of the compliance requirements will be treated as non-compliance leading to the corrections or otherwise imposing penalty on the contractors.

ECP 1: Waste Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	The Contractor shall: - Develop waste management plan for various specific waste streams (e.g., reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to WAPDA for approval. - Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of disposal site, so as to cause less environmental impact. - Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. - Segregate and reuse or recycle all the wastes, wherever practical. - Collect and transport non-hazardous wastes to all the approved disposal sites. - Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. - Provide refuse containers at each worksite. - Request suppliers to minimize packaging where practicable. - Place a high emphasis on good housekeeping practices. - Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.
Hazardous Waste	Health hazards and environmental impacts due to improper waste management practices	The Contractor shall: - Collect chemical wastes in 200 liter drums (or similar sealed container), appropriately labeled for safe transport to an approved chemical waste depot. - Store, transport and handle all chemicals avoiding potential environmental pollution. - Store all hazardous wastes appropriately in bunded areas away from water courses.

		- Make available Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction. - Collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at approved locations. - Construct concrete or other impermeable flooring to prevent seepage in case of spills

ECP 2: Fuels and Hazardous Substance Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Fuels and hazardous goods.	Materials used in construction have a potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous goods/materials on-site, and potential spills from these goods may harm the environment or health of construction workers.	The Contractor shall: - Prepare spill control procedures and submit the plan for WAPDA approval. - Train the relevant construction personnel in handling of fuels and spill control procedures. - Store dangerous goods in bunded areas on a top of a sealed plastic sheet away from watercourses. - Refueling should occur only within bunded areas. - Make available MSDS for chemicals and dangerous goods on-site. - Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site approved by EPA. - Provide absorbent and containment material (e.g., absorbent matting) where hazardous material are used and stored and personnel trained in the correct use. - Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use. - Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. - Store hazardous materials above flood plain level. - Put containers and drums in temporary storages in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area should preferably slope or drain to a safe collection area in the event of a spill. - Put containers and drums in permanent storage areas on an impermeable floor that slopes to a safe collection area in the event of a spill or leak.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		- Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. - Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials.

ECP 3: Water Resources Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Hazardous Material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	The Contractor shall: - Follow the management guidelines proposed in ECPs 1 and 2. - Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, storm water systems or underground water tables
Discharge from construction sites	During construction both surface and groundwater quality may be deteriorated due to construction activities in the river, sewerages from construction sites and work camps. The construction works will modify groundcover and topography changing the surface water drainage patterns, including infiltration and storage of storm water. The change in hydrological regime leads to increased rate of runoff and in sediment and contaminant loading, increased flooding, groundwater contamination, and effect habitat of fish and other aquatic biology.	The Contractor shall: - Install temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials - Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from site - Divert runoff from undisturbed areas around the construction site - Stockpile materials away from drainage lines - Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting where possible and transport to a approved waste disposal site or recycling depot - Wash out ready-mix concrete agitators and concrete handling equipment at washing facilities off site or into approved bunded areas on site. Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This should be done in every exit of each construction vehicle to ensure the local roads are kept clean.

Project Activity/ Impact Source	**Environmental Impacts**	**Mitigation Measures/ Management Guidelines**
Soil Erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall: - Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion - Ensure that roads used by construction vehicles are swept regularly to remove sediment. - Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds)
Construction activities in water bodies	Construction works in the water bodies will increase sediment and contaminant loading, and effect habitat of fish and other aquatic biology.	The Contractor shall: - Dewater sites by pumping water to a sediment basin prior to release off site – do not pump directly off site - Monitor the water quality in the runoff from the site or areas affected by dredge plumes, and improve work practices as necessary - Protect water bodies from sediment loads by silt screen or bubble curtains or other barriers - Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, storm water systems or underground water tables. - Use environment friendly and non-toxic slurry during construction of piles to discharge into the river. - Reduce infiltration of contaminated drainage through storm water management design - Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets.
Drinking water	Groundwater at shallow depths might be contaminated and hence	The Contractor shall: - Control the quality of groundwater to be used for drinking water on the bases of

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	not suitable for drinking purposes.	NEQS and World Bank standards for drinking water. Safe and sustainable discharges are to be ascertained prior to selection of pumps. - Tube wells will be installed with due regard for the surface environment, protection of groundwater from surface contaminants, and protection of aquifer cross contamination - All tube wells, test holes, monitoring wells that are no longer in use or needed shall be properly decommissioned
	Depletion and pollution of groundwater resources	- Install monitoring wells both upstream and downstream areas near construction yards and construction camps to regularly monitor and report on the water quality and water levels. - Protect groundwater supplies of adjacent lands

ECP 4: Drainage Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Excavation and earth works, and construction yards	Lack of proper drainage for rainwater/liquid waste or wastewater owing to the construction activities harms environment in terms of water and soil contamination, and mosquito growth.	- The Contractor shall: - Prepare a program for prevent/avoid standing waters, which EMSU will verify in advance and confirm during implementation - Provide alternative drainage for rainwater if the construction works/earth-fillings cut the established drainage line - Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there. - Rehabilitate road drainage structures immediately if damaged by contractors' road transports. - Build new drainage lines as appropriate and required for wastewater from construction yards connecting to the available nearby recipient water bodies. Ensure wastewater quality conforms to the relevant standards provided by EPA, before it being discharged into recipient water bodies. - Ensure the internal roads/hard surfaces in the construction yards/construction camps that generate has storm water drainage to accommodate high runoff during downpour and that there is no stagnant water in the area at the end of the downpour. - Construct wide drains instead of deep drains to avoid sand deposition in the drains that require frequent cleaning. - Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the drainage system to avoid drainage congestion - Protect natural slopes of drainage channels to ensure adequate storm water drains. - Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem. - Reduce infiltration of contaminated drainage through storm water management design

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Ponding of water	Health hazards due to mosquito breeding	- Do not allow ponding of water especially near the waste storage areas and construction camps - Discard all the storage containers that are capable of storing of water, after use or store them in inverted position

ECP 5: Soil Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Storage of hazardous and toxic chemicals	Spillage of hazardous and toxic chemicals will contaminate the soils	The Contractor shall: - Strictly manage the wastes management plans proposed in ECP1 and storage of materials in ECP2 - Construct appropriate spill contaminant facilities for all fuel storage areas - Establish and maintain a hazardous materials register detailing the location and quantities of hazardous substances including the storage, use of disposals - Train personnel and implement safe work practices for minimizing the risk of spillage - Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site - Remediate the contaminated land using the most appropriate available method to achieve required commercial/industrial guideline validation results
Construction material stock piles	Erosion from construction material stockpiles may contaminate the soils	The Contractor shall: - Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds

ECP 6: Erosion and Sediment Control

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Clearing of construction sites	Cleared areas and slopes are susceptible for erosion of top soils that affects the growth of vegetation which causes ecological imbalance.	The Contractor shall: - Reinstate and protect cleared areas as soon as possible. - Mulch to protect batter slopes before planting - Cover unused area of disturbed or exposed surfaces immediately with mulch/grass turfings/tree plantations
Construction activities and material stockpiles	The impact of soil erosion are: (i) Increased run off and sedimentation causing a greater flood hazard to the downstream, (ii) destruction of aquatic environment in nearby lakes, streams, and reservoirs caused by erosion and/or deposition of sediment damaging the spawning grounds of fish, and (iii) destruction of vegetation by burying or gullying.	The Contractor shall: - Locate stockpiles away from drainage lines - Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds - Remove debris from drainage paths and sediment control structures - Cover the loose sediments and water them if required - Divert natural runoff around construction areas prior to any site disturbance - Install protective measures on site prior to construction, for example, sediment traps - Control drainage through a site in protected channels or slope drains - Install ‘cut off drains’ on large cut/fill batter slopes to control water runoff speed and hence erosion - Observe the performance of drainage structures and erosion controls during rain and modify as required.

ECP 8: Air Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	The Contractor shall: - Fit vehicles with appropriate exhaust systems and emission control devices, in compliance with the NEQS. Maintain these devices in good working condition. - Operate the vehicles in a fuel efficient manner - Cover haul vehicles carrying dusty materials moving outside the construction site - Impose speed limits on all vehicle movement at the worksite to reduce dust emissions - Control the movement of construction traffic - Water construction materials prior to loading and transport - Service all vehicles regularly to minimize emissions - Limit the idling time of vehicles not more than 2 minutes
Construction machinery	Air quality can be adversely affected by emissions from machinery and combustion of fuels.	The Contractor shall: - Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. - Focus special attention on containing the emissions from generators - Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites - Service all equipment regularly to minimize emissions
Construction activities	Dust generation from construction sites, material stockpiles and access roads is a nuisance in the environment and can be a health hazard.	- Water the material stockpiles, access roads and bare soils on an as required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds) - Minimize the extent and period of exposure of the bare surfaces - Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary to avoid during

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		periods of high wind and if visible dust is blowing off-site - Restore disturbed areas as soon as practicable by vegetation/grass-turfing - Store the cement in silos and minimize the emissions from silos by equipping them with filters.

ECP 9: Noise and Vibration Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	The Contractor shall: - Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures - Make sure all drivers will comply with the traffic codes concerning maximum speed limit, driving hours, etc.
Construction machinery	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall: - Appropriately site all noise generating activities to avoid noise pollution to local residents - Use the quietest available plant and equipment - Modify equipment to reduce noise (for example, noise control kits, lining of truck trays or pipelines) - Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures - Install acoustic enclosures around generators to reduce noise levels. - Fit high efficiency mufflers to appropriate construction equipment
Construction activity	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall: - Notify adjacent residents prior to any typical noise event outside of daylight hours - Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions - Employ best available work practices on-site to minimize occupational noise levels - Install temporary noise control barriers where appropriate - Notify affected people if noisy activities will be undertaken, e.g. blasting - Plan activities on site and deliveries to and from site to minimize impact - Monitor and analyze noise and vibration results and adjust construction practices as required.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		- Avoid undertaking the noisiest activities, where possible, when working at night near the residential areas

ECP 10: Protection of Flora

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Local flora are important to provide shelters for the birds, offer fruits and/or timber/fire wood, protect soil erosion and overall keep the environment very friendly to human-living. As such damage to flora has wide range of adverse environmental impacts.	The Contractor shall: - Reduce disturbance to surrounding vegetation - Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetations. - Get approval from supervision consultant for clearance of vegetation. - Make selective and careful pruning of trees where possible to reduce need of tree removal. - Control noxious weeds by disposing of at designated dump site or burn on site. - Clear only the vegetation that needs to be cleared in accordance with the plans. These measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill and construction of diversion roads, etc. - Do not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. - Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of the roadside it came from. - Avoid work within the drip-line of trees to prevent damage to the tree roots and compacting the soil. - Minimize the length of time the ground is exposed or excavation left open by clearing and re-vegetate the area at the earliest practically possible. - Ensure excavation works occur progressively and re-vegetation done at the earliest

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		- Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction - Supply appropriate fuel in the work caps to prevent fuel wood collection

ECP 11: Protection of Fauna

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities	The location of construction activities can result in the loss of wild life habitat and habitat quality,	The Contractor shall: - Limit the construction works within the designated sites allocated to the contractors - check the site for animals trapped in, or in danger from site works and use a qualified person to relocate the animal
	Impact on migratory birds, its habitat and its active nests	The Contractor shall: - Not be permitted to destruct active nests or eggs of migratory birds - Minimize the tree removal during the bird breeding season. If works must be continued during the bird breeding season, a nest survey will be conducted by a qualified biologist prior to commence of works to identify and located active nests - Minimize the release of oil, oil wastes or any other substances harmful to migratory birds to any waters or any areas frequented by migratory birds.
Vegetation clearance	Clearance of vegetation may impact shelter, feeding and/or breeding and/or physical destruction and severing of habitat areas	- The Contractor shall: - Restrict the tree removal to the minimum required. - Retain tree hollows on site, or relocate hollows, where appropriate - Leave dead trees where possible as habitat for fauna - Fell the hollow bearing trees in a manner which reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated or rendered assistance if injured. After felling, hollow bearing trees will remain unmoved overnight to allow animals to move of their own volition.
Construction camps	Illegal poaching	- Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.

ECP 13: Road Transport and Road Traffic Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Increased traffic use of road by construction vehicles will affect the movement of normal road traffics and the safety of the road-users.	The Contractor shall: - Prepare and submit a traffic management plan to WAPDA for their approval at least 30 days before commencing work on any project component involved in traffic diversion and management. - Include in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary diversions, necessary barricades, warning signs/lights, road signs, etc. - Provide signs at strategic locations of the roads complying with the schedules of signs contained in the Pakistani Traffic Regulations. - Install and maintain a display board at each important road intersection on the roads to be used during construction, which shall clearly show the following information in Urdu: - Location: chainage and village name - Duration of construction period - Period of proposed detour/alternative route - Suggested detour route map - Name and contact address/telephone number of the concerned personnel - Name and contact address/telephone number of the Contractor - Inconvenience is sincerely regretted.
	Accidents and spillage of fuels and chemicals	- Restrict truck deliveries, where practicable, to day time working hours. - Restrict the transport of oversize loads. - Operate road traffics/transport vehicles, if possible, to non-peak periods to minimize traffic disruptions. - Enforce on-site speed limit

ECP 15: Cultural and Religious Issues

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities near religious and cultural sites	Disturbance from construction works to the cultural and religious sites, and contractors lack of knowledge on cultural issues cause social disturbances.	The Contractor shall: - Communicate to the public through community consultation and newspaper announcements regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction. - Do not block access to cultural and religious sites, wherever possible - Restrict all construction activities within the foot prints of the construction sites. - Stop construction works that produce noise (particularly during prayer time) should there be any mosque/religious/educational institutions close to the construction sites and users make objections. - Take special care and use appropriate equipment when working next to a cultural/religious institution. - Stop work immediately and notify the site manager if, during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until approval to continue is given by the PMU - Provide separate prayer facilities to the construction workers. - Show appropriate behavior with all construction workers especially women and elderly people - Allow the workers to participate in praying during construction time - Resolve cultural issues in consultation with local leaders and supervision consultants - Establish a mechanism that allows local people to raise grievances arising from the construction process. - Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters

ECP 16: Worker Health and Safety

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Best practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction workers will be exposed to a number of (i) biophysical health risk factors, (e.g. noise, dust, chemicals, construction material, solid waste, waste water, vector transmitted diseases etc), (ii) risk factors resulting from human behavior (e.g. STD, HIV etc) and (iii) road accidents from construction traffic.	The Contractor shall: - Implement suitable safety standards for all workers and site visitors which should not be less than those laid down on the international standards (e.g. International Labor Office guideline on 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and contractor's own national standards or statutory regulations, in addition to complying with the national acts and rules of the Government of Pakistan - Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of hazards in the work areas, - Provide personal protection equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones. - Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job - Appoint an environment, health and safety manager to look after the health and safety of the workers - Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters
	Child and pregnant labor	- The Contractor shall: - not hire children of less than 14 years of age and pregnant women or women who

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		delivered a child within 8 preceding weeks, in accordance with the Pakistani Labor Laws and Employment of Child Act (1977).
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	- Provide health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations should be easily accessible throughout the place of work - Document and report occupational accidents, diseases, and incidents. - Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice. - Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. - Provide awareness to the construction drivers to strictly follow the driving rules - Provide adequate lighting in the construction area and along the roads
Construction Camps	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ECP 14 Construction Camp Management: - Adequate ventilation facilities - Safe and reliable water supply. Water supply from deep tube wells that meets the national standards - Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. - Treatment facilities for sewerage of toilet and domestic wastes - Storm water drainage facilities. - Recreational and social facilities - Safe storage facilities for petroleum and other chemicals in accordance with ECP 2 - Solid waste collection and disposal system in accordance with ECP1. - Arrangement for trainings

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		- Paved internal roads. - Security fence at least two m height. - Sick bay and first aid facilities
Water and sanitation facilities at the construction sites	Lack of Water sanitation facilities at construction sites cause inconvenience to the construction workers and affect their personal hygiene.	- The contractor shall provide portable toilets at the construction sites, if about 25 people are working the whole day for a month. Location of portable facilities should be at least six m away from storm drain system and surface waters. These portable toilets should be cleaned once a day and all the sewerage should be pumped from the collection tank once a day and should be brought to the common septic tank for further treatment. - Contractor should provide bottled drinking water facilities to the construction workers at all the construction sites.
Other ECPs	Potential risks on health and hygiene of construction workers and general public	The Contractor shall follow the following ECPs to reduce health risks to the construction workers and nearby community: - ECP 2: Fuels and Hazardous Goods Management - ECP 4: Drainage Management - ECP 8: Air Quality Management - ECP 9: Noise and Vibration Management - ECP 13: Road Transport and Road Traffic Management
Trainings	Lack of awareness and basic knowledge in health care among the construction workforce, make them susceptible to potential diseases.	The Contractor shall: - Train all construction workers in basic sanitation and health care issues (e.g., how to avoid malaria and transmission of sexually transmitted infections (STI) HIV/AIDS. - Train all construction workers in general health and safety matters, and on the specific hazards of their work Training should consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. - Commence the malaria, HIV/AIDS and STI education campaign before the start of the

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		construction phase and complement it with by a strong condom marketing, increased access to condoms in the area as well as to voluntary counseling and testing. - Implement malaria, HIV/AIDS and STI education campaign targeting all workers hired, international and national, female and male, skilled, semi- and unskilled occupations, at the time of recruitment and thereafter pursued throughout the construction phase on ongoing and regular basis. This should be complemented by easy access to condoms at the workplace as well as to voluntary counseling and testing.

Annexure 7. Ground Water Quality Monitoring Report

Location RMC Lahore, FFD Division

Sample No.			EHS-LHR-193/2018-02		
Client ID			D.W (Tube Well)		
Sample Matrix			Drinking Water Sample		
Sample Date / Time			24-02-18 11:30		
Sample Receipt Date / Time			26-2-18 12:30		
Sampled By			SGS		
Parameter	Units	LOR	Results	Limit as per NEQS	Remarks
Taste Physical 2160 A					
Taste	-	-	Non Objectionable	Non Objectionable	C
Turbidity based on APHA 2130 B 22nd Edition					
Turbidity	NTU	1.0	<1.0	<5NTU	C
pH based on APHA 4500H+ B 22nd Edition					
*pH	pH unit	0.1	7.38	6.5 – 8.5	C
Color based on APHA-2120 B/C 22nd Edition					
Color	Pt-Co.	5.0	<5.0	≤15TCU	C
Odour Physical 2150 A					
Odour	-	-	Non Objectionable	Non Objectionable	C
Total Dissolved Solid based on APHA 2540 C 22nd Edition					
*Solids, Total Dissolved (TDS)	mg/L	5.0	475	<1000	C
Total, Hardness based on APHA 2340 C & B 22nd Edition					
*Hardness, Total as $CaCO_3$	mg/L	1.0	371.68	<500	-
Chloride based on APHA-4500Cl- B 22nd Edition					
*Chloride	mg/L	0.5	24.64	<250	C
Fluoride based on APHA 4500 F- B, D 22nd Edition					
Fluoride F^-	mg/L	1.0	<1.0	≤1.5	C
Cyanide based on APHA 4500 CN B&E 22nd Edition					
Cyanide (CN)	mg/L	0.05	<0.05	≤0.05	C
Nitrate, Nitrogen (NO_3) Micro based on APHA 4500 NO_3 B 22nd Edition					
Nitrate (NO_3), Nitrogen	mg/L	1.0	<1.0	≤50	C
Total Phenols based on APHA 5530 C 22nd Edition					
Phenols, Total (Phenolic Compounds)	mg/L	0.01	<0.01	-	-
Chlorine Macro based on APHA 4500 Cl G 22nd Edition					
Residual Chlorine (Free)	mg/L	0.001	<0.001	0.2-0.5***	C
Metals by AAS / ICP-OES based on APHA 3111 / 3120 B 22nd Edition					
^Arsenic (As)	mg/L	0.005	#	≤0.05	-
*Chromium (Cr),total	mg/L	0.02	<0.02	≤0.05	C
*Copper (Cu)	mg/L	1.0	<1.0	2	C
*Nickel (Ni)	mg/L	0.02	<0.02	≤0.02	C
^Antimony (Sb)	mg/L	0.005	#	≤0.005	-
^Aluminum (Al)	mg/L	0.005	#	≤0.2	-
*Zinc (Zn)	mg/L	1.0	<1.0	5.0	C
^Barium (Ba)	mg/L	0.005	#	0.7	-
^Boron (B)	mg/L	0.005	#	0.3	-
*Cadmium (Cd)	mg/L	0.01	<0.01	0.01	C
^Selenium (Se)	mg/L	0.005	#	0.01	-
^Lead (Pb)	mg/L	0.05	<0.05	≤0.05	C
*Manganese (Mn)	mg/L	0.5	<0.5	≤0.5	C
Mercury by ICP-OES based on APHA 3112 B 22nd Edition					
^Mercury (Hg)	mg/L	0.001	#	≤0.001	-
Total Colony Count Pour Plate Technique APHA 9215 B 22nd Edition					
*Total Colony Count	CFU/ml	-	700	-	-
Total Coliforms Membrane Filtration Technique APHA 9222 B 22nd Edition					
*Total Coliforms	CFU / 100ml	-	Absent	0CFU/100ml	-
Fecal Coliforms (*E.coli*) Membrane Filtration Technique APHA 9222 D 22nd Edition					
* Fecal Coliforms (*E.coli*)	CFU / 100ml	-	Absent	0CFU/100ml	-
Fecal *streptococci/ Enterococci* Membrane Filtration Technique APHA 9230 C 22nd Edition					
*Fecal *Streptococci/ Enterococci*	CFU /100ml	-	Absent	-	-

Annexure 8. Ambient Air Quality and Noise Monitoring Report

Nature of Monitoring : Ambient Air

Monitoring Location : Near Radar (PMD Office Lahore)

Date of Intervention : February 23-24, 2018

Sr. #	Time	CO	NO	NO_2	SO_2
		(mg/m^3)	(µg/m3)	(µg/m3)	(µg/m3)
1.	12:00	8.12	3.59	14.21	5.29
2.	13:00	8.54	3.55	14.02	5.25
3.	14:00	8.55	3.59	14.19	5.29
4.	15:00	7.86	3.41	14.11	5.46
5.	16:00	7.63	3.49	14.24	5.75
6.	17:00	7.70	3.66	14.59	5.83
7.	18:00	8.01	2.83	14.86	4.58
8.	19:00	8.33	2.76	15.01	3.97
9.	20:00	9.88	2.80	15.06	4.53
10.	21:00	8.96	7.15	15.18	4.75
11.	22:00	7.88	7.18	15.20	4.84
12.	23:00	7.14	7.20	15.25	4.85
13.	00:00	7.02	7.08	15.02	4.89
14.	01:00	6.54	7.01	14.91	4.39
15.	02:00	5.12	6.64	14.85	4.84
16.	03:00	5.21	6.24	14.61	4.88
17.	04:00	5.29	6.12	14.24	4.31
18.	05:00	4.14	5.91	14.02	4.38
19.	06:00	4.48	5.42	13.84	4.37
20.	07:00	4.95	4.15	13.43	9.85
21.	08:00	7.10	3.04	12.91	10.1
22.	09:00	7.20	3.19	12.99	10.1
23.	10:00	6.80	4.45	13.45	10.25
24.	11:00	7.80	6.01	14.26	10.29
Average Concentration		7.09	4.85	14.35	5.96

Nature of Monitoring : Ambient Air

Monitoring Location : Near Radar (PMD Office Lahore)

Date of Intervention : February 23-24, 2018

Time	Ambient Temperature	Wind Direction	Wind Speed	Humidity	Pressure (mm of Hg)
	^{o}C		m/s	%	
12:00	23	NW	0.9	41	744.5
13:00	25	NW	1.3	36	744.7
14:00	26	NW	1.4	32	744.9
15:00	27	NW	1.0	30	745.1
16:00	27	W	0.3	30	745.0
17:00	26	W	1.3	32	744.7
18:00	25	NW	2.0	37	744.4
19:00	23	N	1.3	51	744.5
20:00	22	NE	0.7	55	744.7
21:00	21	E	0.3	59	744.8
22:00	21	E	0.7	61	745.5
23:00	21	E	1.7	64	745.0
00:00	19	NE	3.3	60	746.3
01:00	18	NE	3.0	60	745.5
02:00	17	N	1.7	57	746.3
03:00	17	NW	0.7	55	746.3
04:00	17	N	1.3	65	746.0
05:00	16	N	1.0	62	745.4
06:00	16	NE	2.3	69	746.8
07:00	18	NE	2.6	68	746.9
08:00	17	NE	2.0	75	746.0
09:00	17	E	1.8	76	745.8
10:00	19	E	1.8	74	7459
11:00	19	E	1.9	73	745.7

SGS PAKISTAN (PVT.) LTD

Nature of Monitoring : **Noise Level Monitoring**

Monitoring Location : **Near Radar (PMD Office Lahore)**

Date of Intervention : February 23-24, 2018

Sr. #	Time (Hrs)	Noise Level (Reading-1)	Noise Level (Reading-2)	Noise Level (Reading-3)
1.	12:00	68.2	68.3	68.5
2.	13:00	68.6	68.7	68.9
3.	14:00	68.9	69.0	69.2
4.	15:00	69.1	69.3	69.5
5.	16:00	69.2	69.5	69.7
6.	17:00	69.0	69.1	69.2
7.	18:00	67.8	67.9	68.1
8.	19:00	66.8	66.9	67.0
9.	20:00	65.2	65.3	65.8
10.	21:00	64.7	64.8	65.1
11.	22:00	64.0	64.2	64.5
12.	23:00	63.5	63.7	63.8
13.	00:00	61.2	61.8	61.9
14.	01:00	59.2	59.5	59.9
15.	02:00	58.5	58.6	58.8
16.	03:00	56.3	56.5	56.8
17.	04:00	56.1	56.3	56.4
18.	05:00	56.8	57.1	57.8
19.	06:00	57.9	58.1	58.3
20.	07:00	58.4	58.5	58.6
21.	08:00	59.8	60.1	60.3
22.	09:00	60.8	61.2	61.4
23.	10:00	62.2	62.5	62.7
24.	11:00	63.8	64.2	64.8

As per OSHA; Standard Max Permissible Limit is 90 dB
As per PEQS; Standard Max Permissible Limit is 75 dB for day Time
As per PEQS; Standard Max Permissible Limit is 65 dB for night Tim

Monitored By	Laboratory / Field In charge	Chief Analyst / DH
Mr. Babar / Mr. Waleed	Mr. Maqbool Alam	Mr. Ali Hashim

Nature of Monitoring : **Noise Level Monitoring**
Monitoring Location : **Near Radar (PMD Office Lahore)**
Date of Intervention : February 23-24, 2018

Sr. #	Time (Hrs)	Noise Level (Reading-1)	Noise Level (Reading-2)	Noise Level (Reading-3)
1.	12:00	68.2	68.3	68.5
2.	13:00	68.6	68.7	68.9
3.	14:00	68.9	69.0	69.2
4.	15:00	69.1	69.3	69.5
5.	16:00	69.2	69.5	69.7
6.	17:00	69.0	69.1	69.2
7.	18:00	67.8	67.9	68.1
8.	19:00	66.8	66.9	67.0
9.	20:00	65.2	65.3	65.8
10.	21:00	64.7	64.8	65.1
11.	22:00	64.0	64.2	64.5
12.	23:00	63.5	63.7	63.8
13.	00:00	61.2	61.8	61.9
14.	01:00	59.2	59.5	59.9
15.	02:00	58.5	58.6	58.8
16.	03:00	56.3	56.5	56.8
17.	04:00	56.1	56.3	56.4
18.	05:00	56.8	57.1	57.8
19.	06:00	57.9	58.1	58.3
20.	07:00	58.4	58.5	58.6
21.	08:00	59.8	60.1	60.3
22.	09:00	60.8	61.2	61.4
23.	10:00	62.2	62.5	62.7
24.	11:00	63.8	64.2	64.8

As per OSHA; Standard Max Permissible Limit is 90 dB
As per PEQS; Standard Max Permissible Limit is 75 dB for day Time
As per PEQS; Standard Max Permissible Limit is 65 dB for night Tim

Ambient Air Monitoring

Ambient Air Quality Monitoring

Drinking Water Sampling

Annexure 9. Record and of Stakeholder Consultation

Record of the Consultation Meeting

Installation of Weather Surveillance Radar, FFD Lahore

Stakeholder:	M.I Traders
Date:	March 01, 2018
Time:	04:45 pm
Meeting Venue:	249-Shadman 1
Attended by:	Muhammad Naeem, Owner of M.I Traders
Conducted by:	Muhammad Imran, Public Consultation Consultant
Recorded by:	Muhammad Imran
Language:	Urdu, English
Information Provided:	Office of M.I Traders is situated at the south side (Backside) of the proposed location of the project. The discussion started with the introduction of the consultant. Mr Imran briefed about the purpose of the meeting and gave a comprehensive description of the Project.
Concerns	Mr. Naeem showed no concerns but he appreciated the proposed development and said that it would be useful for nation.

Stakeholder:	General public
Date:	March 01, 2018
Time:	04:51 pm
Meeting Venue:	160-Shadman 1
Attended by:	Khuram Shahzad, head of household
Conducted by:	Muhammad Imran, Public Consultation Consultant
Recorded by:	Muhammad Imran
Language:	Urdu, English
Information Provided:	Household is located in the south east side of the proposed location of the project. The discussion started with the introduction of the consultant. Mr Imran briefed about the purpose of the meeting and gave a comprehensive description of the Project.
Concerns Raised	Mr. Khuram said that area covered by Pakistan Meteorology Department is already congested and it is suggested that new installation of the radars should be in new area outside of the city.

Stakeholder:	Black Box Concepts
Date:	March 01, 2018
Time:	05:05 pm
Meeting Venue:	292-Shadman 1
Attended by:	Zahid Hassan, Manager
Conducted by:	Muhammad Imran, Public Consultation Consultant
Recorded by:	Muhammad Imran
Language:	Urdu, English

Information Provided:	Office is located in the south side (Backside) of the proposed location of the project. The discussion started with the introduction of the consultant. Mr Imran briefed about the purpose of the meeting and gave a comprehensive description of the Project.
Concerns	Mr. Zahid showed his concerns about the effects of Radar System on the telecommunication.

Stakeholder:	General Public
Date:	March 01, 2018
Time:	05:30 pm
Meeting Venue:	Shadman
Attended by:	Amir Mukhtar, Resident of nearby area
Conducted by:	Muhammad Imran, Public Consultation Consultant
Recorded by:	Muhammad Imran
Language:	Urdu, English
Information Provided:	Mr. Amir was interviewed at the front of MPD. The discussion started with the introduction of the consultant. Mr Imran briefed about the purpose of the meeting and gave a comprehensive description of the Project.
Concerns	Mr. Amir appreciated the proposed development and said that employment opportunities will be available for the locals and other public. Construction activities may increase dust in the area. The trucks carrying excavated soil should be covered. During the construction of existing tower, no noise or dust pollution was observed.

Stakeholder:	A.K Motors
Date:	March 01, 2018
Time:	05:45 pm
Meeting Venue:	51 Jail Road, Lahore
Attended by:	Ehtsham Khan, Executive Director
Conducted by:	Muhammad Imran, Public Consultation Consultant
Recorded by:	Muhammad Imran
Language:	Urdu, English
Information Provided:	Showroom of A.K Motors is located at the north side (front) of the proposed location of the project. The discussion started with the introduction of the consultant. Mr Imran briefed about the purpose of the meeting and gave a comprehensive description of the Project.
Concerns	Mr. Ehtsham said that rays of the radar will affect humans, especially infants. During the construction, mitigation measure should be adopted to avoid noise pollution. The security situation can worse due to influx of labor in the area.

Stakeholder:	Pakistan State Oil, Pump Station
Date:	March 01, 2018
Time:	05:54 pm
Meeting Venue:	51-A Jail Road, Lahore

Attended by:	Yasir Rahman, CEO
Conducted by:	Muhammad Imran, Public Consultation Consultant
Recorded by:	Muhammad Imran
Language:	Urdu, English
Information Provided:	Showroom of A.K Motors is located at the north side (front) of the proposed location of the project. The discussion started with the introduction of the consultant. Mr Imran briefed about the purpose of the meeting and gave a comprehensive description of the Project.
Concerns	Mr. Yasir said that this is indeed a very good step towards development but concerned department should take mitigation measures to avoid effects of harmful radiations on the nearby population.

Photographs of Consultations in Lahore


Residents of project site Neigbourhood


Buisnes community in the area


Meeting with PMD Officials

Annexure 10. Flood Resistant Design Guideline

Any proposed development in the regulated floodplain must be consistent with the need to minimize flood damage. This can be accomplished, in part, by using materials, equipment, and construction techniques that are resistant to flood damage in locations that would be wet during a 100-year flood.

- New construction and substantially improved structures (including accessory structures): It is required that materials and equipment located below the flood protection level (and outside of dry flood proofed areas) be resistant to flood damage. This may apply to foundations, floor beams, joists, enclosures, and equipment servicing the building (electrical, plumbing, mechanical, ducts, etc.).
- Non-substantial improvements to existing (pre-FIRM) buildings and non-building development: New and replacement electrical, plumbing, and mechanical equipment must be located or designed to resist flood damage. The entire project should utilize

What Does "Flood Resistant" Mean?

Floodplain areas can be subjected to hydrostatic (standing water) and hydrodynamic (flowing water) pressures during floods. These pressures can result in displaced foundation walls, collapsed structures, floating fuel tanks, scouring, and other damage. Flood resistance thus requires that structural and non-structural components be durable, resistant to flood forces (including buoyancy), and resistant to deterioration caused by inundation with floodwater. Options that require emergency operation (such as shutting off electricity or removing vulnerable components) should be avoided if possible, particularly in areas subject to flash flooding. "Flood resistant" is not "dry floodproofing" of non-residential structures.

Flood Damage-Resistant Building Materials

It is important that all parts of a building or other project that are susceptible to flooding (including fasteners and connectors) be made of materials that are resistant to flood damage. "Flood-resistant materials" include any building product capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage. "Prolonged contact" means at least 72 hours, and "significant damage" is any damage requiring more than cleaning or low-cost cosmetic repair (such as painting). The need to replace flood damaged drywall or other material is considered "significant damage" and is thus not acceptable. Components that are not inundated should be resistant to excessive humidity.

Flood damage-resistant materials include:

- Glazed brick, concrete, concrete block, glass block or stone (with waterproof mortar or grout);
- Steel trusses, headers, beams, panels, or hardware;
- Naturally decay resistant lumber, recycled plastic lumber, or marine grade plywood;
- Clay, concrete, rubber, or steel tiles (with chemical-set or waterproof adhesives);
- Cement board;
- Metal doors, cabinets, and window frames;
- Mastic, silicone, or polyurethane formed-in-place flooring;
- Sprayed polyurethane foam or closed-cell plastic foam insulation;
- Water-resistant glue; and
- Polyester epoxy paint (mildew-resistant paint contains toxic ingredients and should not be used indoors).

Anchoring

Foundations, equipment, accessory structures, and other components located below the flood protection level must be firmly anchored to resist flotation, collapse, and lateral movement.

Mechanical, Plumbing, and Electrical Systems

Location above the flood protection level is generally the best way to protect service equipment, such as heating, ventilating, air conditioning, plumbing appliances, plumbing fixtures, duct systems, and electrical equipment (service panels, meters, switches, and outlets). If these components are at a lower level, they must be designed to prevent damage from flooding. This may involve waterproof enclosures, barriers, protective coatings, or other techniques to protect vulnerable components. The municipality may require certification from a licensed professional that the standards for resistance to flood damage are met.

Backflow and Automatic Shut-Off Valves

Flooding can cause sewage from sanitary sewer lines to back up into buildings through drain pipes, causing both damage and health hazards. Backflow valves are designed to temporarily block pipes and prevent flow into the building and should be installed on any pipes that leave the building or are connected to equipment located below the flood protection level. In addition to sanitary sewer and septic connections, this may include water lines, washing machine drain lines, laundry sinks, downspouts, and sump pumps. Fuel supply lines must be equipped with float operated automatic shut-off valves.

Storage Tanks

Unanchored fuel tanks can be easily moved by flood waters, posing a serious threat of contamination and other damage. Even a buried tank can be pushed to the surface by buoyant effects. A tank can be anchored by attaching it to a concrete slab that is heavy enough to resist

the force of flood waters or by running straps over it and attaching them to ground anchors. Tanks and other containers should have watertight fill caps, vents that extend above the flood protection level, and accurate labeling of contents (so that emergency personnel know what it contains if the tank breaks loose and floats away).

Additional Resources

- *Wet Flood proofing Requirements for Structures Located in Special Flood Hazard Areas*, Technical Bulletin 7-93, FEMA FIA-TB-7 (1993), available at http://www.fema.gov/library/viewRecord.do? id=1720, includes planning, safety, and engineering considerations for wet flood proofing.
- *Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas*, Technical Bulletin 2, FEMA FIA-TB-2 (2008), available at http://www.fema.gov/library/ viewRecord.do?id=1580, includes lists of acceptable materials for flood-resistant construction.
- *Protecting Building Utilities from Flood Damage: Principles and Practices for the Design and Construction of Flood Resistant Building Utility Systems*, FEMA 348 (1998), available at http://www.fema.gov/hazard/flood/pubs/pbuffd.shtm. This publication provides technical guidance for the design and construction of flood-resistant utility systems, including HVAC systems, fuel systems, electrical systems, sewage management systems, and potable water systems.
- *Elevator Installation for Buildings Located in Special Flood Hazard Areas*, Technical Bulletin 4-93, FEMA FIA-TB-4 (1993), available at http://www.fema.gov/library/viewRecord.do?id=1717. Provides guidance concerning the installation of elevators below the Base Flood Elevation.
- *Flood-Resistant Design and Construction,* American Society of Civil Engineers (ASCE) 24-05, purchase at www.asce.org, highlights available at http://www.fema.gov/library/viewRecord.do?id=3515. ASCE 24 is a referenced standard in the NYS Building Code and the NYS Residential Code. Buildings designed according to ASCE 24 are better able to resist flood loads and flood damage

Annexure 11. Asbestos Handling Guidelines

Guidelines Asbestos and Asbestos Based Product use during Construction

Asbestos is a group of naturally occurring fibrous silicate minerals. It was used widely in the production of many industrial and household products because of its useful properties, including fire retardation, electrical and thermal insulation, chemical and thermal stability, and high tensile strength[4].

Asbestos based products include Asbestos –Cement (A-C) construction materials such as A-C flat and corrugated sheets, A-C pipe, and A-C water storage tanks. Over 90% of the asbestos fiber produced today is chrysotile which is found in these products. Vehicle brake, clutch pads, roofing and gaskets are some other products that are still being manufactured with asbestos content. Due to international laws banning the use of asbestos, it is hardly used in construction materials other than asbestos –cement products. However, it is still found in older buildings in the form of friable surfacing materials, thermal system insulations, non-friable flooring materials, and other applications. In Sri Lanka, asbestos roofing sheets are widely used as it is the most cost effective and durable material given climate, environment and other factors. Other alternatives to asbestos roofing sheets in Sri Lanka are clay tile, zinc-aluminum, cadjan (matted coconut/Palmyra/palm leaves) and concrete. These alternatives have disadvantages such as:

- Clay tiles are easy to remove, and in areas where there are monkeys it poses a practical problem. Monkeys tend to travel over roofs and either deliberately or accidentally break tiles, thus expenses for replacing is high.
- Zinc-Aluminum – While durable and long lasting, given the tropical climate and monsoon rains, such roofing heats up during the day and during rainy periods the noise makes it impractical especially to use in classrooms.
- Cement – due to the climate in Sri Lanka if not properly treated can result in leaks and damage to the structure. Furthermore, in high temperatures the heat absorption is high thus increasing the temperature in the buildings. In classrooms, it would make it difficult for students and teachers to work. Furthermore, concrete roofs are costly, and will not be affordable, given the large number of school infrastructure requirements that will need to be met through the project.
- Cadjan roofs while environmentally friendly, need to be replaced frequently, causes leaks and will not be acceptable on school buildings.

Ban on Asbestos Use:

As health risks related to exposure to asbestos is widely known, many countries have banned the commercial use of asbestos. The International Labor Organization (ILO) established an Asbestos Convention (C162) in 1986 to promote national laws and regulations for the "prevention and control of, and protection of workers against, health hazards due to

occupational exposure to asbestos". As of March 4, 2008, 31 countries had ratified the Convention, 17 of them have banned asbestos use. ILO asbestos convention requirements include:

- Work clothing to be provided by employers,
- Double changing rooms and wash facilities to prevent dust from going home on street clothes, Training of workers about the health hazards to themselves and their families,
- Periodic medical examinations of workers,
- Periodic air monitoring of the work environment, with records retained for 30 years,
- Development of a work plan for demolition work, to protect workers and provide for proper waste disposal, and
- Protection from retaliatory and disciplinary measures of workers who remove themselves from work that they are justified in believing presents a serious danger to health.

Health Risks:

Health hazards from breathing asbestos dust include:

- Asbestosis – a lung scarring disease
- Form of cancer such as mesothelioma.

The main risks of exposure from asbestos is where fibers are easily made air borne under little pressure, such as cutting of A-C products that can release fibers. Risks are from construction materials that need to be altered, repaired and disposed of that may release particles into the air, and increase the risk of inhalation. Renovations, repairs and decommission of buildings containing A-C products such as roof sheets can pose a risk. However, in the case of Asbestos –Cement (AC) corrugated sheets, the fiber is present in the non- friable form which means that fiber is embedded in cement and cannot be easily air-borne. Such materials are known to have little health risk once (a) the roof has been completed and (b) given that material is in good condition and not disturbed[8]. Although IDA Group's Good Practice Note on Asbestos , and its Health and Safety Guidelines do not encourage the use of asbestos products in construction, in light of the practical uses for construction of school infrastructure, the costs, its availability in local markets and lack of feasible alternatives, the use of asbestos is the most feasible option. However, to minimize the health risks that asbestos products do pose, the following guidelines adapted from the World Bank's Health and Safety Guidelines and other sources are recommended to be followed. As Sri Lanka has no regulations regarding the use of Asbestos, the use of ILO convention guidelines as stated above are recommended as well.

Construction phase:

- To minimize the risk of damage of A-C sheets for roofing, transportation of material must be done with care. Where possible, sheets should be transported in airtight containers or with dust covers.
- During installation of sheets, ensure that damage is minimized. Use of power tools to drill holes that may release particles needs to be kept to the minimum.

- Use a protective sheet (i.e. insulation foil) between the A-C sheets and the classrooms to reduce the risk of minute particles entering the rooms.
- Workers who are involved in handling and installing A-C sheets should take precautions to minimize exposure by wearing protective masks and showering to minimize spread of dust. Work clothes used during the installation of sheets should be washed and workers change to clean clothes before leaving construction site.
- Workers should be made aware of the risks of A-C sheets, and how to minimize these risks.

Post Construction/De-Commissioning:

- Contractors should dispose of waste containing asbestos in a manner that does not pose a health risk to the workers concerned or the population in the vicinity. Disposal at approved landfills and prompt burial under various levels of material apply to friable asbestos waste. Contractors should consult the Local Authority and Central Environmental Authority to obtain guidance on proper disposal of material.
- Contractor should be encouraged to develop an asbestos management plan that identifies the content (whether it is in friable form and has potential to release fibers), and proper removal procedures.
- During the removal of A-C sheets, workers should wear proper protective gear such as masks and shower to prevent the spread of dust. Clothes worn during this process should be washed and workers should change into clean clothes prior to leaving construction site.
- Workers who are, or have been, exposed to asbestos in their occupational activities should be provided, in accordance with national laws and practices, with such medical examinations as are necessary to supervise their health in relation to the occupational hazard, and to diagnose occupational diseases caused by exposure to asbestos. For the prevention of disease and functional impairment related to exposure to asbestos, all workers assigned to work involving asbestos exposure should be provided with:

- a pre-assignment medical examination;
- periodic medical examinations at appropriate intervals (at least every 3 years);
- other tests and investigations, in particular chest radiographs and lung function test, which may be necessary to supervise their state of health in relation to the occupational hazard and to identify early indicators of disease caused by asbestos;
- a copy of their medical record.
- The above requirements will be based on the type of construction and its magnitude.

Annexure 12. Chance Find procedures

Chance Find Procedures

Chance find procedures which will be used during this Project are as follows:

- Stop the construction activities in the area of the chance find;
- Delineate the discovered site or area;
- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be present until the responsible local authorities and the Ministry in charge of Department of Archaeology take over;
- Notify the supervisory Engineer who in turn will notify the responsible local authorities and the Ministry immediately (within 24 hours or less);
- Responsible local authorities and the Ministry in charge of Department of Archaeology would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archeologists of the Department of Archaeology and Museums (within 72 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;
- Decisions on how to handle the finding shall be taken by the responsible authorities and the Ministry in charge of Department of Archaeology. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration and salvage;
- Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the Ministry in charge of Department of Archaeology; and
- Construction work could resume only after permission is given from the responsible local authorities and the Ministry in charge of Department of Archaeology concerning safeguard of the heritage.

These procedures must be referred to as standard provisions in construction contracts, when applicable. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered or observed.

Annexure 13. Sample Terms of Reference

Environment Specialist will be based in Project Implementation Unit (PIU) PMD Islamabad.

Tasks: Environmental Specialist will be responsible for the following duties and responsibilities relevant to project environmental safeguards compliances and mitigation measures

Objective:

Provide expert support to executing agencies in the office and field, provide support to implement activities related to the project components to compliance the environmental safeguards and mitigation measures.

Main responsibilities are:

- Deal with environmental aspects of the project and provide feedback to the Project Director on implementation of environmental action plan under the activities of the project.
- Support in compliance of the credit conditions and covenants pertaining to Environmental Safeguards.
- Update in Implementation of Environmental aspects of the project.
- Oversee environmental monitoring of the ESMF and site specific ESMPs
- Provide technical support to works consultants in the development of site specific ESMPs
- Coordinate with implementing agencies and works contractors for onsite implementation of ESMPs.
- Organize and conduct the trainings on ESMF and ESMP compliances as proposed in mitigation plan.
- Prepare monthly, quarterly progress reports of Environment and Social Management Framework (ESMF).
- Prepare final progress report of the ESMF and submit to the World Bank.
- Ensure the HSE compliance onsite by the civil works consultants / contractor at project sites.
- Coordinate and conduct Environmental Field Monitoring visits of Project Areas.
- Review and revision of documents and ensuring timely delivery of outputs as agreed between The World Bank and PIU, PMD.
- As and when required contribute to the ongoing activities of the safeguard unit.
- Assist the Project Director in routine office matter when require.
- Work as the focal point for World Bank to provide necessary requirements of environmental compliances within the project.

Academic Qualification:

Post Graduate degree in Environmental Sciences with 5-8 years of relevant work experience in dealing with Environmental management and implementation in development projects.

Salary and Benefits:
PMD will decide as per their rules and regulations for the project
Duration: Till project duration

Social Safeguards Specialist

Social Safeguards Specialist will be based in Project Implementation Unit (PIU) PMD Islamabad.

Tasks: Social Safeguards Specialist will be responsible for the following duties and responsibilities relevant to project social safeguards compliances and mitigation measures

Objective:

Provide expert support to executing agencies in the office and field, provide support to implement activities related to the project components for compliance to social safeguards and mitigation measures.

Main responsibilities are:

- Deal with social aspects of the project and provide feedback to the Project Director on implementation of RPF, GRM and social safeguards under the activities of the project.
- Support in compliance of the conditions and covenants pertaining to Social Safeguards.
- Oversee social monitoring of ESMPs
- Provide technical support to works consultants in the development of site specific ESMPs
- Coordinate with implementing agencies and works contractors for onsite implementation of ESMPs.
- Organize and conduct the trainings on ESMF and ESMP compliances as proposed in mitigation plan.
- Prepare monthly, quarterly progress reports of ESMP
- Coordinate and conduct Social Field Monitoring visits of Project Areas.
- Review and revision of documents and ensuring timely delivery of outputs as agreed between The World Bank and PIU, PMD.
- As and when required contribute to the ongoing activities of the safeguard unit.
- To carry out the screening of the sub-projects with respect to the social aspects as defined in the ESMF;
- Monitor and check the proper implementation of all social mitigation measures as suggested in ESMP;
- Monitoring and evaluation of social related matters of the project and maintain a social complaint register to document social issues;
- Top supervise the Contractor's activities and make sure that all the contractual obligations related to the social compliance are met;
- Review of periodic environmental and social reports being prepared by the investor/contractor
- Ensure inclusion of ESMMP guidelines in project designs.

Academic Qualification:

Post Graduate degree in Social Sciences with 5-8 years of relevant work experience in dealing with Environmental management and implementation in development projects.

Salary and Benefits:

PMD will decide as per their rules and regulations for the project

Duration: Till project duration.

Annexure 14. ESMP Monitoring Checklist

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
Design Phase							
Biodiversity and Natural Resources	The project sites WSR and AWS may require tree cutting for site clearing.	1. Incorporate technical design measures to minimize unnecessary removal of trees and vegetative cover; 2. Plan for compensatory planting of eight trees against each fallen tree of similar floral function; 3. Disallow introduction of invasive/ exotic species; and recommend native species for plantation.	Construction designs Tree count Compensatory Tree Plantation Plans Tree Species	At the time of design preparation At the time of design finalization			
Natural Disasters	The Sub-project site is in Zone 2- minor to moderate in case of earthquakes. There is also some seasonal flooding during Monsoor rains due to blocked drains	1. The building design will be earthquake resistant according to Building Codes of Pakistan with Seismic provision and international best practices to avoid damage caused by earthquake; 2. Variety of structural engineering measures or structural components like shear walls, braced frames, moment resisting frames, and diaphragms, base isolation, energy dissipating devices and bracing of non-structural components are proposed. Simpler techniques include avoiding soft stories and bolting the sill plate of houses to the foundation; 3. Primary focus of earthquake design is initial life safety and getting people out of the building safely, not necessarily the ability of a building to withstand the effects of an earthquake, or to ensure	Sub-project design maps with incorporation of building codes for Zone 2 Construction contractor ToRs	At the time of design			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
		occupancy or functionality following an event. Therefore building design will include emergency exits and alarm system. 4. Planning, designing and constructing the building to minimize any potential flood damages using guidelines of **Annexure 10.** Following are proposed: ▪ elevating as much of the building as possible above the design flood level, ▪ designing the building foundation and any portions subject to flooding to withstand design flood conditions and loads, ▪ using flood-damage-resistant materials for any portions of the building below the design flood level ▪ where flood proofing is permitted, employing appropriate methods and materials to either dry-flood proof or wet-flood proof those portions of the building below the design flood level					
Water /Electricity/ Natural Gas/ Fuel Consumption	There will be an increase in infrastructure utilities/ resource consumption due to construction work.	1. Prepare an Energy and Water Conservation Plan for construction 2. Design of buildings will include installation of Solar Panels; 3. Provision of Low Voltage electrical appliances will be made in procurement procedures.	Design provision for water, electricity, natural gas and fuel conservation	At the time of design			
Air Quality and Noise Levels	Project activities associated with construction may increase the ambient air quality and noise levels of the at the sub-project sites. The impacts are likely to be moderate.	1. Air quality and noise level baselines will be established to enable monitoring during construction phase; 2. Provision of compliance to NEQS of vehicular emission will be made in the contract of construction contractor and SOP's of PMD vehicles;;	Preparation of Emissions Monitoring Plan, Traffic Management Plan and Site Management Plan	At the time of design			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
		3. Locations of Batching Plant, concrete mixers and other noise generating equipment will be identified away from residents; 4. Contractor shall prepare an Emissions Monitoring Plan to ensure constant checking of emissions by construction machinery and vehicles with operations and maintenance plan for the same; 5. Traffic Management Plan for construction will be formulated during design phase that enable continuous traffic flow and avoid congestions which result in increased vehicle smoke density at a given area; 6. Plan to neutralize dust emissions from construction activity, such as regular watering of sub-project sites to settle dust; 7. Use of Hazardous material list will be strictly prohibited in construction and provision will be made part of the contract.	Construction contractor ToRs				
Solid Waste Management	Improper solid waste disposal can result in increased air pollution through burning of waste, vector borne diseases, contamination of water sources and ambient aesthetics for surrounding communities. The impacts are likely to be moderate.	1. Prepare a detailed **Solid Waste Management Plan** for construction site 146inimizing use of plastics and encourage recycling 2. Identify current municipal systems of waste management or private waste disposal services; 3. Placement of waste collection containers throughout the project area; 4. Disallow the burning of any of type of waste; 5. Prepare plans for the safe handling, storage and disposal of harmful materials and hazardous waste	Solid Waste Management Plan Contractual binding on prohibited use of Hazardous Material for construction contractor (CC) Construction contractor ToRs	At award of construction Contract			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
Workers Health and Safety	Use of heavy machinery and handling of chemicals by workers can result in health impacts and accidents. The impacts are likely to be moderate.	1. Prepare a **Worker Health and Safety Plan** for the construction phase	Worker Health and Safety Plan	At award of Construction Contract			
Operations Phase							
Landscape/Soil	Construction at sites is likely to carry out site clearance, vehicular, labour and machinery movement causing soil erosion and compaction. There is also a potential for contamination of soil via runoff from construction activities including oil spills, construction material, dredged / spoil materials and construction waste. Impact on soil quality is high in case of the spill.	1. Removal of vegetation and trees will be avoided to the extent possible; 2. Proper Safe drainage of run-off from construction activities will be ensured; 3. Removal of vegetation and trees will be avoided to the extent possible; 4. Water will be sprinkled during construction building of foundation to avoid soil erosion and dust pollution; 5. Construction materials will be stored in proper stores on impervious sheets to avoid any soil contamination; 6. Machinery and vehicles will be operated at designated routes to avoid erosion and compaction of un-impacted soils; 7. Visual Inspection will be carried out for land contamination and dust emissions; 8. The soil contaminated from minor and moderate spills will be removed and will be handed over to waste contractor for treatment at nearest incineration facility or waste disposal and treatment at Mehmood Boti; 9. Major spills may require specialized treatment such as incineration, bioremediation and biodegradation. The biological agents will be introduced to the spill to hasten biodegradation. Most of the	Visual inspections and photographic record of site clearing and oil spills. Water sprinkling	Daily			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
		components of oil will be broken down by bacteria and other microorganisms into harmless substances such as fatty acids and carbon dioxide. To stimulate the growth of the microorganisms, fertilizing nutrients like nitrogen and phosphorous will be placed near the oil tanks..					
Ambient Air Quality and Climate	The construction activities at sub-project sites will cause impact on air quality, cement mixers (Batch Plant), movement of the machinery, generators soil excavation, construction vehicles, is likely to generate dust and exhaust emissions. Impact on local air quality is moderate	1. Contractor shall provide an **Emissions Monitoring Plan** to ensure constant checking of emissions by construction machinery and vehicles; Contractor should provide an operations and maintenance plan for the same; 2. Water will be sprinkled twice a day to avoid fugitive dust emissions; 3. Construction machinery and vehicles will be kept in good conditions to avoid vehicular emissions. Vehicular and generator exhaust emissions will be monitored to ensure compliance; 4. Unnecessary movement of vehicles will be avoided at the construction location; 5. Open burning of solid waste from the Contractor's camps should be strictly banned; 6. Wind breaks /barriers (either natural or constructed) will be deployed to reduce the possibility of suspended particles in air; 7. Raw materials such as cement, gravels and sand will be kept under sheet covers to prevent air flow; 8. In order to further reduce the environmental impact Cement Works (Concrete Batching Plant), the concrete batching plant will incorporate the following design and practices:	Ambient Air Quality monitoring for SOx, NOx and Particulate Matter PM2.5/10	Monthly			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
		▪ Cement will be transferred directly from barges to the plant. ▪ All mixing will be in the enclosed electric motor driven plant mixer, NOT in trucks. ▪ Truck loaded with concrete will be in wet form. ▪ All washing water used by the batch plant and storm water will be collected and stored and recycled for re-use. ▪ No water will be discharged outside the plant boundary. ▪ Concrete recycling machine be used to recycle waste material to slurry water and aggregates for reuse.					
Surface/Ground Water Resources	Drainage channel in close vicinity of project site is a Shadman nullah leading to River Ravi. Construction activities may encourage soil erosion and waste may increase the sediment loads into the city drainage, while accidental leaks/spills of oil/fuel from storage tanks or maintenance vehicles can also pollute surface waters. The impact is likely to be low as the construction site is 1km meters away from the drainage channel.	1. Contractor shall execute the Emissions Monitoring Plan to ensure constant checking of emissions by construction machinery and vehicles with operations and maintenance plan for the same; 2. Water will be sprinkled twice a day to avoid fugitive dust emissions; 3. Contractor shall execute the Traffic Management Plan to enable continuous traffic flow and avoid congestions which result in increased vehicle smoke density; 4. Construction machinery and vehicles will be kept in good conditions to avoid vehicular emissions. Vehicular and generator exhaust emissions will be monitored to ensure compliance; 5. Unnecessary movement of vehicles will be avoided at the construction location;	Surface Water Quality	Monthly Quarterly			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
		6. Open burning of solid waste from the Contractor's camps work areas should be strictly banned; 7. Wind breaks /barriers (either natural or constructed) will be deployed to reduce the possibility of suspended particles in air; 8. Raw materials such as cement, gravels and sand will be kept under sheet covers to prevent air flow; 9. In order to further reduce the environmental impact of Cement Works (Concrete Batching Plant), the concrete batching plant will incorporate the following design and practices: 10. Cement will be transferred directly from barges to the plant 11. All mixing will be in the enclosed electric motor driven plant mixer, NOT in trucks. 12. Truck loaded with concrete will be in wet form. 13. All washing water used by the batch plant and storm water will be collected and stored and recycled for re-use. 14. No water will be discharged outside the construction boundary. 15. Concrete recycling machine be used to recycle waste material to slurry water and aggregates for reuse.					
Water /Electricity/ Natural Gas	Construction activities require a large amount of water that may reduce the availability of water in residing area. It will add	1. Contractor will execute the Energy and Water Conservation Plan 2. Water meters will be installed at sub-project site to monitor water consumption;	Water, Electricity and Natural Gas Consumption	Monthly/ Quarterly			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
and Fuel Consumption	load to the electricity, natural gas fuel consumption increasing GHG emissions. The impact is likely to be high.	3. Construction staff will be trained on water conservation practices to avoid excessive loss; 4. Water required for construction should be obtained in a way so that water availability and supply to residing area remains unaffected; 5. Approval will be attained from local authorities prior to construction work..	Energy Conservation Plan				
Solid Waste Generation	During construction phase, solid waste can be generated from discarded equipment parts, scrap metals, equipment boxes, wood parts, empty bags, and leftover construction debris. The construction material and waste may include toxic/hazardous chemical materials. If not contained the impact of solid waste is likely to be high.	1. Solid Waste Management Plan will be executed by Construction Contractor. In case of the occurrence of toxic/hazardous chemical materials, it will be handled according to hazardous waste management best international practices. The plan will be prepared with following provisions: 2. Solid waste collection, segregation, storage and disposal will be carried out for waste generated. For at source segregation separate waste bins will be placed at sub-project sites. Recyclable material will be segregated whereas non-hazardous waste will be disposed-off at approved disposal site; 3. Private contractors will be hired for responsible disposal of construction waste 4. Labeling of containers will be carried out including the identification and quantity of the contents, hazard information; 5. Marking of Hazardous/toxic waste 'if generated' separately and disposal using international best practices through registered contractor; 6. Used oil will be collected in separate containers stored on impervious platform	Solid Waste Management Plan Amount and type of solid waste generated from sub-project sites; List of hazardous chemical used for construction	Monthly			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
		with restricted access and must be sold to licensed contractor; 7. Burning of solid and waste oil should be strictly prohibited 8. Training of workers will be carried out in the storage and handling of materials and chemicals that can potentially cause soil contamination; 9. Emergency Response Plan will be prepared to address the accidental spillage of fuels and hazardous/toxic material, fire, vandalism and natural hazards; 10. On completion of the construction phase of the project, the contractor will be required to rehabilitate the site. Rehabilitation will include removal of all construction materials and wastes, and the grading and landscaping of all exposed sites that may be prone to erosion. Where natural erosion protection measures may not be possible or practical, suitable physical erosion protection methods will be used. The purposes of site rehabilitation will be to minimize the potential for soil erosion, enhance the aesthetic appearance of the site and restore safe public access to the surrounding area.				
Noise Levels	The construction activities are likely to generate high noise levels. The sources of noise in construction include Asphalt Plant excavation work, heavy earth moving equipment/ machinery, pilling work, welding, cuttings, drilling, grinding and material	1. The location for stationary noise sources like asphalt plant, grinding, drilling and welding machinery will be selected at a reasonable distance from residing population. The cement tankers will be working inside enclosure with cladding to reduce noise;; 2. The construction material loaders will only operate during night time as per	Noise Monitoring Residing Areas and Construction Site	Monthly			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
	loading/offloading vehicles. Impact is likely to be high.	rules of traffic police in Islamabad. Working hours will be allocated for the use of batching plant, equipment and other machinery; 3. School time and late night construction activities will be avoided; 4. Use of noise barriers in locations next to schools; 5. Blowing of horn will be strictly prohibited; 6. Noise monitoring will be carried out at various locations using noise meters. Site labour working in high noise areas including asphalt plant, grinding and welding machinery, where noise level exceeds 85 dB (A), will wear earplugs and ear muffs; 7. Measures will be taken to maintain noise level of 55 dB at day and 45 dB at night time will be maintained.					
Biodiversity and ecological resources (Flora and Fauna)	The impacts on ecology are negligible entirely build up and there are very few trees. However, if the construction requires cutting of trees and clearing of vegetation.	1. Eight trees will be planted for every tree cut during construction; 2. Invasive or exotic species will not be introduced through plantation.	Tree count Tree Plantation in designated area and count eight for one cut	Prior /Start/ Post construction			
Public Health and Safety	Construction activities and movement of heavy vehicles may impact public safety. Similarly emissions and noise from the site may impact the	1. Use signage to inform general public of construction area and its limits; 2. Train drivers operating heavy vehicles in road and pedestrian safety; 3. Set appropriate speed limits to avoid accidents;	Traffic Management Plan Public Safety Plan Complaint/	Monthly			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
	health of residing communities	4. Use of heavy vehicles on public roads will be avoided during hours when students are coming to school or leaving school; 5. Placement of construction and diversion signage, particularly at urban areas and at sensitive/accident-prone spots, in accordance to a Public Safety Plan; 6. Provision of alternate routes for use by the public will be planned	Accident Register				
Workers Health and Safety	Use of heavy machinery and handling of hazardous waste and chemicals may result in health impacts for workers on the construction site.	In accordance to the **Solid Waste Management** and **Workers Health and Safety Plan**, ensure: 1. The workers have full access to health facilities and emergency response centers (fire, earthquake and floods) and police station. In case of emergency, the injured will be taken to the nearest medical facility. 2. Provision of clean drinking water will be ensured for the construction crew; 3. Hygiene inspections will be carried out to avoid disease epidemic; 4. In case of unlikely incidents (fire, vandalism) the workers will be evacuated and emergency response and law enforcement agencies will be engaged; 5. Fire safety alarms will be installed at various locations; 6. Fire extinguishers will be placed at various locations including a water hose installation at ground level; 7. Fire safety and emergency response trainings will be conducted;	Workers Health and Safety Plan and trainings Medical record of workers	Monthly			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
		8. Hazards indicator signs and firefighting equipment will be installed; 9. The construction crew will be trained on important aspects of workplace safety; 10. Construction machinery operators and drivers will be trained to avoid associated accidents using machines and vehicles; 11. Flammables and other toxic materials will be marked and stored at secured sites; 12. Onsite first aid kits will be kept at construction sites and randomly moving vehicles\machinery. 13. Do not allow workers with inadequate training to operate heavy machinery; 14. Provision of appropriate and high quality Personal Protective Equipment (PPE) to workers such as gloves, vests, hard-hats, masks etc.; 15. Train workers in the use of PPE and safety measures while using heavy machinery and handling chemicals. 16. Follow guidelines for Asbestos and Asbestos based product use in construction (Annexure 11)					
Physical /Cultural/ Archeological Resources	The sub-project area has religiously and culturally important sites at a reasonable distance. Excavation work during construction may result in the uncovering of ancient	Construction staff will be trained and informed on identifying the evidence of archaeological/historic remains. In case evidence of archaeological remains is found during construction activities, the actions listed below will be undertaken.	Consultation with the relevant departments Preparation of PCR Plan, if needed.	At the start of construction			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
	sites or artifacts. Impact is likely to be low.	1. Excavation work in the vicinity of the find will be stopped; 2. Assistance will be sought from the nearest office of the Department of Archaeology and Museums to identify the remains; 3. If the department decides to salvage the find, PMD will provide assistance. 4. Detailed procedure for Archaeological Chance Finds included in Annexure 12.					
Traffic Management	The sub-project site is in an urban area close to social sensitive receptors like houses, schools, colleges and offices. The construction work may highly impact the traffic flow.	1. Contractor will execute the Traffic Management Plan. 2. Vehicles will be inspected prior to start of construction work. 3. Alternate routes will be created to avoid disturbance to schools and hospital; 4. Movement of construction equipment will be limited to specific duration when there is least disturbance to the residing offices and nearby schools; 5. Adequate road signs will be erected to warn general public; 6. The contractor will be advised to follow vehicular maintenance to reduce engine noise; 7. Drivers will be trained to follow the designated routes and avoid honking; 8. The construction trucks will be adequately covered with tarpaulin covers to avoid flow into air.	Traffic Management PLan Construction vehicles trimmings Accident register	Continuous			
Operations Phase							

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
EMF	The danger of electromagnetic field occurs because the body absorbs radiation which has high impact on body tissues and cell.	1. Engineering controls for EMF include interlocks, electronic means to exclude the radar pointing within office complex in the tower building, and shielding; 2. Administrative controls include audible and visible alarms, warning signs, and restriction of access through barriers, locked doors, or limiting access time to radar; 3. Workers will use personal protective equipment to ensure compliance with exposure standards. Conductive suits, gloves, safety shoes and other types of personal protective equipment for RF fields are now commercially available. PPEs should be used with great care, since the attenuation properties of the material used to make this protective equipment can vary dramatically with frequency; 4. RF safety glasses will be used near the radar operating area. Special care will be taken in buying the glasses since any metal may enhance local fields by acting as a receiving antenna; 5. There are no exposure situations where members of the general public need to use protective equipment for RF fields from weather radars;	Testing of EMF Use of protective gear	Continuous			

Aspects	Environmental and Social Impacts	Proposed Mitigation Measures	Monitoring Parameter(s)	Frequency	Yes	No	Comments
		6. Radar will be installed at a specified height.					
Air Quality and Climate	An increase in number of vehicles entering the offices may pose moderate negative impacts on the air quality of the area.	1. The project staff will be advised to car pool and use and local transport; 2. Provision of pick and drop for staff to avoid additional load on air quality; 3. Vehicles with excessive smoke emissions should not be allowed to enter the sub-project locations.	Vehicular Emissions	Quarterly			
Solid Waste Generation	There will be an increase in solid waste generation due to additional staff and building maintenance. In the presence of waste disposal system in the area impact is Moderate Hazardous waste will include rechargeable batteries from the AWS and solar panels.	1. Decrease solid waste going to landfills by segregating at source with labeled dust bins for biodegradable, non-biodegradable and recyclable products; 2. Disposal of biodegradable to the municipality for treatment; 3. Clearance of reusable and recyclable waste to certified recycling companies; 4. Recycle rechargeable batteries through certified companies	Weight of waste generated and disposal	Monthly			

Annexure-14: Quarterly Progress Report

1. Project Description

2. Internal Monitoring

1. ESSMP Monitoring Checklist
2. Monitoring Reports

3. ESMMP Reporting

1. Construction site monitoring report
2. Traffic management monitoring report
3. Time table of works
4. Construction waste monitoring report
5. Noise, air and vehicular emission monitoring report
6. Water quality monitoring report
7. Labour health and safety monitoring report
8. Labour training Monitoring report
9. Hazardous waste handling Monitoring report
10. Energy and water conservation Monitoring report
11. Site restoration monitoring report
12. Sampling, testing and monitoring Report

4. External Monitoring/Third Party Validation

Third Party Evaluation Report

5. Corrective Action Plan

6. Photographic Evidence