INITIAL ENVIRONMENTAL EXAMINATION (IEE)

INSTALLATION & COMMISSIONING OF 120 MW SOLAR POWER PLANT IN DEH HALKANI AND DEH BAND MURAD DISTRICT WEST, KARACHI

FEBRUARY 2023

EMC Pakistan Private Limited

SINDH SOLAR ENERGY PROJECT

INITIAL ENVIRONMENTAL EXAMINATION (IEE)

INSTALLATION & COMMISSIONING OF 150 MW SOLAR POWER PLANT IN DEH HALKANI AND DEH BAND MURAD DISTRICT WEST, KARACHI

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Final Report
Feb 2023

EMC PAKISTAN PVT. LTD.
503, Anum Estate, Opp. Duty Free Shop, Main Shahrah-e-Faisal, Karachi.
Phones: 9221-34311466, 34324680, Fax: 9221-34311467.
E-mail: mail@emc.com.pk, info@emc.com.pk
Website: www.emc.com.pk

Executive Summary

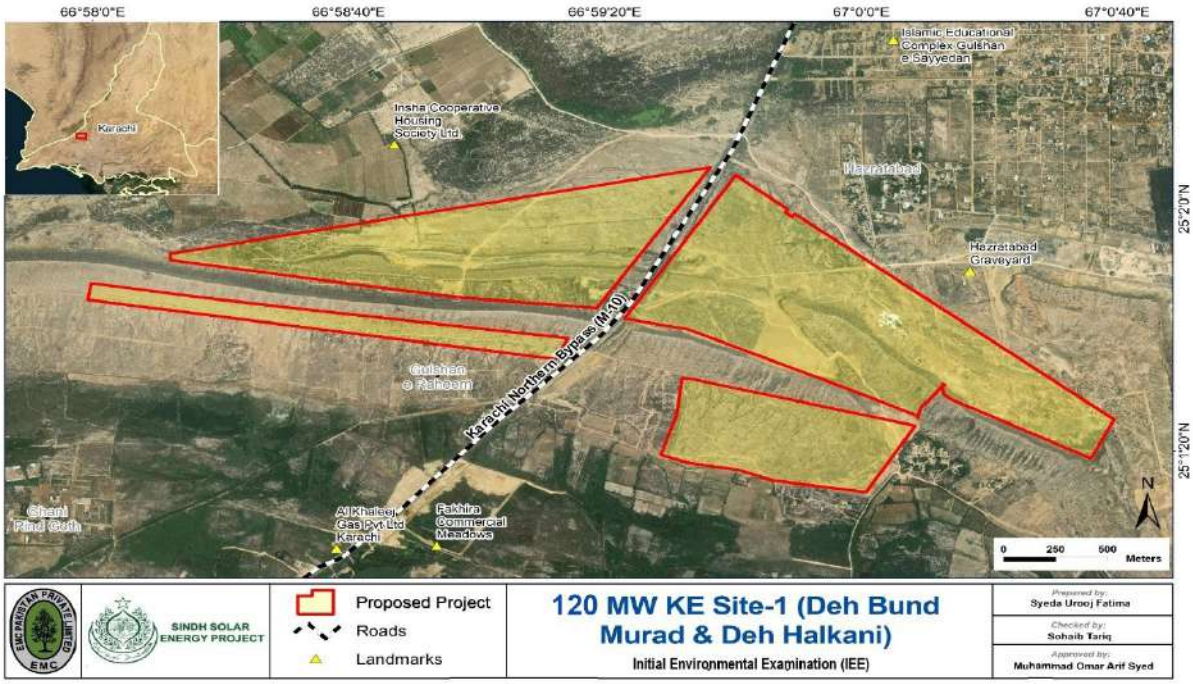
Sindh Solar Energy Project (SSEP) under Energy Department, Government of Sindh, plans to install and commission a 120MW Solar Power Plant (PP) in Deh Halkani and Deh Band Murad in District West, Karachi. The project will be located on the land of Government of Sindh (GoS).

The electricity generated by the project would be stepped up and sold to K-Electric Limited (KE). Project aims to meet the continuously increasing demand of electricity and at the same time reducing the carbon footprints by the development of this project. EMC Pakistan Pvt. Limited has been engaged by to conduct the Initial Environmental Examination (IEE) of the proposed project and to comply with the provisions of Sindh Environmental Protection Act, 2014 and the Sindh EPA Environmental Assessment Regulations, 2021.

Solar projects are listed in Schedule-II of the Sindh EPA Regulations 2021 therefore, IEE is conducted for solar projects because of their overall minimal impact on environment. Moreover, the SSEP (hereafter refered as proponent) itself initiates the IEE study to address and rectify any potential environmental impacts of the proposed project in design stage and well before the construction proceeds.

The microenvironment of the proposed project site is located in Deh Halkani and Deh Band Murad, District West, Karachi. Project location map is shown in figure ES-1.

The project will encompass 1) PV area having arrays of PV modules, tracking and mounting structures, inverters and cables 2) Switchyard having transformers, gantry and gas insulated switchgear (GIS) 3) MW switchgear room for protection and isolation of PV plant with grid 4) housing area for plant personnel 5) cleaning system for panels and 6) Weather station 7) ancillary facilities.



ES-1: Solar PV Power Plant Project Location

Environmental surveys were conducted to collect primary information for the project area. The environmental surveys focused on collection of specific baseline information of the project area including meteorology, air quality and noise assessment, ecology of the area and topography of the area.

The project site is open land, separated by Northern Bypass (M10) and by hills. The ambient air and noise quality presented in the baseline of this IEE shows that the air quality and noise levels meet the required Sindh Environmental Quality Standards (SEQS) limits. There is no surface water available in the close vicinity of the project site. Condition of the physical environment described above suggests that it would be difficult for natural vegetation to survive under harsh climatic conditions, accentuated by drought, making Xerophytes the dominant vegetation.

Most of the project's environmental and social impacts will be beneficial, including for example generation of clean electricity, saving of carbon footprint of energy generation, generation of employment for locals etc. However, during construction phase, there will be some negative environmental impacts including, air quality deterioration due to dust and exhaust emissions during construction activities. There are chances of groundwater quality deterioration, in particular during rainy season, due to spills from construction equipment, fuel, inadequate disposal of liquid and solid waste, possible noise emissions from running of construction machinery, community nuisance etc. These impacts require appropriate mitigation and management measures to contain them. The project specific measures suggested are; a) water should be sprinkled to suppress emission of dust. Wiping and sweeping should be adopted as a continuous activity to keep the site clean; b) machinery operation and high noise activities should be carefully planned and scheduled; c) sign postings, warning signs, diversion signs and barriers will be installed to alert nearby community of all potential hazards including limited access to construction sites; d) construction works related solid waste should be disposed to Landfill site; e) it will be ensured that the wastes generated from construction activities are stored in a proper interim location onsite which should be adequately barricaded and covered to avoid ingress of storm water. The location of onsite waste storage site will be selected by CC as per detailed construction plan; f) fuel oils and lubricants for construction machinery will be stored in covered diked areas, underlain with HDPE membrane; g) damage to ecology will be avoided by not altering the natural drainage pattern during construction; h) greening of the project site should include the plantation of native/indigenous trees and invasive species should be avoided; i) appropriate personal protective equipment (PPE) will be provided to construction labor to minimize risks, such as appropriate outerwear, safety shoes and gloves, safety helmets, harness etc.; j) extensive consultation with stakeholders will be carried out beforehand and their feedback, concerns and input will be taken into account in the project planning and execution; k) it will be ensured that the construction site is appropriately cordoned off with hard barricade; n) wastewater from discharged through Septic Tank connected with soakage pit. The main impact during operational phase is the disposal of disused and broken solar panels. They will be disposed through an EPA Certified Waste Contractor.

Environmental Management and Monitoring Plan (EMMP) presents mitigation measures of each environmental effect and monitoring parameters with responsibilities defined separately for each aspect. The environmental management and monitoring plan also presents the proposed corrective measures taken if the monitoring parameter results crosses the prescribed threshold limits defined under Sindh Environmental Quality Standards (SEQS).

EMMP implementation cost: The total cost of the EMMP implementation has been estimated to be about Pak Rupees **4.08 million.**

The IEE Study concludes that if the measures recommended in the Environmental Management Plan are implemented and the monitoring is carried out for the aspects in accordance with the monitoring plan, the proposed Solar PV Power Project will be a sustainable development and will provide clean energy over its lifetime.

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Abbreviations and Acronyms

AC	Alternating Current
ARE	Alternative and Renewable Energy
BNEF	Bloomberg New Energy Finance Limited
CC	Construction Contractor
CO	Carbon monoxide
CO2	Carbon dioxide
dB	Decibel (Unit of Sound level)
DC	Direct Current
EIA	Environmental Impact Assessment
EMF	Electromagnetic Fields
EMMP	Environmental Management and Monitoring Plan
EPA	Environmental Protection Agency
GIS	Gas Insulated Switchgear
GS	Grid station
HSE	Health Safety and Environment
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEE	Initial Environmental Examination
ISO	International Organization for Standardization
KE	K-Electric
kV	Kilo Volt
kW	Kilo watt
NO2	Nitrogen dioxide
NO	Nitric oxide
NOC	No Objection Certificate
O3	Ozone
PCB	Polychlorinated Biphenyl
PM	Particulate Matter
PP	Power Plant
PPE	Personal Protective Equipment
PV	Photovoltaic
SCADA	Supervisory control and data acquisition
SEQS	Sindh Environmental Quality Standards
SF_6	Sulfur Hexafluoride
SO2	Sulfur Dioxide
SOx	Sulfur Oxides
SPM	Suspended Particulate Matter
SSEP	Sindh Solar Energy Project
UTC	Coordinated Universal Time

Chapter 1 INTRODUCTION

Sindh Solar Energy Project (SSEP) under Energy Department, Government of Sindh, plans to install and commission a 120MW Solar Power Plant (PP) in Deh Halkani and Deh Band Murad in District West, Karachi. The project will be located on GoS land.

The electricity generated by the project would be stepped up and sold to K-Electric Limited (KE). Project aims to meet the continuously increasing demand of electricity and at the same time reducing the carbon footprints by the development of this project. EMC Pakistan Pvt. Limited has been engaged by to conduct the Initial Environmental Examination (IEE) of the proposed project and to comply with the provisions of Sindh Environmental Protection Act, 2014 and the Sindh EPA Environmental Assessment Regulations, 2021.

1.1. Project Overview

The project involves construction, installation, operation, and maintenance of 120 MW Solar Power Plant over an area of about 612. The location of the project is shown in fig 1.1. The project will encompass 1) PV area having arrays of PV modules, tracking and mounting structures, inverters and cables 2) Switchyard having transformers, gantry and gas insulated switchgear 3) MW switchgear room for protection and isolation of PV plant with grid 4) housing area for plant personnel 5) cleaning system for panels 6) Weather station and 7) ancillary facilities.

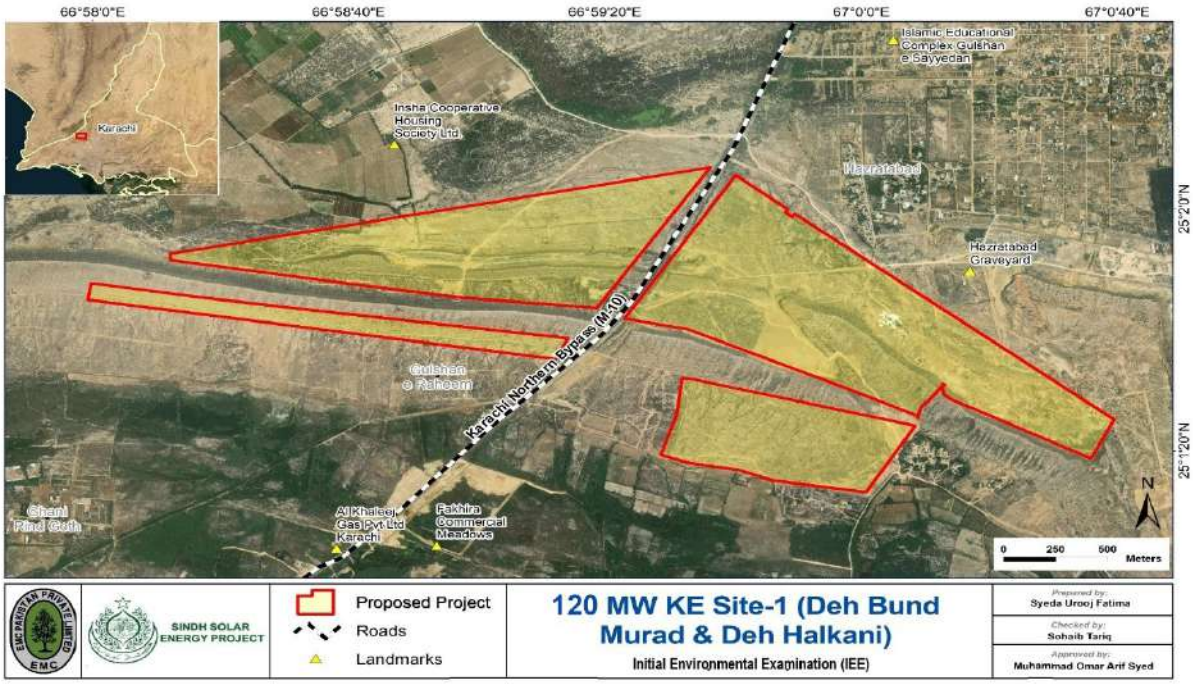


Figure 1.1: Location of Solar PP project

1.2.Project Categorization

Solar projects are listed in Schedule-II, therefore, IEE is conducted for solar projects because of their overall minimal impact on environment as per Sindh EPA Environmental Assessment Regulations 2021.

Project is categorized as;

Schedule-II – List of projects requiring IEE

B. Energy

9. All Renewable energy Projects (excluding Protected/Sensitive area under any law)

1.3.Objectives of IEE Study

It aims to predict environmental impacts at an early stage in project planning and design, finding ways and means to reduce the adverse impacts, shape projects to suit the local environment, and presenting options to decision-makers.

The main purpose of this IEE Study is to provide and analyze information on the nature and severity of environmental aspects and propose mitigation measures in case of negative impacts arising from the construction and operation of the project and related activities that would take place concurrently or subsequently. The IEE study will, in fact, respond to the provision Sindh Environmental Protection Act, 2014 and Guidelines for the Preparation and Review of Environmental Reports. The Study will:

- Identify all major and minor impacts, negative as well as positive, on the environment (physical and ecological) during its different stages viz. pre-construction, construction and operation of Project;
- Identify Socioeconomic aspects, and
- Devise Environmental Management & Monitoring Plan (EMMP) for sustainable operation of the Project.

1.4.Methodology Adopted for IEE Study

This Initial Environmental Examination (IEE) was conducted in the following manner:

Scoping

A scoping exercise was undertaken to identify the potential issues that are to be considered in the Initial Environmental Examination (IEE). The scoping exercise included the following tasks:

- **Data Compilation**: A generic description of the proposed activities relevant to this environmental assessment was compiled.
- **Primary data collection**: Primary data was collected through reconnaissance surveys and onsite environmental monitoring.
- **Review of Published literature**: All available published and unpublished information pertaining to the micro and macro environment of the study area was obtained and reviewed. It included the earlier studies conducted in the study area, environmental and social baselines and impact assessment studies conducted by different consultants in past. Secondary data was very helpful in understanding the issues that were identified by other consultants.
- **Review of applicable Legislation**: Information on relevant legislation, regulations, guidelines, and standards was reviewed and compiled.

- **Identification of potential impacts**: The information collected in the above procedures was reviewed and potential environmental impacts were identified.
- **Initial site visit**: An initial site visit was conducted to get an overview of site conditions and the surrounding areas.

Review of Legislation and Guidelines

National legislation, international agreements and environmental guidelines were reviewed to set environmental standards that the SSEP will be required to follow during construction & operation phase of the project.

Baseline Data Collection

Baseline Data was collected from different sources including electronic and print media, studies previously conducted by EMC Pakistan Pvt. Limited and archives of the experts, and field surveys conducted for this study by the team of EMC Pakistan Pvt. Limited etc.

Previous published and unpublished literature and other information were collected in order to gain a complete understanding of existing environmental conditions in the area including the following:

- **Physical environment**: Topography, geology, soil, water resources, ambient air, noise and climate;
- **Biological environment**: Flora and fauna within the proposed site and its surroundings;
- **Socio-economic environment**: Settlements, socio-economic conditions, infrastructure and land use; and

Identification of Aspects

Identification of environmental aspects and their significance is fundamentally important for the determination of severity of incidence of impacts at different stages of the project. This step is aimed at obtaining an inventory of the aspects. The aspects identified during this step cover all activities like construction, installation and operation, in order to determine those which, have or can have a significant impact on the environment.

Impact Assessment & EMMP

Environmental experts at EMC Pakistan Pvt. Limited analyzed and assessed the anticipated impacts that are likely to arise due to the identified aspects. Potential impacts were evaluated using the environmental, ecological, socioeconomic, and project information collected. The impact assessment covers the following aspects:

- Potential change in environmental parameters likely to be affected by Project-related activities;
- Prediction of potential impacts;
- Evaluation of the likelihood and significance of potential impacts;
- Defining of mitigation measures to reduce impacts to as low as reasonably practicable;
- Prediction of any residual impacts, including all long-term and short-term, direct and indirect, and beneficial and adverse impacts; and

- Monitoring of residual impacts.

An environmental management & monitoring plan (EMMP) was developed to oversee the environmental performance of the project, adoption of proposed mitigation measures, to monitor impacts of all activities and performance of mitigation measures and to identify the residual impact, and also the positive/negative changes in the physical, ecological, and socioeconomic environment.

Documentation & Review

This is the final step of the IEE study. The data generated during and for the study was compiled and examined by experts. Sections of this report were prepared as the study progressed, by consultation with experts. The report was finally reviewed by Team Leader, who analyzed the information, assessed the potential environmental impacts in the light of national and international guidelines, and examined the alternatives in the light of observations on the field as well as meetings with the stakeholders.

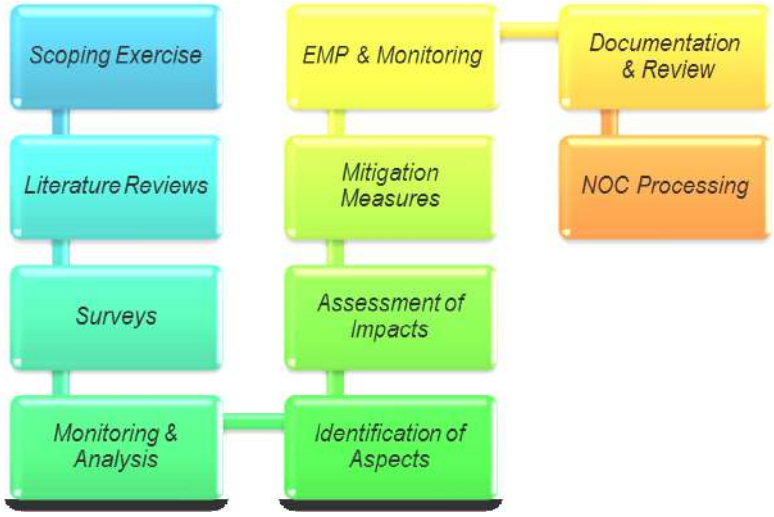


Figure 1-2: IEE Methodology

1.5.Structure of IEE

This document is structured as follows:

- **Chapter 1:** Introduction to Project and IEE Processes;
- **Chapter 2:** Provides an overall description of the project;
- **Chapter 3:** Describes the legislative and policy framework governing the project;
- **Chapter 4:** Provides environmental (Physical & Biological) and Social baseline conditions of the macro and microenvironment of the project area;
- **Chapter 5:** Screening of environmental impacts of the project and appropriate mitigation measures;
- **Chapter 6:** Provides environmental management and monitoring plan (EMMP); and
- **Chapter 7:** Provides conclusions and recommendations.

The main text of the report is supported by a series of Annexure which provides supplementary information including respective sections of prominent provincial and national laws and guidelines.

1.6.IEE Team

EMC Pakistan Pvt. Limited formed the following team for conducting the Initial Environmental Examination (IEE) of the proposed Solar Power Plant in District West, Karachi.

Table 1-1: List of IEE Study Team

S. No.	Name of Experts	Position in IEE Team
1.	Mr. Syed Nadeem Arif	Director/Team Lead
2.	Mr. Ahmed Zohair Siddiqui	Deputy Team Lead
3.	Mr. Tanvir Ahmed	Senior Sociologist
4.	Mr. Sohaib Tariq	Environmental Engineer
5.	Mr. Syed M. Omer Arif	Environmental Engineer
6.	Ms. Saira Tariq	Environmentalist
7.	Mr. Ather Adil	Field Monitor

Chapter 2 PROJECT DESCRIPTION

2.1.Project Ownership

120MW Solar Power Plant Project in Deh Halkani and Deh Band Murad is being developed by Sindh Solar Energy Project (SSEP), Energy Department, GoS.

2.2.Project Location

The project is located in Deh Halkani and Deh Band Murad, District West, Karachi. The Project will be installed at the site allocated by GoS with location shown map shown below;

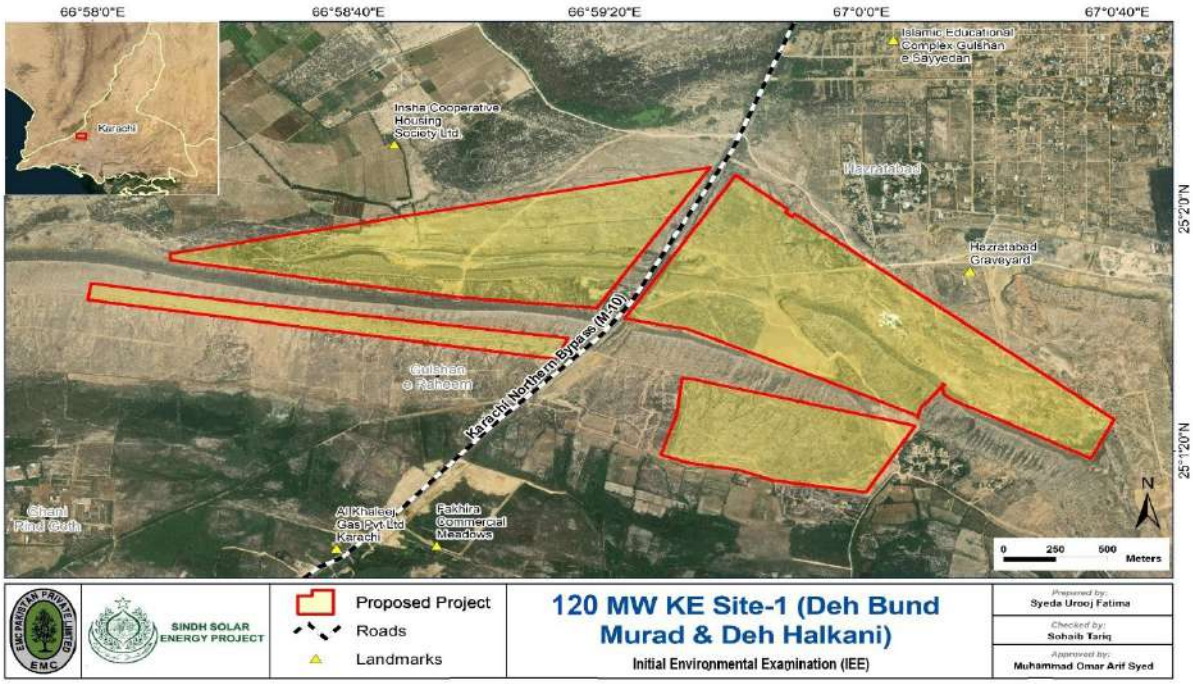


Figure 2.1: Satellite Imagery of Location of Solar PP project

2.3.Project Technical Details

All plant and equipment shall be new and shall be designed, manufactured, and tested in accordance with the latest IEC or other equivalent standards.

Major equipment/structure that is to be installed at each site is detailed below:

Solar Panel

Latest technology including single-axis tracking of panel considering the site/area condition shall be selected.

Power Inverters

The project site shall consist of inverters for converting 120MW DC power to AC, which would either be String or central inverters having standard warranty period, efficiency 97% or above and complying with IEC/UL Standards.

Power Transformer and other Switchyard Equipment

The Complex design will include the step-up transformers and shall comprise of adequate electrical and mechanical protections to ensure safety and reliability.

SCADA, Tele-Communication and Protection Schemes

SCADA, telecommunication and tele-protection equipment of the Complex side shall be two channels established till load dispatch center for data transfer to SCADA system. Each transmission line will have dedicated protection relays. Bus-bar protection and step-up transformer protection will be as per Complex design.

Weather Station

Weather station will include the equipment to measure wind speed, tilted irradiance, horizontal irradiance, ambient temperature, PV panel temperature etc.

Civil/ Mounting Structure

Mounting system shall be directly anchored into the ground (driven piers, concrete footers, ground screws, etc.). Mounting system shall be selected so as to withstand wind speeds, earthquakes, floods etc. in the region and ensure design operations for the life of the project. Civil design of Plant shall have provision for flood water outlet too.

Balance of System:

The BOS will be selected to ensure that the system is able to service for the life of the project, broadly some of the aspects of the BOS are:

Medium voltage switchgears, MV transformer, DC system, control and protection equipment of adequate capacities and complying with IEC standards. MV and LV Cabling shall be according to site conditions and Plant design.

RO plant (if required) shall be installed for cleaning and plant operational services. Outdoor electronic equipment and panels having Ingress protection class 65. Substation properly equipped with LV Power supplies, back-up power supplies, UPS, Diesel generators, auxiliary transformers, telephone and internet connection, lighting, HVAC, water supplies, drainage, fire and intruder alarms, PV plant earthing, cables protection and insulation monitoring etc.

Safety & Security

Lighting arrestors, proper grounding of all equipment shall be ensured and surge protection shall be provided on all electrical systems. There will be underground interconnecting solar arrays. Fire safety protection and adequate lighting at regular intervals to ensure visibility at all times. Fencing and surveillance to ensure security of the complex, security cameras and microwave sensors etc.

Interconnection Requirements

The interconnection point will be droppers from the terminal tower connected to the gantry of transmission lines and the proposed interconnection scheme will be double circuit in-out from transmission line.

Chapter 3 ENVIRONMENTAL LAWS, POLICIES AND GUIDELINES

This section provides detailed review of policies, legislation, and guidelines that have relevance to the proposed Solar PV Power Plant project and review of administrative framework as well as institutional set-up relevant to the environmental and social management of the proposed subproject.

3.1. National Laws and Regulations

Pakistan's statute books contain a number of laws related to the regulation and control of the environmental and social aspects. However, the enactment of comprehensive legislation on the environment, in the form of an act of parliament, is a relatively new practice. Most of the existing laws on environmental and social issues have been enforced over an extended period of time, and are context-specific. After the Eighteenth amendment in the Constitution of Pakistan, many federal subjects devolved to provincial legislation. The Concurrent List in fourth schedule of the Constitution containing entries of subjects wherein federal and provincial legislation could legislate has been abolished. Since project coverage is in province of Sindh; therefore, only those national laws and regulations are discussed here which have application in the project. There are still several federal laws which have not been repealed by the provinces and applicable in provinces with its original titles. The laws relevant to the proposed subproject are briefly reviewed below.

3.1.1 National Environmental Policy, 2005

The National Environmental Policy, 2005 aims to protect, conserve and restore Pakistan's environment in order to improve the quality of life for the citizens through sustainable development. It provides an overarching framework for addressing the environmental issues facing Pakistan, particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification, natural disasters and climate change. It also gives direction for addressing the cross sectorial issues as well as the underlying causes of environmental degradation and meeting international obligations.

The National Environmental Policy, 2005 while recognizing the goals and objectives of the National Conservation Strategy, National Environmental Action Plan and other existing environment related national policies, strategies and action plans, provide broad guidelines to the Federal Government, Provincial Governments, Federally Administrated Territories and Local Governments for addressing environmental concerns and ensuring effective management of their environmental resources.

3.1.2 National Conservation Strategy, 1992

The Pakistan National Conservation Strategy (NCS) is the principal policy document for environmental issues in the country. The NCS was developed and approved by the Government of Pakistan in 1992. The NCS works on a ten-year planning and implementation cycle. It deals with fourteen core areas as follows:

- Maintaining soils in cropland;
- Increasing irrigation efficiency;
- Protecting watersheds;
- Supporting forestry and plantations;
- Restoring rangelands and improving livestock;

- Protecting water bodies and sustaining fisheries;
- Conserving of biodiversity;
- Increasing energy efficiency;
- Developing and deploying material and energy renewable;
- Preventing and abating pollution;
- Managing urban wastes;
- Supporting institutions for common resources;
- Integrating population and environmental programs;
- Preserving the cultural heritage

3.1.3 Land Acquisition Act, 1894

This Act is a colonial legacy which provides law for the acquisition of land needed for public purposes. The Act provides complete mechanism for determining the amount of compensation for land, trees, horticulture, to be made on account of such acquisitions. The law provides details of various peculiarities involved in acquisition of land such as preliminary investigation, objection to acquisition, declaration of intended acquisition, enquiry into measurements, value & claims, taking possession, reference to court and procedure thereon, apportionment of compensation, payment, temporary occupation of land, acquisition of land for companies, disputes resolutions, penalties and exemptions, etc. This Act has 55 sections addressing different areas. Section 4(2) of the Act mentions that it shall be lawful for any official authorized by the Collector to enter upon and survey, to dig or to do all other acts necessary to ascertain whether the land is suitable for such purpose.

The LAA and its implementation rules require that impacts assessment/valuation effort, land and crops are compensated in cash at market rate to titled land owners and registered land tenants/users, respectively.

Based on the LAA, only legal owners/title holders and tenants registered with Land Revenue Department or possessing formal lease agreements, are eligible for compensation or livelihood support. However, other national projects, have been awarded compensation and assistance, in good faith, to non-title holders and other forms of PAPs (squatters /encroachers) based on their own resettlement policies.

The project will be developed on the land of GoS. Land acquisition is not required.

3.2 Provincial Laws and Regulations

3.2.1 Sindh Environmental Protection Act, 2014

Sindh Environmental Protection Agency as a part of Sindh Act No. VIII of 2014 prepared Sindh Environmental Protection Act (SEPA), 2014 which was passed by the provincial assembly of Sindh on 24th February, 2014 and asserted by the Governor of Sindh on 19th March, 2014 and notified on 20th March, 2014. It is a fairly comprehensive legislation and provides legislative framework for protection, conservation, rehabilitation and improvement of the environment. It contains concrete action plans and programs for the prevention of pollution and promotes sustainable development.

Act has 11 parts with 37 Sections followed by sub-sections and clauses. Part VI is related to the environmental examinations and assessments while part X is related to the public participation.

3.2.2 Sindh EPA (Environmental Assessment) Regulations, 2021

These regulations set out:

• Key policy and procedural requirements for filing an EIA;

• The purpose of environmental assessment;

• The goals of sustainable development;

• The requirement that environmental assessment be integrated with feasibility studies;

• The jurisdiction of the Provincial EPA and Planning &Development (P&D) Departments;

• The responsibilities of proponents;

• Duties of responsible authorities;

• Provides schedules of proposals that the Project requires either EC, IEE or an EIA;

• The environmental screening process of the projects under schedule I, II and III; and

• The procedure for the environmental approval for filing the case with the Sindh EPA for the granting of the NOC.

3.2.3 Sindh Environmental Quality Standards (SEQS)

SEPA has formulated the Sindh Environmental Quality Standards (SEQS) as per Clause (g) of sub-section (1) of Section 6 of SEPA Act 2014. The SEQS were promulgated in 2016 which includes standards for liquid effluent, industrial gaseous emissions, ambient air, drinking water quality, noise levels and standards for motor vehicle exhaust, diesel vehicle, and petrol vehicles.

3.2.4 Sindh Wildlife (Protection, Preservation, Conservation and Management) Act, 2020

This Act provides for the preservation, protection, conservation and management of wildlife by the formation and management of protected areas and prohibition of hunting of wildlife species declared protected under the Act.

The Act also provides classifications of the protected areas; national parks, wildlife sanctuaries, game reserves and private game reserves, community game reserves. Activities such as hunting and breaking of land for mining are prohibited in national parks, as are removing vegetation or polluting water flowing through the park. Wildlife sanctuaries are areas that have been set aside as undisturbed breeding grounds and cultivation and grazing is prohibited in the demarked areas. Nobody is allowed to reside in a wildlife sanctuary and entrance for the general public is by special dispensation. However, these restrictions may be relaxed for scientific purpose or betterment of the respective area on the discretion of the governing authority in exceptional circumstances. Game reserves are designated as areas where hunting and shooting is not allowed except under special permits.

The project site does not fall in under any protected area.

3.2.5 Sindh Occupational Health and Safety Act, 2017

The act makes provisions for occupational safety and health conditions at all workplaces in the province for the protection of workers during work. Under the Act, an Occupational Safety and Health Council will be established in Sindh with secretary of Sindh government's Labor and Human Resources Department as its chairperson.

The proposed council lays down penalties in case of death and injury due to violation. In case of death sub-section 01 of section 38 will accord 2 years' imprisonment or a fine of PKR 100,000 or both. Similarly, in case of injury the imprisonment may extend to six months or a fine up to PKR 20,000 or both.

3.2.6 Hazardous Substances Rules, 2014

The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. General safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are also described in these rules.

3.3 Administrative Framework

Environmental issues are governed by Provincial Government. The Government of Sindh (GOS) has designated its Environment Protection Department (SEPA), to administer matters related to the environment in the province.

3.3.1 Institutional Setup for Environmental Management

The highest environmental body in the country is the Pakistan Environmental Protection Council (PEPC), which is presided over by the Chief Executive of the country. Other bodies include the Pakistan Environmental Protection Agency (Pak-EPA), provincial EPAs (for four provinces, AJK and Northern Areas), and Environmental Tribunals. The Federal government has also formed the Federal EPA, which is headed by a Director General and has wide-ranging functions given in PEPA 1997. These include the preparation and coordination of national environmental policy for approval by the PEPC, administering and implementing the PEPA 1997 and preparation, revision or establishment of NEQS. The Provincial Environmental Protection Agencies are formed by the respective Provincial Governments. A Director General who exercises powers delegated to him by the Provincial Government heads each Provincial EPA. IEEs and EIAs are submitted to provincial EPAs for approval.

3.4 Environmental and Social Guidelines

Two sets of guidelines, the Pakistan-EPA's guidelines and the World Bank Guidelines are reviewed here. These guidelines address the environmental as well as social aspects.

3.4.1 Environmental Protection Agency's Environmental and Social Guidelines

The Federal EPA has prepared a set of guidelines for conducting environmental and social assessments. 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 EIA conductors 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.
- **Guidelines for Sensitive and Critical Areas:** The guidelines identify officially notified protected areas in Pakistan, including critical ecosystems, archaeological sites, etc., and present checklists for environmental assessment procedures to be carried out inside or near such sites. Environmentally sensitive areas include, among others, archaeological sites, biosphere reserves and natural parks, and wildlife sanctuaries and preserves.

3.4.2 World Bank Social 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
- Pollution Prevention and Abatement Handbook 1998: Towards Cleaner Production
- Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues.
- Social Analysis Sourcebook

3.4.3 IFC General EHS Guidelines

The EHS guidelines published by IFC are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects; however, these guidelines have been benefited from for other projects as well. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during construction,

operation, and decommissioning phase of a project or facility. Environmental issues associated with the construction and maintenance activities may include, among others, noise and vibration, soil erosion, and threats to biodiversity including habitat alteration and impacts to wildlife.

Examples of the impacts addressed in the General EHS Guidelines include:

- Construction site waste generation;
- Soil erosion and sediment control from materials sourcing areas and site preparation activities;
- Fugitive dust & other emissions (e.g., from vehicle traffic, land clearing activities, & materials stockpiles);
- Noise from heavy equipment and truck traffic;
- Potential for hazardous materials and oil spills associated with heavy equipment operation and fueling activities.

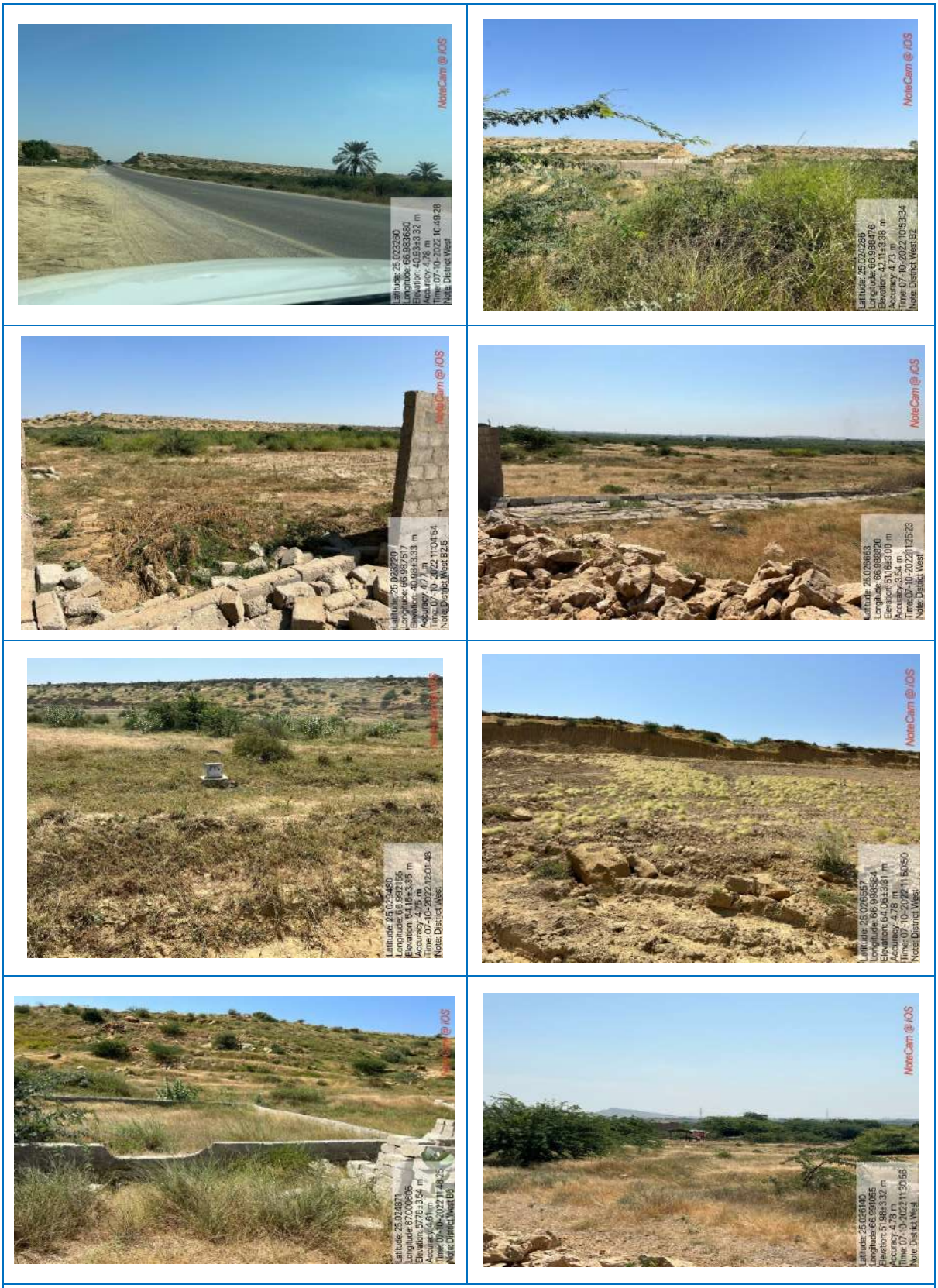
Chapter 4 ENVIRONMENTAL & SOCIAL BASELINE

4.1 General

The baseline study is the existing environmental conditions of the project area related to the physical, biological and socio-economic environment prior to the beginning of construction activities. The existing baseline study would assist in understanding the prevalent macro and micro environment of this project and would also enable assessment of possible environmental impacts that may arise as a result of the activities associated with the project. It would also assist the design team in defining the mitigation measures that would be required to minimize the negative impacts which are identified in this study.

The microenvironment of the proposed project site is located in Deh Halkani and Deh Band Murad, District West, Karachi. Project surroundings comprise of farmlands, sand quarry, settlements/goths and prospective house societies. Prominent settlement is Hazaratabad. Gulshan e Raheem is a prospective house society in project vicinity. Gul Muhammad Qalandarani Goth is at a distance from the project site northwards. Primary accessible road to the project area is Karachi Northern Bypass (M-10).

Left Portion of project site



Right Portion of project site

Figure 4.1: Photographs from project site

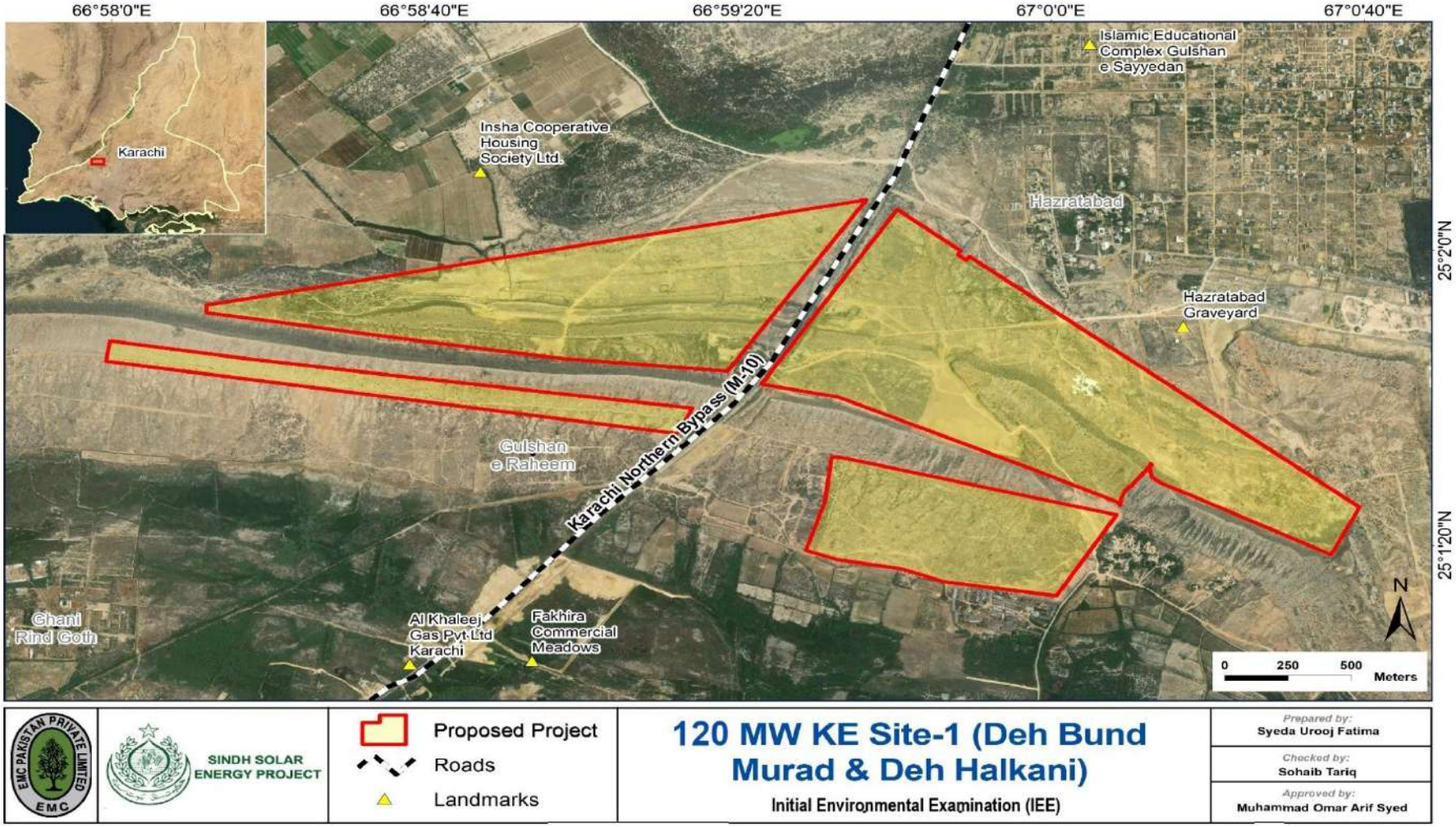


Figure 4.2: Location Map of Proposed power plant

4.2 Geography

Geology: Karachi is the part of major synclinorium stretching from Ranpathani River in the east to Cape Monze in the west, Mehar and Mole Jabal (Mountains) in the north. Within the synclinorium a number of structures such as Pipri, Gulistan-e-Jauhar, Pir Mango and Cape Monze are exposed. The presence of concealed structures under the Malir River valley, Gadap and Maripur plains can fairly be deduced.

Rock aggregates, sand, limestone and clay are some of the potentials for gainful utilization. Gulistan-e-Jauhar member of the Gaj formation offers groundwater potential for limited use. The area is underlain by rocks of sedimentary origin ranging in age from Eocene to Recent. Major structural trends and the basin axis strike generally south but with a "bulge" to the east also called Karachi Arc (Bender and Raza 1995).

Geomorphology of Karachi: Karachi is located in the south of Sindh, on the coast of the Arabian Sea. It covers an area of approximately 3,600 km2, comprised largely of flat or rolling plains, with hills on the western and northern boundaries of the urban sprawl. The city represents quite a variety of habitats such as the sea coast, islands, sand dunes, swamps, semi-arid regions, cultivated fields, dry stream beds, sandy plains, hillocks. Classified according to physiographic features, Karachi City District can be divided into three broad categories: Hilly Region (Mountain Highland), Alluvial Plain (Piedmont Plain) and Coastal Areas (Valley Floor). The metropolitan area is divided by two non-perennial river streams namely Lyari and Malir Rivers. The Malir River flows from the east towards the south and centre, and the Lyari River flows from north to the south west. Gujjar and Orangi are the two main tributaries of the Lyari River while Thaddo and Chakalo are the main tributaries of the Malir River. The dry weather flow of both rivers carries urban sewage that is ultimately drained in the Arabian Sea. Among the various physiographic features, low flat-topped parallel hills devoid of vegetation, interspersed with widespread plains and dry riverbeds are the main topographic characteristics of the city.

The greatest height of the region is 250 ft. that gradually decreases to 5 ft above mean sea level along the coastline. The Karachi Harbour is a sheltered bay to the south-west of the city, protected from storms by the Sand spit Beach, the Manora Island and the Oyster Rocks.

The Arabian Sea beach lines the southern coastline of Karachi. Dense mangroves and creeks of the Indus delta can be found towards the south east side of the city. Towards the west and the north is Cape Monze, an area marked with projecting sea cliffs and rocky sandstone promontories.

Soil: The soil mainly consists of fill materials brown medium dense to dense, coarse sand, coarse sand and little clayey silt up to the depth of 10 feet from ground surface. Beneath this, substrata comprise of dense to brown hard, conglomerate fractured upto 25 ft.; then followed by the layer of brown soft to medium hard claystone deposits upto the depth of roughly 30ft..

4.3 Seismicity

Seismo-tectonic Study for macro-environment of Project site aims at elucidating the impact of tectonic movement induced seismicity on the microenvironment. Karachi is Pakistan's largest city with population exceeding 18 million and is amongst the top five most congested cities in the world. Karachi has experienced no earthquake related damage in the recorded history of past ~ 175 years. Yet, Karachi is located in a seismically active tectonic setting often compared to Los Angeles with active plate boundary faults and triple junctions within a radius of ~ 150 km. This discrepancy in earthquake history and seismo-tectonic setting has led to diverse seismic hazard assessments for Karachi ranging from assignment of seismic hazard zones I (least severe) to IV (most severe). Recent assessment adopted in Building Code of Pakistan (2007) assigns an intermediate seismic hazard value of 0.16–0.24 g (Zone IIB) to Karachi, which is broadly accepted but sometimes criticized to be an underestimation.

A recent study entitled "Seismic sources for southern Pakistan and seismic hazard assessment of Karachi"[1], based on a new active fault's compilation and seismic sources definition together with incorporation of maximum possible information on historical earthquakes (up to 893AD), has led to a re-assessment of seismic hazard for Karachi using probabilistic and deterministic seismic hazard assessment approaches. The main findings of this study are:

- Karachi is assessed to be prone to ground motions ~ 0.25 g with metropolitan areas having hazard values between 0.21 and 0.25 g for 10% probability of exceedance in 50 years (475-year return period).
- The deterministic seismic hazard analysis suggests maximum that peak ground acceleration (PGA) varies from 0.19 to 0.99 g in Karachi and its higher values are concentrated around the Nagar Parker fault that is controlling and hazardous for Karachi.

Despite a safe seismic history spanning past about 175 years, Karachi is located in a tectonic setting, which is considered amongst the most active in the world. The active Chaman transform fault marking plate boundary between the Indian and Eurasian plates is located only 120 NW of Karachi. Karachi itself is located at the southern tip of N–S trending Kirthar active foreland thrust-fold belt at the western deformed edge of the Indian plate. The triple junction between the Indian, Arabian and Eurasian Plates is located 110 km to the SW of Karachi.

[1] Waseem, M., Khan, M. A., & Khan, S. (2019). Seismic sources for southern Pakistan and seismic hazard assessment of Karachi. *Natural Hazards*, *99*(1), 511-536.

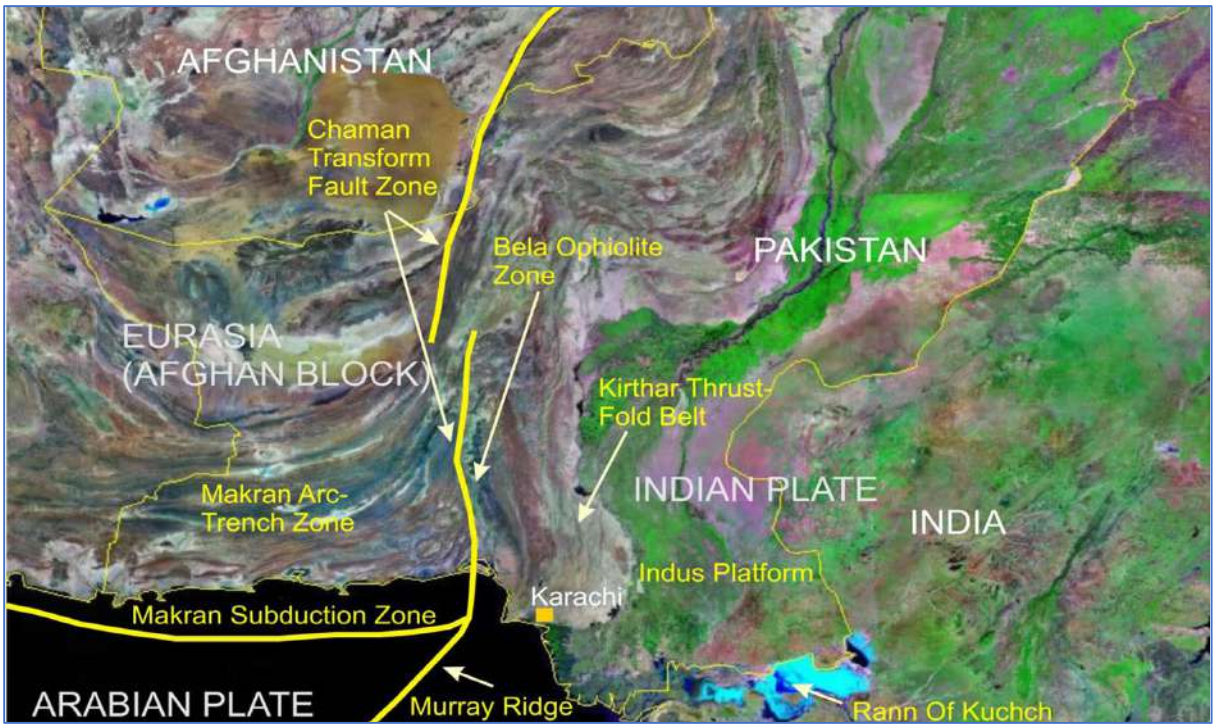


Figure 4.3: Tectonic setting of Karachi[2]

Seismic activity in the region is the result of the triple junction as well as the Karachi Arc, located in southeastern Pakistan, as a large fold and thrust belt that shows Neogene thin-skinned eastward movement. Seismic activity in and around the region shows that the Karachi Arc has been active since long in prompting the eastward movement of the delta. It is possible that the movement is related to the rebound that takes place after mass shift. Sarwar has suggested that the eastward creep of Karachi Arc is directly related to active subsidence of the Hyderabad graben that underlies it and also defines the northern and southern limits of the Karachi Arc.[3]

It may be added that subsidence such as that on Southern coast of Sindh, occurs naturally as a result of plate tectonic activity above active faults, and in places where fluid is expelled from underlying sediments and is common at river deltas that may have receded. Earthquakes arise and result from the release of the force along the growth fault plane. As a result, many different growth faults are created as sediment loads shift basin ward and landward.

Seismic Coefficient: According to uniform building code (1997) the soil profile type of the project falls in category "Sc" corresponding to "Soft Rock/Very Dense Soil". Details are annexed in Subsoil Geotechnical Investigation Report. Following parameters can be adopted: Seismic Zone = 2B, Zone Factor = 0.2, Soil Profile Type = Sc, Seismic Coeff "Ca" = 0.24 and Seismic Coeff "Cv" = 0.32

Earthquakes: Historically the coastal region has suffered a number of earthquakes. Detailed review of the geological history including the modern time reveals the occurrence of deep-sea earthquakes at different times, throughout history in the North Arabian Sea, as presented below:

[2] Waseem, M., Khan, M. A., & Khan, S. (2019). Seismic sources for southern Pakistan and seismic hazard assessment of Karachi. *Natural Hazards*, *99*(1), 511-536.
[3] (Sarwar, G., 2004. Earthquakes and the Neo-Tectonic Framework of the Kutch-Hyderabad-Karachi Triple Junction Area, Indo-Pakistan. Pakistan Journal of Hydrocarbon Research, 14, 35-40).

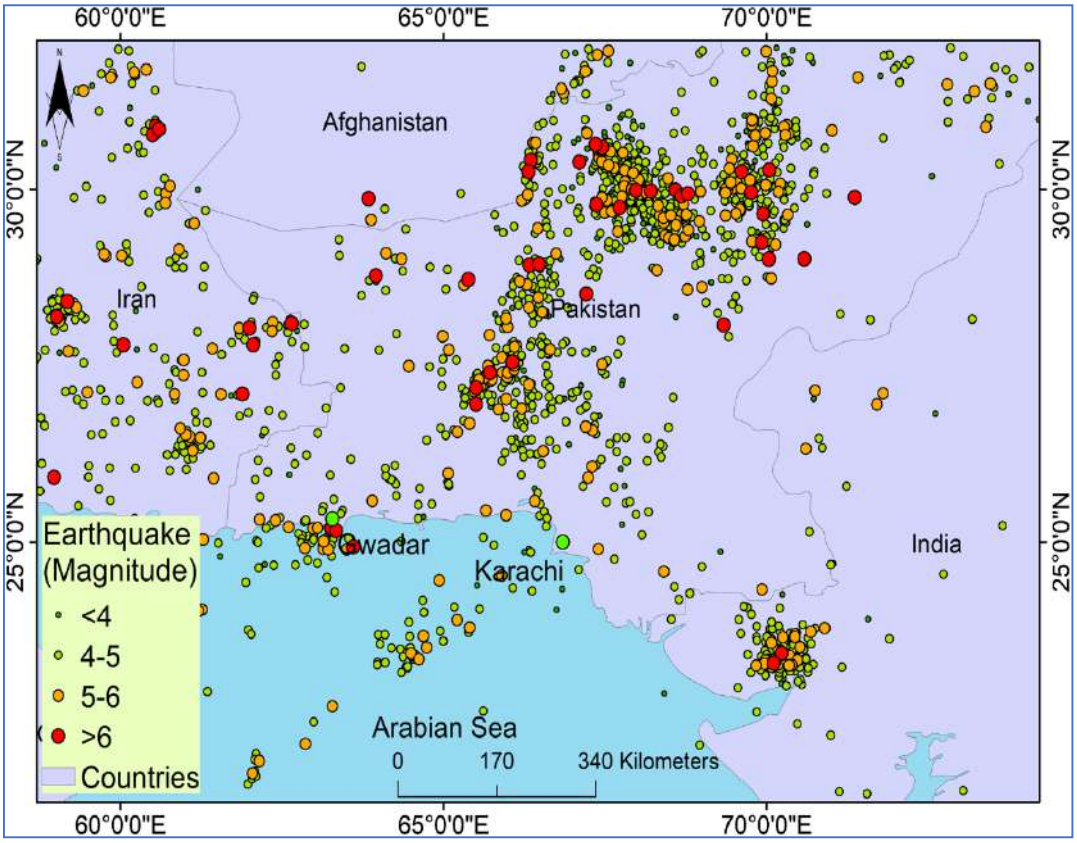


Figure.4: Earthquake recorded (1950–2019) in the Arabian Sea and its surroundings[4]

Seismicity of the Site: According to the Uniform Building Code (1997), Karachi and its adjoining areas fall in Seismic Zone-2B.

Sarwar and Alizai have compiled a list of earthquakes during the 1902-2013 period and also produced the above map that gives a distribution of hypocenters of earthquakes during the same period. From the distribution of hypocenters, it has been inferred that the entire Karachi Arc and surrounding areas are seismically active with hypocenters ranging in depth from 0-500 kilometers. From the depth of hypocenters, it is inferred that active deformation has taken place at multi-levels ranging from shallow too deep in the basement. Quite a few of the recent epicenters are found within or in close proximity to parts of Karachi that have faced recurrent earthquake activity.

[4] Aslam, B., Ismail, S., & Maqsoom, A. (2020). Geospatial mapping of Tsunami susceptibility of Karachi to Gwadar coastal area of Pakistan. *Arabian Journal of Geosciences*, *13*(17), 1-12.
[4] (Sarwar, G., 2004. Earthquakes and the Neo-Tectonic Framework of the Kutch-Hyderabad-Karachi Triple Junction Area, Indo-Pakistan. Pakistan Journal of Hydrocarbon Research, 14, 35-40).

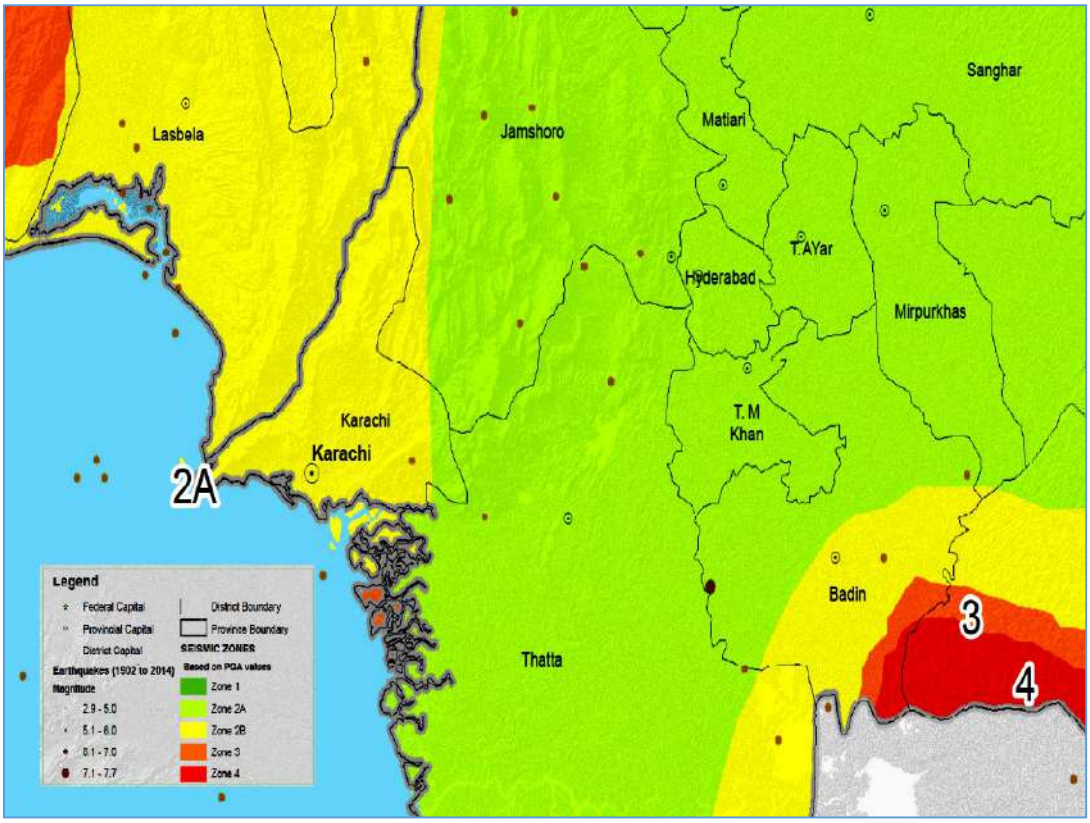


Figure 5: Seismic Zones in Karachi[5]

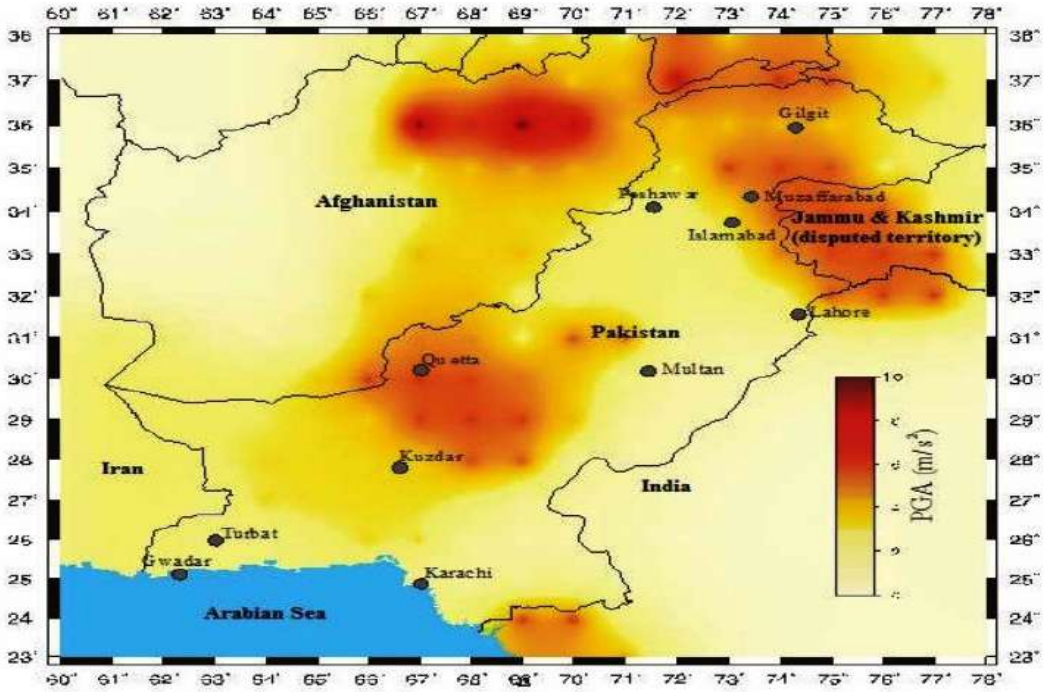


Figure.6: Seismic Hazard for Pakistan in terms of Peak Ground Acceleration (PGA)[6]

[5] Map data source(s): PMD, GSP, Pakistan Engineering Council – Prepared by Al Hasan Systems Private Ltd.
[6] PMD Seismic Monitoring and Early Tsunami Warning Centre - http://seismic.pmd.gov.pk/seismicnew/map2.html

4.4 Meteorology and Climate

The coastal part of Karachi is largely influenced by the subtropical monsoon regime. The weather during the inter-monsoon periods is uncertain and short spells of dust storms, dry weather, or a humid cool breeze may prevail for short durations.

Table 4.1: Seasonal Characteristics of the Climate of Karachi

Season	Temperature	Rainfall	Wind
Summer (Mid-March to Mid-June)	The summer is hot with temperature increasing from 26.2 °C in March, rising up to 40 °C in June.	There are less frequent rain showers in summer with no more than 1 or 2 rainy days in summer. Average total amount of rain in summer is around 10 mm	The wind speed in summer is variable. It is around 2.5 m/s in March and rises up to 18 m/s in April and drops to 4 m/s for the rest of the season. The direction mostly remains blowing from West
Monsoon (Mid-June to mid-September)	The temperature in monsoon remains high but relatively lower than summer and oscillates around 32°C.	Almost 80 % of the yearly rain occurs in the monsoon with July and August being the wettest month.	The wind direction in the monsoon is mostly blowing from East.
Post-Monsoon Summer (Mid-September to November)	The average temperature post monsoon drops and average min temperature may reach 12 °C in November.	The post-monsoon period remains mostly dry and rainfall in November is around 1.8 mm.	The wind speed in September is around 3.7 m/s and drops to 1.4 m/s in November.
Winter (December to mid-March)	The winter is mild with January being the coolest month where average minimum temperature falls to 6 °C.	Like the other seasons, except monsoon, there is little occasional rainfall. The rainfall in winter	The wind speed in the winter season increases from 1.4 m/s in December to 2.6 m/s in March. The wind direction for most part winter season is blowing from NE and changes its

Table 4.1: Seasonal Characteristics of the Climate of Karachi			
Season	**Temperature**	**Rainfall**	**Wind**
		is less than 50 mm.	course to blowing from West in early March

i. Temperature

The air temperature in Karachi Division and its coastal areas are generally moderate throughout the year due to presence of sea. Climate data generated by the meteorological station at Karachi Airport represents climatic conditions for the region. The mean monthly maximum and minimum temperatures, recorded during the last 21 years in Karachi to describe the weather conditions are shown in Table 4.2(a) and 4.2(b) respectively.

Table 4.2(a): Mean Monthly Maximum Temperatures (°C) in Karachi

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	27.2	29.6	33.1	34.6	35.1	34.9	32.2	32.3	33.1	36.0	33.5	30.4	32.7
2002	27.0	28.2	33.3	35.4	35.6	35.1	32.2	31.6	31.4	36.5	32.7	28.1	32.3
2003	27.6	28.5	32.4	36.6	35.7	34.9	34.1	32.6	32.5	37.0	32.2	28.3	32.7
2004	26.6	29.9	36.2	35.4	36.8	35.6	33.8	32.7	32.8	33.7	33.1	29.4	33.0
2005	24.9	26.3	31.5	35.3	35.4	36.0	33.2	32.2	34.2	35.2	33.1	28.4	32.1
2006	26.0	31.3	31.8	34.0	34.6	35.3	33.8	31.0	34.2	35.0	33.4	26.3	32.2
2007	26.9	29.4	31.4	37.7	36.0	36.4	N/A	N/A	N/A	N/A	N/A	N/A	33.0
2008	24.4	26.9	34.3	34.4	33.9	35.1	33.5	31.9	34.7	35.5	32.5	27.2	32.0
2009	26.2	29.8	33.0	36.0	36.8	35.7	34.5	33.0	32.8	35.9	33.0	28.6	32.9
2010	27.5	29.2	34	35.7	36.5	34.7	34.6	33.2	34.5	35.9	32.7	28	33.0
2011	26.9	28.5	33.2	35.8	35.3	35.3	34.2	32.8	32.9	N/A	N/A	N/A	N/A
2012	25.7	26.9	31.7	35.1	35.5	34.6	33.2	32.7	33.2	35.0	32.7	28.2	32.0
2013	26.7	28.0	33.3	34.0	35.1	36.5	33.8	32.1	33.0	35.7	32.3	28.3	32.4
2014	25.5	28.0	31.7	35.1	35.9	36.5	34.0	33.7	33.8	36.3	32.9	28.7	32.7
2015	26.3	28.9	31.5	35.9	36.0	37.7	34.1	32.3	34.6	35.8	33.0	28.6	32.9

2016	27.8	30.3	33.3	34.7	35.7	36.1	33.6	33.0	32.9	34.0	33.3	31.0	33.0
2017	25.4	30.2	32.8	35.5	36.2	36.3	33.1	33.8	33.4	36.6	32.3	28.2	32.8
2018	28.5	30.4	34.4	36.2	38.7	35.4	33.8	31.9	32.6	36.8	33.8	28.2	33.4
2019	26.3	26.8	31.3	35.4	36.0	37.2	34.7	32.5	35.7	35.8	31.5	27.1	32.5
2020	24.3	30.1	31.2	36.2	36.6	37.3	36.7	34.6	35.0	36.2	31.4	28.1	33.1
2021	26.6	31.3	34.6	37.3	37.5	36.1	34.5	32.6	36.3	34.8	34.0	27.6	33.6

Source: *Pakistan Meteorological Department*

Table 4.2(b): Mean Monthly Minimum Temperatures (°C) in Karachi

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	11.5	14.9	19.6	23.8	28.1	29.0	27.1	26.5	25.9	24.4	18.6	15.8	22.1
2002	12.8	13.8	19.5	23.9	27.0	28.2	29.6	25.6	24.8	22.5	17.7	14.9	21.7
2003	12.7	16.9	19.8	24.2	26.5	28.2	23.6	27.0	25.3	20.9	15.2	12.0	21.0
2004	12.9	14.5	19.1	24.8	27.3	28.8	27.5	26.3	25.3	22.4	18.0	15.4	21.9
2005	12.3	11.3	20.3	23.0	26.4	28.3	27.2	26.6	26.6	22.9	18.9	13.0	21.4
2006	11.7	18.1	19.6	24.5	27.5	28.5	28.3	26.3	26.8	25.7	19.4	14.0	22.5
2007	13.0	17.3	19.7	24.7	27.6	28.6	N/A	N/A	N/A	N/A	N/A	N/A	21.8
2008	10.1	11.1	19.6	24.0	27.3	29.1	27.9	26.8	26.6	23.8	17.6	14.9	21.6
2009	14.7	16.5	20.8	23.8	27.6	28.7	28.1	27.5	26.5	22.6	17.0	13.9	22.3
2010	12.2	14.7	21.3	25.1	28	28.2	28.3	27.2	25.8	23.9	17.4	11.1	21.9
2011	11	14.5	19.7	23.1	27.1	28.8	27.8	28.6	26.5	N/A	N/A	N/A	N/A
2012	11.2	11.9	19.1	24.5	27.2	28.0	27.9	26.9	26.4	22.7	18.6	14.2	21.5
2013	11.6	15.1	19.2	24.2	27.1	29.3	28.0	26.6	25.5	25.4	18.1	13.0	21.9
2014	9.9	13.1	18.9	24.4	27.0	29.2	28.3	27.1	26.8	23.3	19.5	13.1	21.7
2015	12.6	16.4	19.2	25.7	27.7	29.8	28.4	26.9	26.3	24.9	18.6	12.6	22.4
2016	14.8	14.9	21.7	24.6	27.9	27.9	28.1	27.1	26.4	24.0	17.1	15.5	22.5

Table 4.2(b): Mean Monthly Minimum Temperatures (°C) in Karachi													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
2017	12.5	18.2	20.3	24.4	27.8	29.2	27.7	27.0	26.2	23.5	16.8	13.0	22.2
2018	12.9	15.8	20.9	25.3	27.7	28.8	28.1	26.3	25.5	23.0	19.3	13.1	22.2
2019	13.3	15.3	19.0	24.0	26.6	28.9	28.1	26.8	27.2	24.0	19.4	13.7	22.2
2020	10.8	15.3	19.1	24.7	27.7	29.7	29.4	28.1	27.3	22.7	16.0	12.5	21.9
2021	9.2	15.0	21.6	25.1	28.9	29.6	28.5	27.4	28.0	23.1	17.6	13.9	22.3
Source: *Pakistan Meteorological Department*													

ii. Precipitation

The main source of precipitation is rainfall which is received mostly in the months of July to September during SW Monsoon winds. It is very erratic as some years are very dry and there is no rain.

Table 4.3: Monthly Amount of Precipitation (mm) at Karachi Airport													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
2001	0	0	0	0	0	10.6	73.6	16.2	N/A	0	0	0	100.4
2002	0	2.4	0	0	0	N/A	N/A	52.2	N/A	0	0.5	0.4	55.5
2003	6.4	21.8	0	0	0	16.3	270.4	9.8	N/A	0	0.2	0	324.9
2004	13.7	0	0	0	0	N/A	3	5.6	N/A	39.3	0	4.3	65.9
2005	6.6	12.8	N/A	0	0	N/A	N/A	0.3	54.9	0	0	17.1	91.7
2006	N/A	0	N/A	0	0	0	66.2	148.6	21.9	0	3.1	61.3	301.1
2007	0	13.2	33.4	0	0	110.2	N/A	N/A	N/A	N/A	N/A	N/A	156.8
2008	8	Trace	1.1	0	0	0	54	37.5	Trace	0	0	21	121.6
2009	3	Trace	0	Trace	0	2.6	159.9	44	68.9	0	0	1.5	279.9
2012	0.2	0	0	0	0	Trace	Trace	8.1	121	0	0	22.8	152.1
2013	Trace	20	2.8	30	0	Trace	5.5	105.4	4	1.2	0	0	168.9
2014	Trace	0	12.4	0	1.3	Trace	1.1	9.9	1.4	0	4.6	0	30.7
2015	0.3	2.1	2.8	0	0	Trace	46.6	1.4	Trace	0	0	0	53.2

2016	3.1	0	Trace	0	0	65.8	1.9	96.9	Trace	0	0	0	167.7
2017	41.5	Trace	0	0	0	58.8	33.3	65.6	26.4	0	0	6.6	232.2
2018	Trace	Trace	0	0	0	Trace	Trace	0.8	Trace	0	0	Trace	0.8
2019	39.4	Trace	2.2	0	0	1.6	66.3	204	51.7	1.2	Trace	Trace	367.3
2020	Trace	2.6	0.5	0	0	Trace	101.2	366.8	Trace	0	3.1	0	474.2
2021	0	0	0	0	0	Trace	45.4	Trace	88.3	17.2	0	16.9	167.8
Source: Pakistan Meteorological Department													

The wet years have been found to follow a 3-year cycle during the first 9 years of the 3rd Millennium. The year 2010 was among the wettest years since Karachi City had witnessed more than 5 spells of 50 mm each during the month of July, three major spells of 60 to 100 mm in August and two spells of 25 and 10 mm each in the month of September. In July and August 2011 again, there was heavy rainfall all over Sindh. Hyderabad received about 74 to 103 mm rain in 24 hours and the same amount poured in Karachi and the villages in its outskirts. Among the other July 2020 was considered to be the wettest month among the others and the total annual rainfall records in 2020 higher than other past 19 years. The torrential rains resulted in flooding of several villages in Karachi District.

Inundation due to Heavy Rainfall Events: Highest rainfall events have occurred in July 1994: 256.3mm, July 2003: 270.4mm and August 2006: 77mm in 3 hours. According to observations recorded for the year 2007, August 10 and 11 were witnesses to unusually high rainfall of 107 mm in 24 hours compared with the normal of about 60 mm for August. The wettest August ever experienced by the city was in 1979, when over 262mm of rainfall was recorded. The record for the maximum rainfall within 24 hours in the eighth month was 166mm of rain on August 7, 1979. The heavy rainfall was not unusual since it was caused by the general monsoon system that travels from across Rajasthan and lays over Sindh. The monsoon weather system did not move towards Baluchistan but the penetration of moist currents from Sindh brought scattered to heavy rain in southern Baluchistan, particularly along its coastal regions. Major inundation and land submergence was noticed in Karachi in July 2003 and August 2006. On both occasions, precipitation pattern and intensity was almost similar. The downpour on both occasions was a cloud burst. For estimating the impact of inundation on the six corridors, the maximum intensity of Rainfall of 18th August 2006 at 77mm in about 3 hours i.e. 25.7mm/hour will be considered critical and adopted for making estimates on land submergence.

iii. Wind Speed & Direction

The wind direction and speed between the summer and winter monsoon seasons are rather unsettled and large variations are noted both with respect to speed and direction. The Tables 4.4 and 4.5 show the wind speed and direction respectively.

Table 4.4: Wind Speed (m/s) at 12:00UTS

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	2.6	3.4	4.3	5.6	7.5	8.1	6.8	7.3	5.5	3.7	2.0	2.4	4.9
2002	3.6	3.9	4.0	6.5	8.5	8.2	9.8	7.3	7.7	3.3	2.9	3.2	5.7
2003	4.0	5.0	5.4	5.2	7.7	8.8	6.7	7.1	6.0	3.2	3.1	3.0	5.4
2004	3.4	3.7	4.0	6.0	8.0	9.0	10.0	9.5	7.3	3.8	1.0	2.5	5.7
2005	3.6	4.2	4.8	5.1	7.1	7.5	9.0	6.9	6.4	3.9	2.0	1.5	5.2
2006	2.0	3.0	3.0	6.2	8.0	7.7	8.3	6.2	4.7	4.2	2.2	3.0	4.9
2007	2.0	3.7	4.0	4.0	6.0	6.3	N/A	N/A	N/A	N/A	N/A	N/A	4.3
2008	4.3	7.6	8.2	10.5	12.6	7.6	11.0	9.3	8.7	6.6	5.1	3.9	7.9
2009	7.0	7.2	7.9	9.3	9.8	9.7	9.5	9.3	9.1	6.1	5.0	3.9	7.8
2012	5.8	6.6	9.3	9.8	12.3	12.8	13.1	11.2	8.4	7.1	5.7	5.8	9.0
2013	5.2	6.9	9.0	10.3	11.5	10.8	12.0	11.2	10.3	7.7	5.1	4.5	8.7
2014	5.9	8.9	8.6	11.5	12.4	13.4	12.8	11.6	11.7	8.3	6.0	4.5	9.6
2015	6.9	10.3	10.1	11.5	12.8	12.3	13.7	12.3	10.5	8.7	5.6	5.8	10.0
2016	7.5	8.7	4.8	1.1	13.0	11.7	11.8	10.5	12.1	9.2	5.5	5.2	8.4
2017	7.0	8.0	10.8	12.1	12.8	11.5	12.1	10.3	8.7	8.5	5.4	7.4	6.9
2018	6.3	7.0	9.5	10.2	10.8	11.1	12.3	12.4	12.2	8.7	6.1	6.8	9.4
2019	6.7	8.9	10.2	11.7	12.1	11.7	13.7	9.1	8.5	8.0	6.9	7.4	9.6
2020	9.0	9.4	9.0	10.5	13.3	10.9	10.1	8.9	9.4	7.3	6.2	5.5	9.1
2021	6.1	7.6	9.7	8.5	11.7	12.7	12.6	11.1	8.8	8.1	6.7	6.6	9.2

Source: *Pakistan Meteorological Department*

Table 4.5: Wind Direction at 12:00UTS

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	S54W	S43W	S42W	S45W	S46W	S45W	N52W	S59W	S44W	N56W	S45W	S06W
2002	S67W	S52W	S51W	S55W	S51W	S42W	S54W	S45W	S48W	S56W	N54W	S41W
2003	S60W	N50W	S45W	S48W	S45W	S68W	S60W	S47W	S43W	S54W	S50W	S27W
2004	N27E	S46W	S53W	S49W	S52W	S54W	S54W	S62W	S56W	S47W	S45W	N86E
2005	N63E	S51W	S50W	S52W	S63W	S48W	S54W	S49W	S87W	S54W	S52W	N23W
2006	S48W	S62W	S50W	S57W	S64W	S60W	S67W	S78W	S51W	S53W	S49W	N79E
2007	S30W	S62W	S47W	S55W	S58W	S47W	S41W	S55W	S60W	S48W	S48W	N45E
2008	N45E	S47W	S54W	S51W	S52W	S39W	S50W	S52W	S46W	S39W	S38W	N
2009	N45E	S45W	S41W	S58W	S46W	S46W	S56W	S49W	S56W	S42W	S39W	S45E
2012	S3E	N56E	S62W	S46W	S61W	S51W	S66W	S51W	S53W	S41W	S41W	N9W
2013	N39W	S54W	S56W	S54W	S61W	S40W	S53W	S52W	S55W	S47W	S17W	N50W
2014	S72E	S54W	S43W	S46W	S46W	S45W	S54W	S48W	S85W	S45W	S49W	S45E
2015	S72E	S54W	S43W	S48W	S50W	S40W	S54W	S55W	S50W	S41W	S	S58W
2016	S43W	S36W	S48W	S54W	S54W	S45W	S48W	S36W	S51W	S45W	S43W	S36W
2017	S83E	S56W	S51W	S45W	S45W	S44W	S66W	S57W	S48W	S51W	S59W	N45E
2018	S54W	S43W	S42W	S45W	S46W	S45W	N52W	S59W	S44W	N56W	S45W	S06W
2019	S67W	S52W	S51W	S55W	S51W	S42W	S54W	S45W	S48W	S56W	N54W	S41W
2020	N31E	S12W	S52W	S55W	S49W	S44W	S47W	S55W	S47W	S38W	S4E	N35E
2021	S21W	S38W	S44W	S42W	S52W	S53W	S55W	S48W	S40W	S41W	S22E	S40E

Source: *Pakistan Meteorological Department*

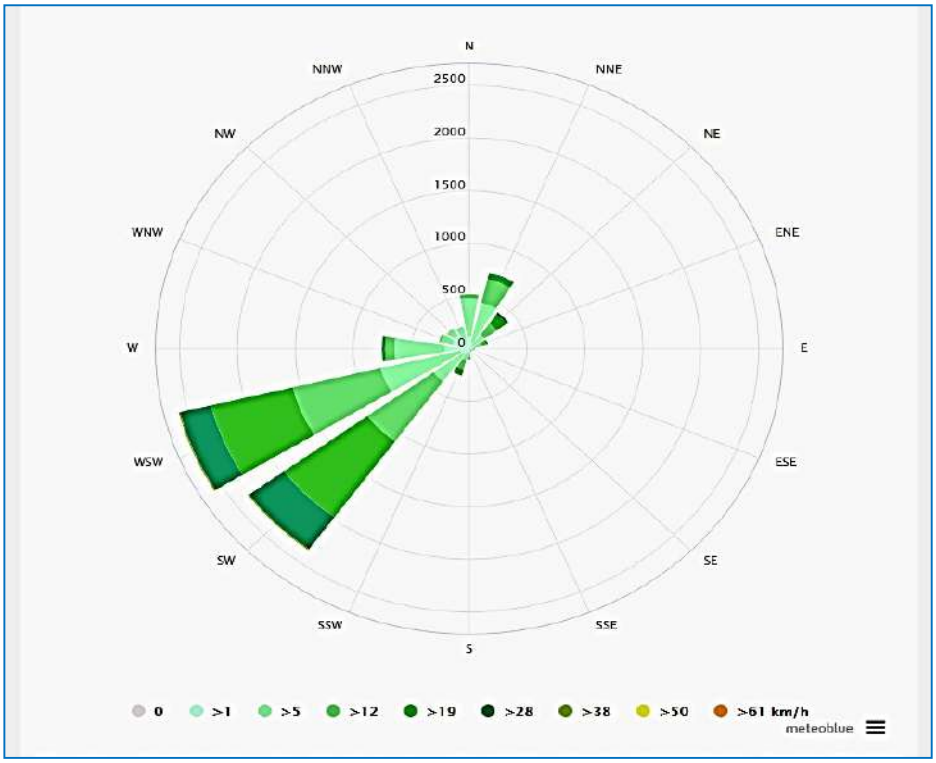


Figure 4.3: Wind rose for Karachi shows[7]

iv. Humidity

The relative humidity typically ranges from 25% (dry) to 70% (humid) over the course of a year, rarely dropping below 20% (very dry) and reaching as high as 90% (very humid).

Table 4.6: Mean Monthly Relative Humidity (Mean) at 1200 UTC (%)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2014	25.0	27.0	35.0	47.0	57.0	61.0	64.0	61.0	60.0	36.0	36.0	31.0	45.0
2015	38.0	41.0	37.0	45.0	60.0	56.0	69.0	67.0	56.0	47.0	28.0	31.0	47.9
2016	46.0	25.0	41.0	47.0	60.0	60.0	68.0	70.0	63.0	57.0	34.0	38.0	50.8
2017	38.0	25.0	36.0	44.0	59.0	62.0	70.0	67.0	63.0	44.0	29.0	20.0	46.4
2018	36.0	37.0	33.0	45.0	46.0	65.0	65.0	68.0	63.0	40.0	32.0	30.0	46.7
2019	40.4	33.9	36.6	48.0	55.6	58.8	64.8	72.6	67.6	41.1	34.6	29.7	48.6
2020	29.9	28.1	34.2	44.4	57.1	56.8	65.0	74.8	62.4	38.1	32.9	29.1	46.1
2021	31.3	34.1	41.2	43.3	54.3	60.3	67.5	64.5	63.0	46.5	27.6	38.7	47.7

Source: *Pakistan Meteorological Department*

1.1- [7] *Source:https://www.meteoblue.com/en/weather/forecast/modelclimate/karachi_pakistan_1174872*

4.5 Hydrology

Surface Water Resources

According to Karachi Water and Sewerage Board (KWSB), there are two sources of water supply in Karachi, i) River Indus supplied 1,200 cusecs daily equal to 645 MGD; and ii) Hub dam supplies about 50 MGD.

The Hub dam supply is rain fed so it fluctuates between about 30 – 15 MGD. By realizing the growing demand of water in Karachi city, the KW&SB is expending water supply system with an additional 650 MGD, known as K-IV water supply project, which will supply additional water from the Indus River through Kinjhar Lake by a different route of approximately 130-km length. The main components of the project include canals, two-phase pumping, three urban water storage reservoirs, and links with existing networks.

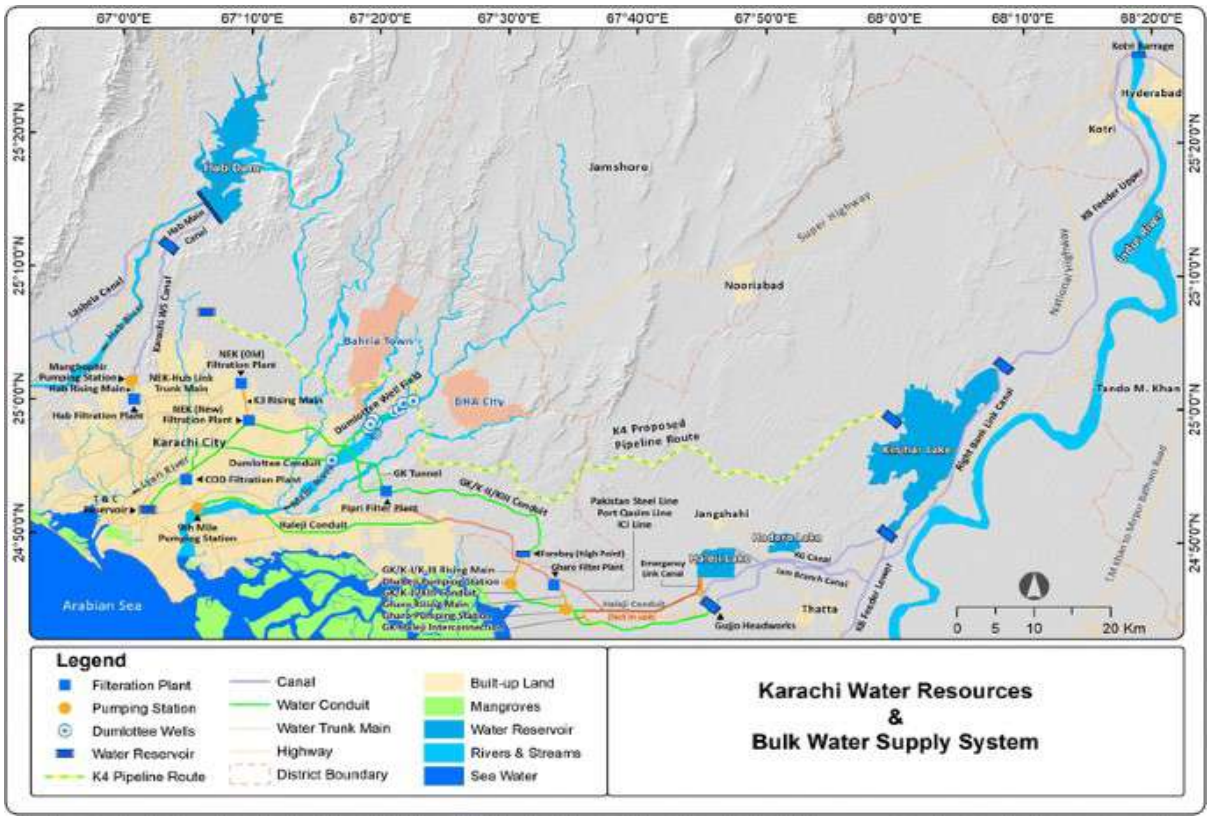


Figure 4.10: Water Resources in Karachi

(Source: Ihsanullah, 2009[8])

The World Bank is providing support to Karachi for the improvement of water and sewerage services and the governance through water supply and sewerage improvement project. The proponent of the project is the 'Karachi Water and Sewerage Board (KWSB)'.

The Project is divided into three implementation phases and every phase shall consists of three components as given below:

[8] Ihsanullah (2009) Evaluation and prospects of scientific management of water resources in Karachi city: A GIS perspective. Department of Geography, University of Karachi, Karachi, Karachi

Component-1: Reforms This component of project comprises of those activities which will support to reform the KWSB institution for better service delivery in the Karachi city.

Component-2: Securing Sustainable Water Supply and Sanitation The water supply and sewerage system improvement will be carried out under this component. Various activities will be carried out for the maintenance of the existing and the installation of new water supply and sewerage infrastructure.

Component-3: Project Management and Studies Under this component, various feasibility studies and tender documents of water / wastewater projects will be prepared for the current and the next phase of the Project.[9]

Groundwater Resources

Groundwater resources in this division are limited. The aquifers close to the coastal belt are mostly saline and unusable for domestic purposes. The aquifers near the Hub River bed are well developed and are source of water for agriculture and other domestic purposes. Generally, the aquifers in Karachi are estimated to lie at depth of 50m to 100m.

Groundwater Recharge Characteristics/Sea water Intrusion: Presently, coastal Karachi is known to have five sources of recharge to its groundwater reserves.

i. Rainfall,
ii. Indus River water supply
iii. Hub-River & Hub Lake water supply
iv. Polluted Lyari and Malir rivers/ contributory channels draining mixtures of domestic industrial and agricultural wastewater, composed of pre-said three sources
v. Seawater.

The possibilities of major contribution to groundwater recharge of shallow/phreatic aquifer directly by local rainfall seems very small, due to very poor frequency of rainfall events and rainfall intensities in the Karachi and high evaporation rates. The long-term (15 years annual record) mean monthly average precipitation for Karachi is between 0-15 mm during the months of January to June, 23 - 91 mm during the months of July to September, and 0-7 mm during the months of October to December. The remaining four sources play a significant role in recharge of the shallow aquifer-system and deep groundwater system (confined aquifer) in coastal Karachi. Unpolluted seawater of Karachi coast is characterized by a δ 18O value of ~ +1 ‰ VSMOW and a chloride content of ~23000 ppm. Both the Lyari River and Malir River waters, as well as the Indus River water and the Hub Lake water, have extremely very low aqueous contents of chloride and sulfate ions as compared to seawater. The average mean value of δ 18O in polluted river waters is ~ 5 ‰ V-SMOW and in shallow groundwater is -5.9 ‰ V-SMOW. The relatively deeper ground waters representing confined aquifer have a mean δ 18O value of -4.3 ‰ VSMOW and excessively high values of aqueous chloride and sulfate.

[9] https://www.kwsb.gos.pk/wp-content/uploads/2020/07/DRAFT-EMF-FOR-KWSSIP.pdf

Water Supply and Demand

Recent studies suggest that population will grow by 30 per cent from 2017 to 2030 in Karachi. This will translate in an increased water demand which will in turn put pressure on the already scarce water resources. The Water supply provided by Karachi Water and Sewerage Board (KWSB) is approximately 665 MGD against a demand of 820-1200 MGD resulting in a shortfall of 155-535 MGD. Unfortunately, an estimated 35 per cent (232 MGD) of the supplied water is lost during transmission thus decreasing the water availability to a mere 433 MGD[10].

The water supplied to Karachi fails to meet the water demand of the city. Therefore, the use of groundwater has increased for certain domestic and industrial purposes within the city. The available groundwater resources are mostly saline in nature as the city is located near coastal belt and excessive extraction of groundwater has resulted in seawater intrusion into the available water aquifers located in the areas near the sea[11].

The table below shows water supply and demand gap till the year 2017.

Table 4.9: Water Supply and Demand Gap till the Year 2017

Year	Population (Million)	Demand (MGD)	Supply (MGD)	Gap (MGD)
1998	11.3	567	410	157
2017	14.9	820	650	170
Source: WWF (2019)[10]				

In January 2018, the Supreme Court appointed Honorable Justice Amir Hani Muslim, a retired Supreme Court judge, the new head of the water commission with a mandate to 'implement" the recommendations of the previous commission that the apex court had formed in December 2016 in response to my constitutional petition. The commission turned into a forum of first choice for many water-starved people, whether living in Tharparker's deserts or Karachi's posh localities. Treatment of sewage, a much-neglected issue, saw a revival under the commission. Thus, Sewage Treatment Plant-III (77MGD) was restored in June 2018. STP-I (100MGD) would start by end of 2019. STP-IV (180MGD) should also operate by December 2020. Five industrial effluent treatment plants are scheduled to be built in the SITE, Trans-Lyari, F.B, Landhi and Superhighway areas.

Table 4.10 Present Water Supply Capacity

Supplied from		Rated Capacity	Actual Supply
Gharo Filtration Plant		20 MGD	30 MGD
Pipri Filtration Plant	with Filtration	100 MGD	102 MGD
	without Filtration	-	32 MGD
Dumlottee Conduit (without	from Wells	20 MGD	0 MGD

[10] WWF. (2019). Situational Analysis of Water Resources in Karachi. https://d2ouvy59p0dg6k.cloudfront.net/downloads/report situational analysis_of_water_resources_of_karachi.pdf
[11] Khattak, M. I., & Khattak, M. I. (2013). Ground water analysis of Karachi with reference to adverse effect on human health and its comparison with other cities of Pakistan. *Journal of Environmental Science and Water Resources*, 2(11), 410-418.

Table 4.10 Present Water Supply Capacity			
Supplied from		**Rated Capacity**	**Actual Supply**
Filtration)	from GK/K-III Systems	-	17 MGD
NEK Old Filtration Plant		25 MGD	5 MGD
NEK New Filtration Plant		100 MGD	100 MGD
COD Filtration Plant	with Filtration	115 MGD	104 MGD
	without Filtration	-	48 MGD
Hub Filtration Plant		80 MGD	80 MGD
Supply without Filtration (from K-III System)		100 MGD	95 MGD
Supply without Filtration (from GK System)		-	17 MGD
Total		560 MGD	630 MGD

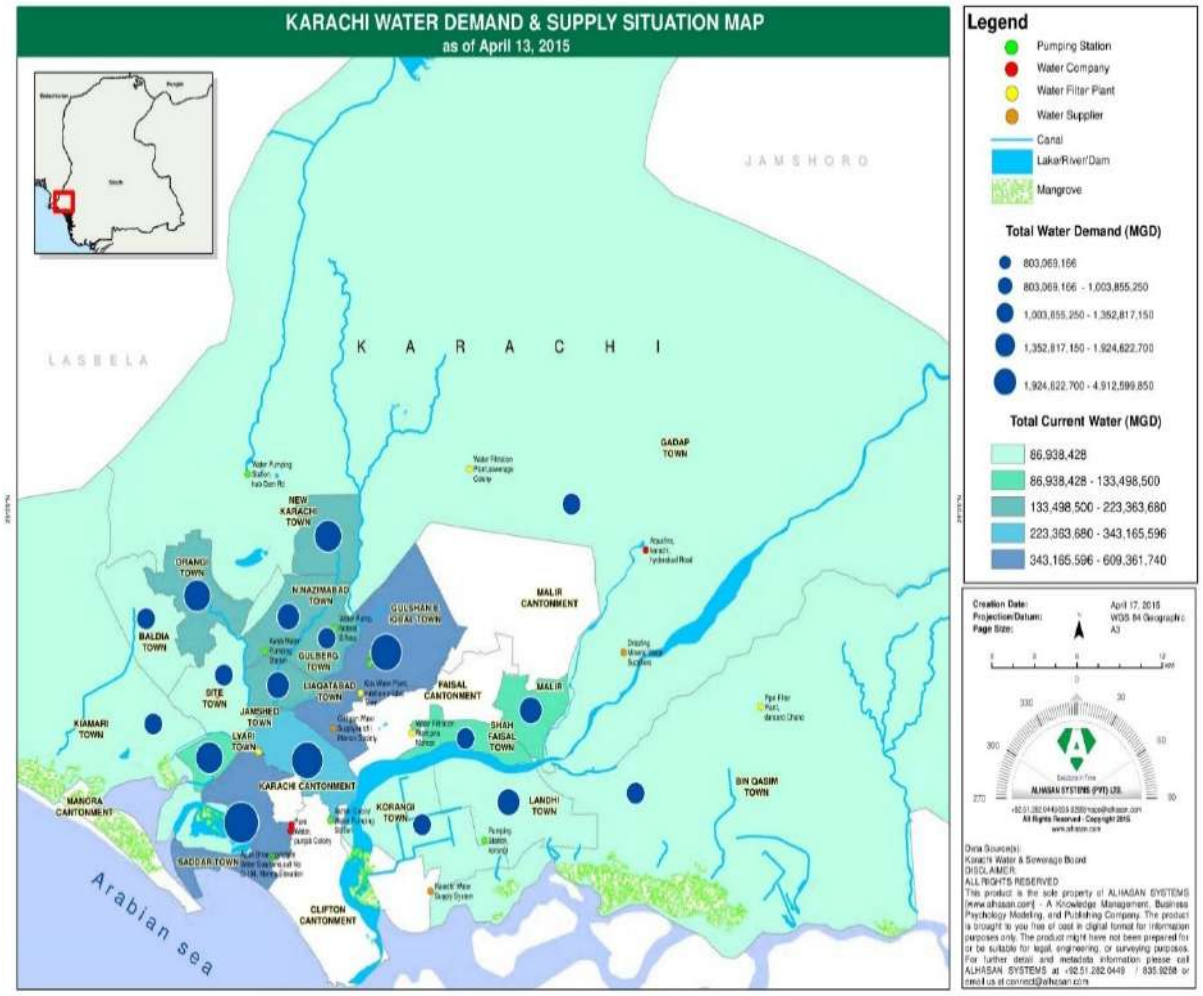


Figure 4.11: Karachi Monthly Water Demand (Source: KW&SB)

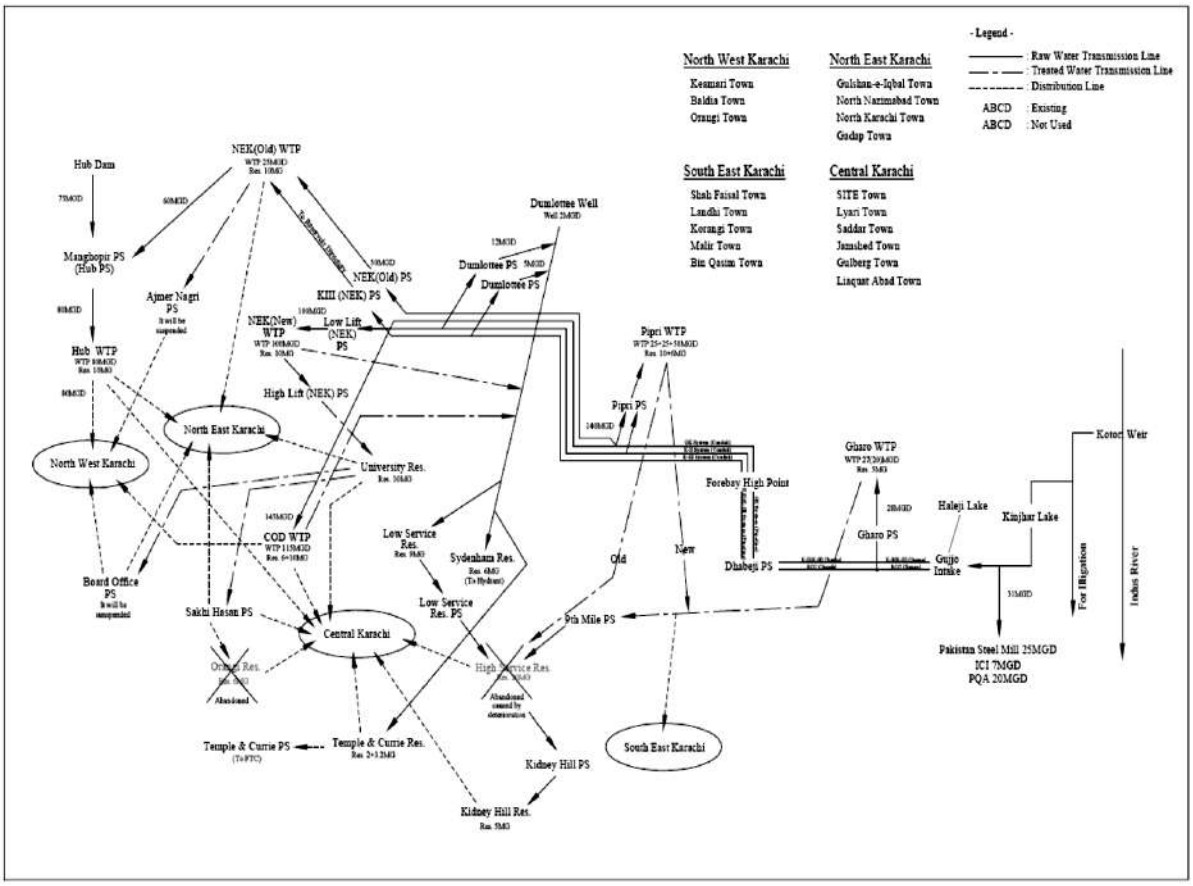


Figure 4.12: Water Transmission System

The Sewerage System: The existing sewerage catchment area which covers 18 towns in Karachi city is divided into three districts, namely: respective catchment area of T.P-1, T.P-2 and T.P-3. KW&SB formulated the Master Plan of the water supply and sewerage system in cooperation with JICA in 2008. However, most of the projects for rehabilitation and augmentation proposed in the Master Plan study, etc. have not been carried out due to financial constraint of KW&SB. Due its negligence to maintain and operationalize the treatment plants, not only municipal effluent but industrial effluent also is directly going into sea destroying marine life.

In January 2018, the Supreme Court appointed Honorable Justice Amir Hani Muslim, a retired Supreme Court judge, the new head of the water commission with a mandate to 'implement" the recommendations of the previous commission that the apex court had formed in December 2016 in response to my constitutional petition. The commission turned into a forum of first choice for many water-starved people, whether living in Tharparker's deserts or Karachi's posh localities. Treatment of sewage, a much-neglected issue, saw a revival under the commission. Thus, Sewage Treatment Plant-III (77MGD) was restored in June 2018. STP-I (100MGD) would start by end of 2019. STP-IV (180MGD) should also operate by December 2020. Five industrial effluent treatment plants are scheduled to be built in the SITE, Trans-Lyari, F.B, Landhi and Superhighway areas.

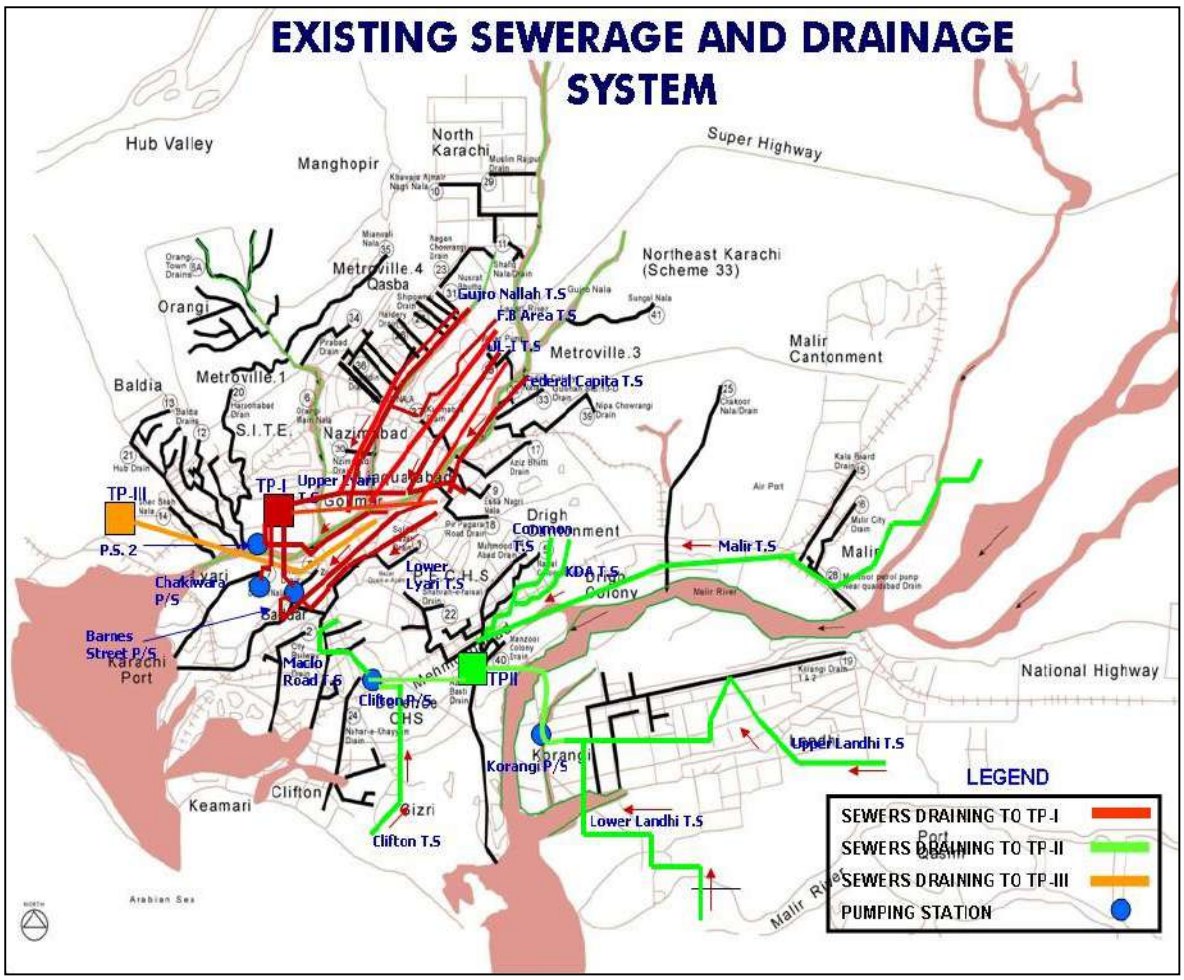


Figure 4.13: Existing Sewerage System of Karachi

Water Quality

Two drinking water samples were taken from the project area and were tested for water quality parameters. Results are shown below;

ANALYTICAL TEST REPORT (Sample-1)							
S. NO.	PARAMETERS	STANDARDS	STANDARD	LDL	UNITS	RESULTS	TEST METHOD
		SSDWQ - LIMITS	WHO				
1	pH value	6.5 – 8.5	6.5 – 8.5	0.01	SU	7.31	USEPA 150.1
2	Odour	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
3	Taste	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
4	Color	≤ 15	≤ 15	1.0	TCU	0.46	APHA-2020 B/C
5	Turbidity	< 5	<5	0.01	NTU	0.33	APHA-2130 B

6	Total Dissolved Solids (TDS)	< 1000	NS	1.0	mg/L	925	Hach 8160
7	Total Hardness as $CaCO_3$	< 500	180	0.1	mg/L	310	EDTA Titration.Hach-8213
8	Fluoride (as F^-)	≤ 1.5	≤ 1.5	0.01	mg/L	0.5	USEPA 340.1
9	Chloride (as Cl^-)	< 250	< 250	0.1	mg/L	280*	Hach 8206
10	Nitrate (NO_3)	≤ 50	≤ 50	0.01	mg/L	0.37	Hach -8039
11	Nitrite (NO_2)	≤ 3	≤ 3	0.001	mg/L	0.031	Hach - 8153
12	Cyanide (as CN-) total	≤ 0.05	< 0.7	0.001	mg/L	BDL	Hach 8027
13	Phenolic Compound as (Phenols)	-	-	0.001	mg/L	BDL	USEPA-420.1
14	Aluminum (Al)	≤ 0.2	≤ 0.2	0.001	mg/L	BDL	APHA-3111 D
15	Antimony (Sb)	≤ 0.005	0.02	0.001	mg/L	BDL	APHA-3111 B
16	Arsenic	≤ 0.05	≤ 0.01	0.01	mg/L	BDL	APHA-3120 B
17	Cadmium	0.01	0.003	0.001	mg/L	BDL	ASTM D-3557
18	Chromium Total	≤ 0.05	≤ 0.05	0.01	mg/L	BDL	ASTM D-1687
19	Copper	2	2	0.01	mg/L	0.021	Hach 8506
20	Lead	≤ 0.05	≤ 0.01	0.001	mg/L	BDL	ASTM D-3559
21	Mercury	≤ 0.001	≤ 0.001	0.001	mg/L	BDL	ASTM D-3223
22	Selenium	0.01	0.04	0.001	mg/L	BDL	ASTM D-3859
23	Nickel	≤ 0.02	< 0.02	0.01	mg/L	BDL	ASTM D-1886
24	Boron	0.3	0.3	0.01	mg/L	BDL	ASTM D-3082
25	Zinc	5.0	3.0	0.01	mg/L	0.043	USEPA 3500 Zn B
26	Manganese	≤ 0.5	≤ 0.5	0.01	mg/L	0.03	Hach 8034
27	Barium	0.7	0.7	0.01	mg/L	BDL	Hach 8014
MICROBIOLOGICAL ANALYSIS REPORT							
28	Total Coliform	0 cfu/100mL	0	0	Cfu	>250*	APHA-SM9221B
29	Fecal Coliform	0 cfu/100mL	0	0	Cfu	>100*	APHA-SM9221F
30	Escherichia Coli(E-Coli)	0 cfu/100mL	0	0	cfu	>80*	APHA-SM9221F

ANALYTICAL TEST REPORT (Sample-2)							
S. NO.	PARAMETERS	STANDARDS	STANDARD	LDL	UNITS	RESULTS	TEST METHOD
		SSDWQ - LIMITS	WHO				
1	pH value	6.5 – 8.5	6.5 – 8.5	0.01	SU	7.60	USEPA 150.1
2	Odour	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
3	Taste	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
4	Color	≤ 15	≤ 15	1.0	TCU	0.41	APHA-2020 B/C
5	Turbidity	< 5	<5	0.01	NTU	0.31	APHA-2130 B
6	Total Dissolved Solids (TDS)	< 1000	NS	1.0	mg/L	902	Hach 8160
7	Total Hardness as $CaCO_3$	< 500	180	0.1	mg/L	299	EDTA Titration.Hach-8213
8	Fluoride (as F^-)	≤ 1.5	≤ 1.5	0.01	mg/L	0.42	USEPA 340.1
9	Chloride (as Cl^-)	< 250	< 250	0.1	mg/L	253*	Hach 8206
10	Nitrate (NO_3)	≤ 50	≤ 50	0.01	mg/L	0.34	Hach -8039
11	Nitrite (NO_2)	≤ 3	≤ 3	0.001	mg/L	0.027	Hach - 8153
12	Cyanide (as CN-) total	≤ 0.05	< 0.7	0.001	mg/L	BDL	Hach 8027
13	Phenolic Compound as (Phenols)	-	-	0.001	mg/L	BDL	USEPA-420.1
14	Aluminum (Al)	≤ 0.2	≤ 0.2	0.001	mg/L	BDL	APHA-3111 D
15	Antimony (Sb)	≤ 0.005	0.02	0.001	mg/L	BDL	APHA-3111 B
16	Arsenic	≤ 0.05	≤ 0.01	0.01	mg/L	BDL	APHA-3120 B
17	Cadmium	0.01	0.003	0.001	mg/L	BDL	ASTM D-3557
18	Chromium Total	≤ 0.05	≤ 0.05	0.01	mg/L	BDL	ASTM D-1687
19	Copper	2	2	0.01	mg/L	0.032	Hach 8506
20	Lead	≤ 0.05	≤ 0.01	0.001	mg/L	BDL	ASTM D-3559
21	Mercury	≤ 0.001	≤ 0.001	0.001	mg/L	BDL	ASTM D-3223
22	Selenium	0.01	0.04	0.001	mg/L	BDL	ASTM D-3859
23	Nickel	≤ 0.02	< 0.02	0.01	mg/L	BDL	ASTM D-1886
24	Boron	0.3	0.3	0.01	mg/L	BDL	ASTM D-3082

Test Results reveal presence of coliforms in water samples.

25	Zinc	5.0	3.0	0.01	mg/L	0.041	USEPA 3500 Zn B
26	Manganese	≤ 0.5	≤ 0.5	0.01	mg/L	0.02	Hach 8034
27	Barium	0.7	0.7	0.01	mg/L	BDL	Hach 8014
MICROBIOLOGICAL ANALYSIS REPORT							
28	Total Coliform	0 cfu/100mL	0	0	Cfu	>200*	APHA-SM9221B
29	Fecal Coliform	0 cfu/100mL	0	0	Cfu	>90*	APHA-SM9221F
30	Escherichia Coli(E-Coli)	0 cfu/100mL	0	0	cfu	>80*	APHA-SM9221F

4.6 Ambient Air Quality and Noise Quality

An Ambient Air monitoring study and Noise monitoring were conducted in the microenvironment of the proposed project site.

Results of ambient air and noise monitoring conducted in the microenvironment of the study area are following:

Ambient air monitotring (location A)						
Parameter	**Unit**	**Monitoring Duration**	**Average Obtained Concentration**	**SEQS**	**IFC Limits**	**Methodology**
Carbon Monoxide (CO)	**mg/m3**	**08 Hours**	**0.09**	**5.0**	**NA**	**Non Dispersive Intra Red (NDIR)**
Nitrogen oxide (NO)	**µg/m3**	**08 Hours**	**15.6**	**40.0**	**NA**	**Chemiluminescence**

Nitrogen Dioxide (NO2)	µg/m3	08 Hours	13.6	80.0	200	
Sulphur Dioxide (SO2)	µg/m3	08 Hours	20.9	120.0	20	Ultraviolet Fluorescence Method
Ozone (O3)	µg/m3	01 Hour	16.2	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM10)	µg/m3	08 Hours	99.2	150.0	50	β Ray Absorption Method
Particular Matter (PM2.5)	µg/m3	08 Hours	20.5	75.0	25	
Total Suspended Particles (TSP)	µg/m3	08 Hours	279.1	500.0	NA	
Lead	µg/m3	08 Hours	ND	1.5	NA	ASS Method

Ambient air monitoring (location B)						
Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m3	08 Hours	0.24	5.0	NA	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m3	08 Hours	13.0	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO2)	µg/m3	08 Hours	20.9	80.0	200	
Sulphur Dioxide (SO2)	µg/m3	08 Hours	25.6	120.0	20	Ultraviolet Fluorescence Method
Ozone (O3)	µg/m3	01 Hour	16.2	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM10)	µg/m3	08 Hours	96.8	150.0	50	β Ray Absorption Method
Particular Matter (PM2.5)	µg/m3	08 Hours	23.7	75.0	25	
Total Suspended Particles (TSP)	µg/m3	08 Hours	231	500.0	NA	
Lead	µg/m3	08 Hours	ND	1.5	NA	ASS Method

Ambient air monitoring (location C)						
Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m3	08 Hours	0.36	5.0	NA	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m3	08 Hours	18.9	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO2)	µg/m3	08 Hours	20.8	80.0	200	
Sulphur Dioxide (SO2)	µg/m3	08 Hours	27.3	120.0	20	Ultraviolet Fluorescence Method
Ozone (O3)	µg/m3	01 Hour	18.4	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM10)	µg/m3	08 Hours	97.2	150.0	50	β Ray Absorption Method
Particular Matter (PM2.5)	µg/m3	08 Hours	21.3	75.0	25	
Total Suspended Particles (TSP)	µg/m3	08 Hours	263.0	500.0	NA	
Lead	µg/m3	08 Hours	ND	1.5	NA	ASS Method

NOISE LEVEL TEST REPORT						
S.NO.	LOCATION/SOURCE	Noise Level Readings				
		Minimum	Maximum	Average	SEQS	WHO
1	Point -1 25°02'02.07"N 66°59'40.41"E	52.1	55.9	54.0	Limits: *65dB(A)	Limits: *70dB(A)
2	Point -2 25°01'37.52"N 66°58'48.15"E	50.6	56.2	53.4		
3	Point -3 25°01'27.32"N 67°00'07.89"E	53.0	57.0	55.0		
4	Point -4 25°01'23.08"N 66°59'31.27"E	51.6	56.8	54.2		
5	Point -5 25°01'56.62"N 66°58'54.05"E	52.0	57.4	54.7		

4.7 Solar Resource

The district receives abundant sunshine round the year and has good solar PV power potential. World bank group's Energy Sector Management Assistance Program (ESMAP) has developed solar maps for countries including Pakistan. Solar's maps have been developed for Direct Normal Irradiation (DNI), Global Horizontal Irradiation (GHI) and Photovoltaic Power Potential. Maps have been depicted below;

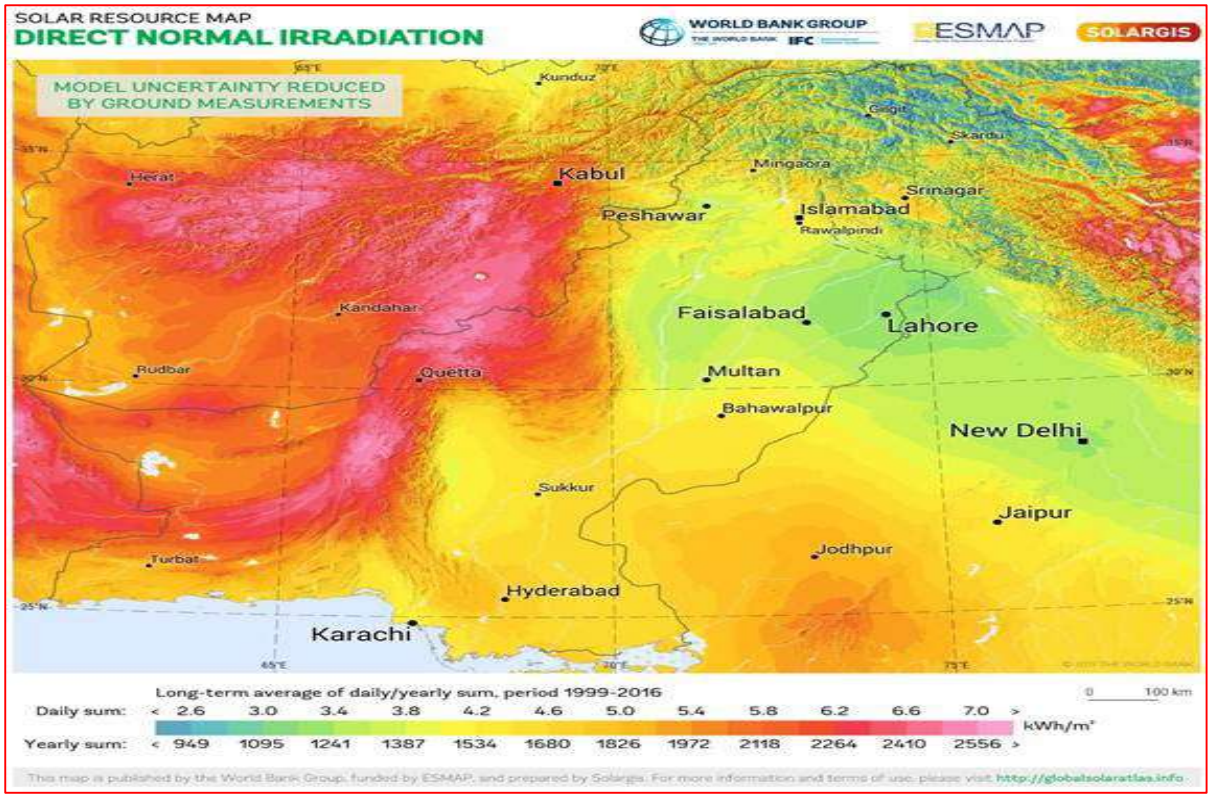


Figure 4.3: Solar Resource Map – Direct Normal Irradiation – Pakistan

DNI value for the Karachi solar power plant site is approx. 1534 kWh/m^2/year.

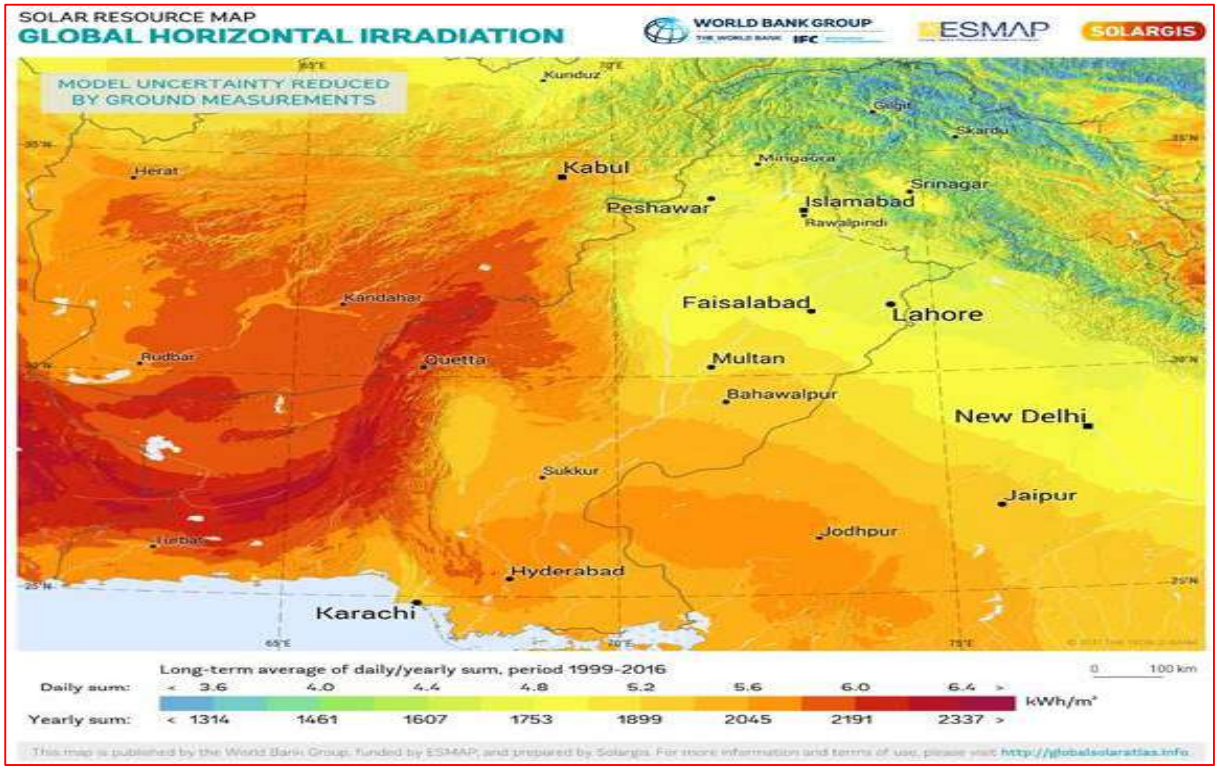


Figure 4.4: Solar Resource Map – Global Horizontal Irradiation – Pakistan

GHI value for Karachi solar power plant site is approx.1899 kWh/m^2/year.

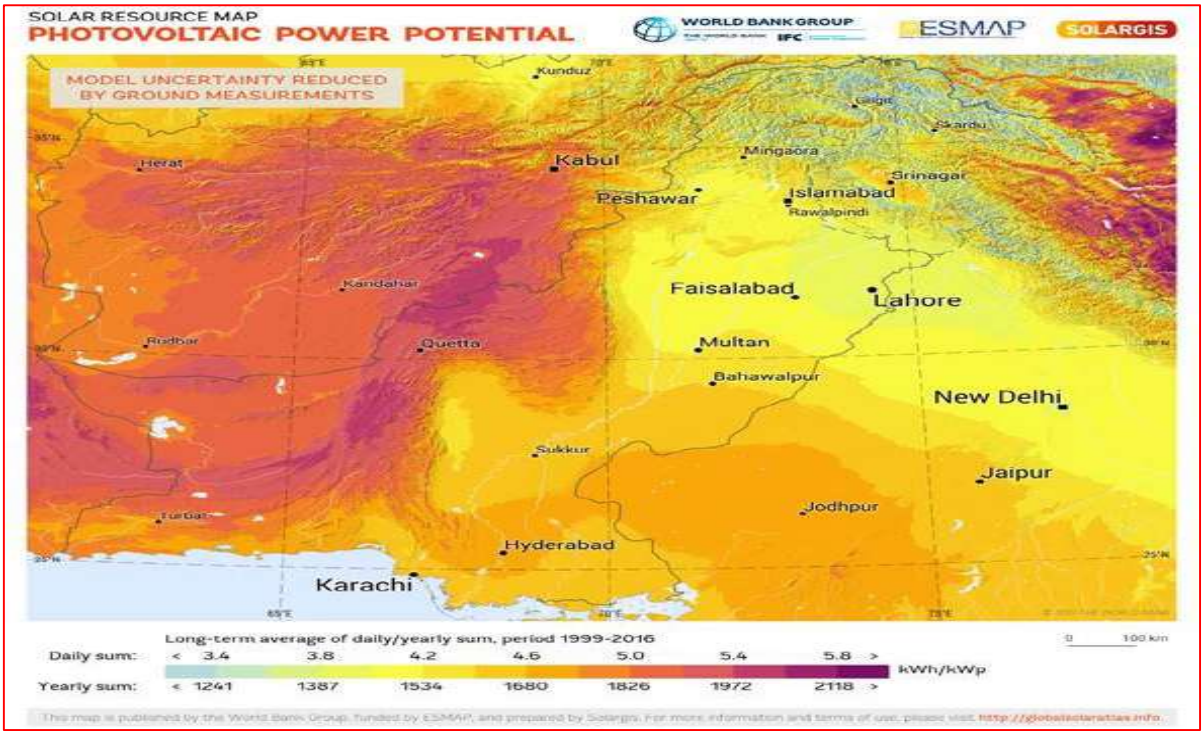


Figure 4.5: Solar Resource Map – PV Power Potential – Pakistan

Total PV Power Potential for Karachi solar power plant site is approx.1680 kWh/kWp.

4.8 Ecology

The ecology of microenvironment and macroenvironment of the project area has completely changed as a result of continuous emergence of urban conglomerates. Ecological risk of high order has been induced by land clearance and removal of natural vegetation from the plains during the urban sprawl to make room for industrialization and urbanization. This has degraded the physical environment as quantified in the above section & the biological environment in the sense that the entire macroenvironment has lost its biodiversity. During the survey, a smaller number of flora species was recorded in the project area such as;

1. Conocarpus spp.
2. Acacia Nilotica - (Sindhi Babur)
3. Capparis Decidua - (Kirar)
4. Ficrus Religiosa - (Pepul)
5. Azadirachta Indica - (Neem)
6. Prosopis juliflora

Horticulturists and tree activists have declared Conocarpus as harmful as the eucalyptus trees planted in the past. Eucalyptus was planted in huge numbers across the city only to be cut down for its negative impact on the environment. The same mistake was repeated with Conocarpus. In response to the

growing concern against planting Conocarpus, district governments have put tremendous efforts in recent years towards plantation of Neem trees and other native species in the city.

4.9 Socio Economic Environment

4.9.1 Administration

Over the past several decades, Karachi has seen dramatic administrative changes. At the turn of the century, the Karachi Division that comprised of five districts was abolished and a new 'City District Government of Karachi' (CDGK) was established. The City District Karachi was divided into 18 Towns and 178 union councils. In July 2011, with the re-emergence of the Pakistan People's Party (PPP), the, Sindh Government restored the 5 districts of Karachi Division and abolished the City District Government Karachi set-up. In November 2013, a new district, Korangi was formed by splitting District East. Furthermore, in September, 2020, the Government of Sindh approved establishment of Karachi's seventh District, Keamari. District Keamari has been carved from the existing District West[12]. Presently, Karachi Division is comprised of District Central, District East, District Malir, District South, District Korangi, District West and District Keamari. There are also six military cantonments, which are administered by the Pakistan Army.

The proposed project is located in District West, Karachi. District west covers a total area of 169.2 sq.km while Manghopir covers an area of 149 sq.km. A total of 3 subdivisions falls under District West Karachi which include Manghopir sub-division, Mominabad sub-division, and Orangi sub-division. District west is managed by the District Municipal Corporation West and is headed by the Chairman, DMC West.

• **Covered Area of District & Sub-Division**	
• **District West**	• Manghopir Sub-Division
• **169 Sq. km**	• 149 Sq. km

Prior to the splitting of District West, which was the biggest district of Karachi had the total area of district is 630 sq.km. On the other hand, the newly established District West excluding District Keamari is only 169 sq.km area with the Manghopir Sub-Division covering the majority of the area of District West. It is mentioned here that data regarding population and area of the newly established district has been according to the data available on the internet.

Population

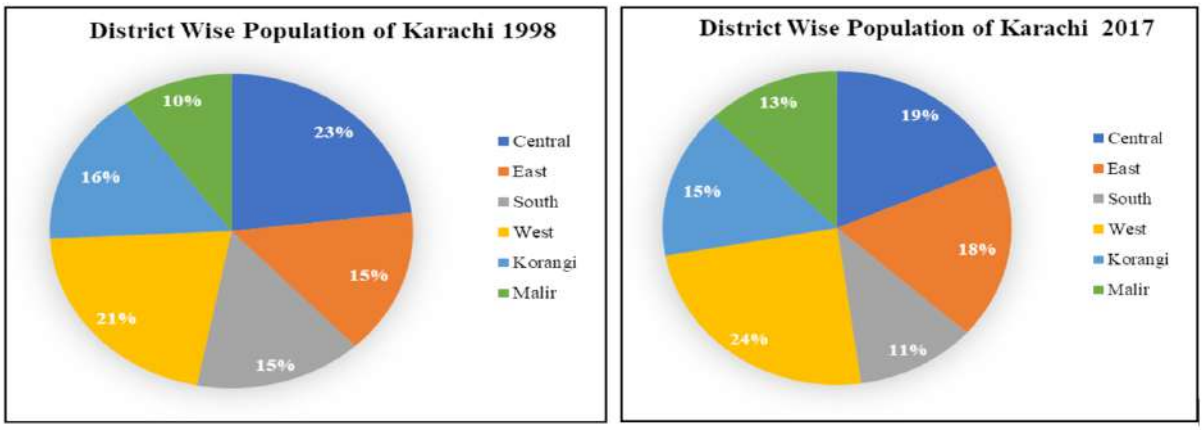
District west is an industrial and commercial district enjoying diverse land use occupations. The main occupation of the people is business and trade. The other major portion of the population consists of labour class including skilled and unskilled labour. There are large numbers of people involved in the fishing industry and transportation business. The remaining small portion of the population are employed in government departments and private companies.

• **Demographic Change in District West and Manghopir Sub-Division (1998-2017)**		
• **1998 Census Population**	• 2017 Census Population	• %Change (1998-2017)

[12]Notification No.08/KEAMARI DISTT/2020/Rev.I(II)719 dated 4.9.2020

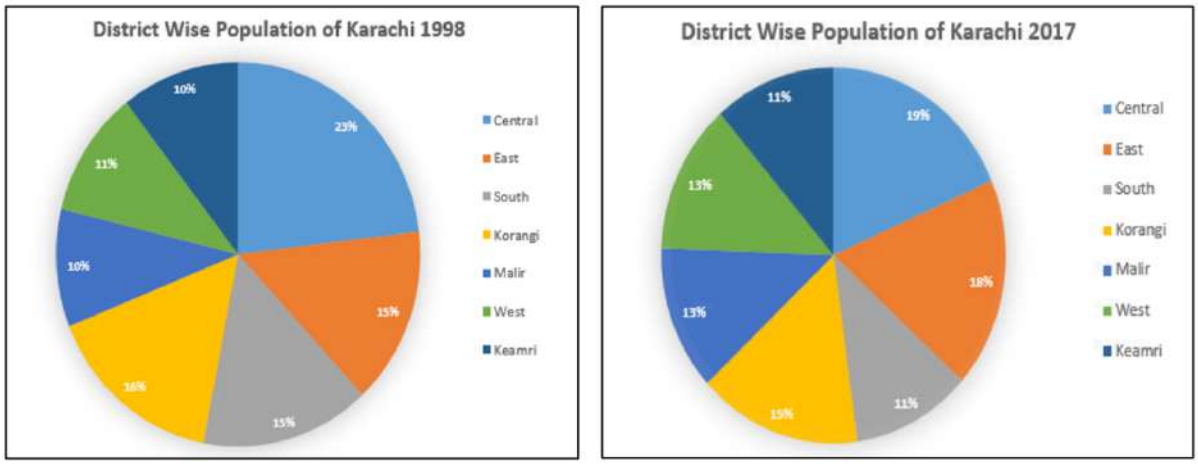
• **District West**		
• **1,052,046**	• 2,080,893	• 98
• **Mangohpir Sub-Division**		
• **118,267**	• 713,753	• 507
• **Source: Pakistan Bureau of Statistics 2017 (PBS)**		

The total population of District West was 1,052,046 in the 1998 census which increased to 2,080,893 in the 2017 census showing an increase of 98%. The total population of the Manghopir sub-division was 118,267 according to the 1998 census which increased to 713,753 in the 2017 census showing an increase of 507%. The new district Kemari is divided out from the District West in 2020. The rising population has come out in about two decades, largely due to massive immigration of low-income communities from the other provinces of the country. Another reason for the dramatic population surge could be the launch of numerous low-income housing schemes in the periphery of the city.



District wise Population according to the 1998 and 2017 Census

According to the 1998 census, District West was the second most densely populated District of Karachi comprising 21% of the entire population before it was not divided. According to the census of 2017 District West was remained the most populated District of Karachi comprising 24% of the population. But below pie-chart shows about equal population of District Malir and West after splitting of West District in 2020.



4.9.2 Transportation

The impact of the transport crisis on people's lives is enormous. Travelling in environmentally degraded conditions for long hour's results in physical and mental health problems. This effects family and social life and limits peoples' choice of livelihoods (especially for women) since they wish to work in areas that they can easily access through the existing transport system. Increasingly, transport availability and quality is also determining where they would like to live.

The Hub River Road, a 4-5-kilometre long which connects Sindh to Baluchistan is busiest and important road. It has heavy traffic which also links to Karachi- Hyderabad Motor way through Northern Bypass Road. The existing road infrastructure serves the localized traffic of the densely populated areas along both sides, traffic of local industries, the recreational traffic to the beaches, the heavy traffic between the port/ SITE area and the Hawks Bay truck stand, and the defence / logistic needs of Pakistan Air force and Naval establishments at Mauripur and Manora. The situation becomes even worse during the rainy season or on holidays and it takes a long time to cross this section due to the rush of light vehicles and mini business of the picnickers.

4.9.3 Economy

District West's industries contribute in the economy of the Karachi as well. There are number of textiles, steel, heavy machinery and chemicals industries in the area namely chemical Coating Centre, Captain P.Q Chemical industries. There are some famous marble industries are Basheer-ud-din Marble Industry and All Karachi Marble association. There are also Textile and Metal industries that are Jawed Metal Industry, Matrix Industries, Al Hafeez Textile Industries Unit-1 and Bliss Textile Industry. Plastic industries are also present in this district that are Mehran Plastic Industries and Sarhad Plastic Industries.

4.9.4 Education Facilities

The education facilities available in the District West are not commensurate with the number population. A large number of schools, colleges, technical colleges have been opened up in the district by the government as well as by private organization. Hamdard University (Madinat-ul-Hikmat) founded by the late Hakeem Muhammad Saeed is promoting knowledge in the field of Medicine, Computer Science and Business Administration is one of the leading institute in the district. The below statistics show that District West has second higher numbers of schools, the enrollment of the students and sufficient numbers of teachers than other districts of the Karachi division. The number of schools, enrollment and teachers shows here active involvement of the residents of the District West in the education sector.

District wise Number of Schools, Enrollment and Staff in Karachi (2016-17)

District	No. of Schools				Enrollment			Teacher		
	Boys	Girls	Mixed	Total	Boys	Girls	Total	Male	Female	Total
Central	117	141	348	606	44,822	58,510	103,332	1,803	4,996	6,799
East	51	64	163	278	23,022	29,106	52,128	870	2,271	3,141
South	70	87	173	330	26,122	35,824	61,946	1,079	2,496	3,575
West	128	101	340	569	38,562	45,454	84,016	1,443	1,909	3,352

Malir	136	113	414	663	34,548	32,333	66,881	1,540	1,148	2,688
Korangi	97	94	220	411	35,192	46,918	82,110	1,025	3,082	4,107
Source: Sindh Education Management Information System (SEMIS) Census 2016 – 2017										

Facilities available in the schools are presented in the table below. It illustrates that advance facilities in schools of District West have improved their standard in educating its residents on a certain level. Apart from the Government-run education institutions, dozens of private schools are also functioning in the district.

District-wise Basic and Advance Facilities in Schools of Karachi							
Districts	Schools	Electricity	Washroom	Drinking Water	Boundary Wall	Lab	Library
Central	607	447	484	507	529	121	56
East	264	223	241	219	238	59	25
South	482	383	426	356	432	49	49
West	363	232	301	256	340	82	27
Korangi	550	397	431	391	509	46	37
Malir	591	240	398	302	479	56	21
Source: SEMIS Census 2016 – 2017							

4.9.5 Public Health Facilities

Like other cities which have innovative and modern healthcare facilities, Karachi is equipped with the best hospitals in Pakistan. These hospitals are possessed by top-notch doctors, surgeons, and health specialists who provide the most authentic and reliable diagnosis and treatment to the patients who come from all corners of the country. The public health facilities in Karachi are highly centralized in a few locations and cannot cater to a large part of the population. The below mentioned public health facilities data is not updated in the government records thus subject to some shortcomings. Though health facilities available in District West Karachi include public, private and welfare hospitals need to be increased.

The following table shows the number of health practitioners and paramedical personnel in Karachi.

District-wise Government Medical and Paramedical Personnel in Karachi 2017											
District	Doctors	Nurses	L.H. V	Dispensers/Dressers	X-Ray Technicians	Lab Technicians	O.T Technicians	X-Ray Assistants	Lab. Assistants	O.T. Assistants	Midwives
Central	579	207	15	82	12	17	25	0	3	12	26
South	324	115	4	51	14	23	33	0	8	8	2

East	245	18	22	26	4	0	3	0	4	1	6
West	356	83	19	67	12	14	22	5	12	15	19
Malir	234	25	14	53	9	4	6	0	10	5	18
Korangi	252	90	38	-	-	-	-	0	8	8	25
Source: Directorate General of Health Services, Hyderabad											

The following table shows the number of health practitioners and paramedical personnel in Karachi.

District-wise Government Health Facilities with Bed Capacity in Karachi 2017														
District	Hospital		Hospital Beds		Dispensaries		R.H Centers		T.B. Centre		B.H. Units		M.C.H.C.	
	Teaching	Civil, Specialized	Teaching	Civil, Specialized	No.	Beds	No.	Beds	No.	Beds	No.	Beds	No.	Beds
Central	-	-	3150	-	5	-	-	-	8	-	2	-	3	6
South	2	4	-	960	5	-	-	-	10	5	-	-	-	-
East	-	-	361	-	5	-	-	-	5	97	4	-	4	-
West	1	1	-	248	14	15	4	20	8	-	7	14	5	6
Malir	-	1	-	48	7	-	2	8	4	-	14	22	6	-
Korangi	-	7	-	724	8	-	-	-	7	-	8	16	4	41
Source: BOS, Government of Sindh (Development Statistics of Sindh, 2017)														

However, there are several dispensaries, maternity homes and child welfare centres and hospitals in the district which cater to the medical emergencies of the people of different localities. Namely Valika Hospital on Manghopir Road. Qatar Hospital in Orangi, Murshid Hospital and Naval Hospital in Mauripur, Ziauddin Hospital, KPT Hospital, Korean Hospital, Al-Khidmat Hospital, Arain General Hospital, Patni General Hospital, Metro Lion's Hospital, Hazrat Hassan Hospital, Rasheeda Memorial Hospital, Al-Mujeeb Welfare Hospital etc.

4.9.6 Micro environment

The microenvironment of the project will be discussed as per the left and right portions of the site;

<u>Left Portion of the Site</u>

- This portion of the site consists of mostly hilly terrain with small portions of flat terrain.

- Limited commercial activity comprising of hill cutting was witnessed.
- Small depressions, possibly formed due to movement of heavy vehicles, had formed in the area, where rainwater had accumulated over time and was serving as grounds for grazing of livestock.
- Due to the recent rains in the area, the area had also witnessed the growth of rain fed vegetation, attracting animals for grazing.

Right Portion of the Site

- This portion of the site also consists mostly of hilly terrain with small portions of flat terrain.
- Limited agricultural activity was found within the boundaries of the site as well as few farmers associated with the fields residing in the area.
- The area showed some signs of work had been done by excavators that had carved into the hills.
- Due to the recent rains in the area, the area had also witnessed the growth of rain fed vegetation, attracting animals for grazing.

Chapter 5 IMPACTS AND MITIGATION

This Chapter assesses the potential environmental and social impacts of the proposed project on environment and community. Also provided in the Chapter are the project-specific mitigation measures to minimize if not eliminating the potentially negative impacts, in order to ensure that the proposed interventions do not cause environmental and social impacts beyond the acceptable levels.

5.1 Environmental Safeguards Processing Steps

Implementation of the mitigation measures will require the following steps closely linking with activity planning, design and implementation steps.

- Step 1: Screening of Projects for impacts
- Step 2: Inclusion of Environmental Specifications and Environmental and Social Management Plan in Contractor(s) bidding documents
- Step 3: Compliance and Monitoring

5.2 Screening of Impacts

Project activities proposed for the subproject will undergo initial screening through a number of filters that include screening environmental and social impacts. Subprojects with any significant, long-term or medium term, irreversible environmental and social negative impacts will be avoided to the extent possible. A rapid assessment checklist for screening of impacts of Solar project and filled as per the environmental survey conducted for the subproject area.

Environmental & Social screening checklist

S. No	Issues	Yes	No	Don't Know	Remarks
1	Does the subproject require land acquisition?				The project will be developed on the land of GoS. Land acquisition is not required.
2	Will the project negatively impact livelihoods				The project activities will confine within the project area which is at present vacant and barren. The project will not negatively impact livelihoods rather, generation of employment is envisaged.
3	Is the project located on land with contested ownership?				No land ownership issues are with the project site.
4	Is the project located in an area with security problems				Project area does not represent substantial security threats.
5	Is the projected located on land reclaimed from floods				project site is not located on land reclaimed from floods.
6	Is the subproject located in a designated protected area?				The subproject is not located within any designated natural reserve.

S. No	Issues	Yes	No	Don't Know	Remarks
7	Is the subproject located in an area which would create a barrier for the movement of conservation-worthy wildlife or livestock?				No such barrier for the movement of wildlife or livestock is envisaged.
8	Is the project located close to groundwater sources, surface water bodies, water courses or wetlands?				No surface water body or wetland lies within 500m radius of project site.
9	Is the project located in an area with designated cultural properties such as archaeological, historical and/or religious sites?				No designated cultural properties exist in the project area.
10	Is the project located in an area from where people have been displaced?				Project site is vacant and barren.
11	Is the project located in a densely populated area?				project is located in sparsely polluted area.
12	Is the project located on prime agricultural land?				Project is not located on prime agriculture land.
13	Is the project located in an area of tourist importance?				Not known or established tourist sites exist in the subproject area nor any tourist activity was observed during surveys.
14	Is the subproject located far from accessible roads?		✓		The project is located off Northern Bypass (M10)

5.3 Assessment of Potential Impacts and Generic Mitigation

The positive and potentially negative impacts are assessed in detail in the subsections below for Solar PV project. The specific mitigation measures for sub-project impacts have also been provided hereunder.

5.3.1 Positive Socio-economic and Environmental Impacts of project

Most of the project's environmental and social impacts will be beneficial, including for example generation of clean electricity, saving of carbon footprint of energy generation, generation of employment for locals etc. The beneficial impacts of the Solar PV subproject are described briefly hereunder:

- Clean electricity generation by avoiding use of fossil fuels, thereby putting effort towards climate change mitigation and adaptation.
- Savings of CO2 emissions over the lifetime of the project.
- Generation of short term and long-term direct employment for locals. Estimated workforce for the construction phase will be 100-150 and operational phase will be around 20-30. It is envisaged that the about three-quarter of the workforce during construction phase will be required for unskilled jobs/work. Locals will be preferred for the workforce, expected to be about two-third of the unskilled workforce. For the operational phase, requirement of local unskilled labor is not expected to be more than half of the workforce. Possession of valid National Identity Card will be required to ensure hiring of locals among the workforce.
- Adding cleaner electricity to National grid to reduce the gap between demand and supply, particularly relevant for peak demand.
- Reduction of chronic power shortages.
- Indirect employment generation for the associated businesses such as suppliers & manufacturers of solar panels, inverters, transformers and maintenance service providers is also envisaged from the proposed project.
- The airshed of the area will remain unpolluted as no air emissions are associated with Solar energy generation.

The project area is underdeveloped, as indicated in the socioeconomic profile and lacks reliable supply of water and electricity. It is therefore recommended that community development in the project area being made part of the project developer's scope.

5.3.2 Impacts and Mitigation Measures

The impacts associated with these activities are impacts of dust emissions, water/groundwater contamination, soil contamination, solid waste management, noise pollution, wastewater disposal, traffic management, occupational and community risks with regards to health and safety.

5.3.3 Project Pre-Construction/Design Phase

Following is a description of impacts on each environmental and social component along with specific mitigation measures;

5.3.3.1 Impact on Ecology

The project site does not lie in a protected area, Ramsar site, reserved forest, wildlife sanctuary or game reserve. No endangered faunal specie could be found during surveys or reported at the subproject site. The project site does not have any significant flora of concern. Therefore, no significant impacts are envisaged on the flora during the project construction and operation phase. Natural drainage pattern exists at the project site.

Mitigation Measures:

- Onsite activities will be so planned that the natural drainage pattern is not disturbed.
- Rainwater drainage system will be connected with natural drainage so as not to alter the site natural drainage pattern.

5.3.3.2 Impact on Cultural/Archaeological Sites

No cultural and archaeological sites are located within 500m of the project site.

Mitigation Measures:

No mitigation measures are required as there is no impact.

5.3.3.3 Land Acquisition and Encroachments

The project is located on land leased by GoS therefore no land acquisition is involved.

Mitigation Measures:

No mitigation measures are required as there is no impact.

5.3.4 Construction Impacts

Project activities will involve earthworks for construction and installation of panels and associated electrical equipment and substation. Following are the potential impacts of the subproject activities;

5.3.4.1 Social Impacts

Social concerns and conflicts during the construction project activities may arise if all the primary and secondary stakeholders are not adequately informed, consented and taken into confidence about the project or its schedule of operations, before the commencement of project activities.

- If the proposed construction site is not appropriately cordoned off to restrain outsiders from entering the site, issues of trespassing and safety issues of trespassers may arise, over to the safety and security of the site personnel and equipment.
- Quarrels between commuters due to increased traffic flow may arise if traffic management is not in place.
- Nuisance to nearby communities is envisaged due to increased heavy traffic and movement of construction equipment and dust and noise emissions.

Mitigation Measures

- Extensive consultation with stakeholders will be carried out and their feedback; concerns and input will be taken into account in the project planning and execution.
- It will be ensured that the construction site is appropriately cordoned off with hard barricade.
- Traffic management will be ensured taking in consideration the nearby community, their access and movement and privacy and optimal access routes to the site from M10.

5.3.4.2 Air Quality Deterioration

The use of construction machinery operated on diesel can generate exhaust emissions including SO_2, NOx, Smoke and Particulate Matter (PM). Site clearance, leveling, minor excavation for solar panels installation and substation foundations and other earthworks will generate dust emissions. Another possible cause of air deterioration is handling and transportation of cement, mortar, concrete, other dusty materials, and handling and storage of aggregates in concrete plants. However, these impacts will be temporary and localized to the construction phase in subproject area.

Mitigation Measures

Different options are available to control dust and exhaust pollution. They are listed below:

- The exposure of construction workers to dust should be minimized by provision of dust masks and mandating the workers to wear them.

➢ ***Dust Reduction Measures***

- Water should be sprinkled daily to wet all the expose surfaces.
- Use of water suppression for control of loose materials on paved or unpaved internal road surfaces. Oil and oil by-products is not a recommended method to control dust[13].
- Truck loads should be covered with tarpaulin.
- Construction site including soil and material piles at the site should be adequately barricaded to avoid material escape, generation of dust.
- Ready-mix can be used in the stages of the project wherever and whenever required and deemed appropriate.
- Careful handling and working under moist conditions and monsoon season will be avoided as much as possible.

➢ ***Exhaust emission reduction measures***

- Construction machinery, vehicles should be properly tuned and kept in good working condition, minimizing exhaust and vehicular emissions. It should be ensured that exhausts from these equipment and vehicles comply with relevant SEQS.
- Excessive engine idling should be discouraged and machinery causing excessive pollution (i.e., visible clouds of smoke) should be banned from site.
- Open burning of solid wastes, whether hazardous or nonhazardous, is not considered good practice and should be avoided, as the generation of polluting emissions from this type of source cannot be controlled effectively[14].

5.3.4.3 Noise

During the construction works, noise will be generated from the operation of machinery, project-related vehicular and material transport. These activities may cause discomfort to nearby communities and populace. Following table shows the noise levels of different construction equipment that will be used during construction phase of subproject.

Table 5.1: Typical noise levels of construction equipment (noise level in dB (A) at 15 m)

Clearing		Structure Construction	
Bulldozer	80	Crane	75-77
Front end loader	72-84	Welding generator	71-82
Jack hammer	81-98	Concrete mixer	74-88
Crane with ball	75-87	Concrete pump	81-84
		Concrete vibrator	76
Excavation and Earth Moving		Air compressor	74-87
Bulldozer	80	Pneumatic tools	81-98

[13] WBG EHS Guidelines
[14] WBG EHS Guidelines

Table 5.1: Typical noise levels of construction equipment (noise level in dB (A) at 15 m)			
Clearing		**Structure Construction**	
Backhoe	72-93	Bulldozer	80
Front end loader	72-84	Cement and dump trucks	83-94
Dump truck	83-94	Front end loader	72-84
Jack hammer	81-98	Dump truck	83-94
Scraper	80-93	Paver	86-88
Grading and Compaction		**Landscaping and clean-up**	
Grader	80-93	Bulldozer	80
Roller	73-75	Backhoe	72-93
		Truck	83-94
Paving		Front and end loader	72-84
Paver	86-88	Dump truck	83-94
Truck	83-94	Paver	86-88
Tamper	74-77	Dump truck	83-94
Source: U.S. Environmental Protection Agency, Noise from Construction Equipment and Operations. Building Equipment and Home Appliance. NJID. December 31, 1971			

Figure 6.5 shows the locations around the subproject area that will be affected from noise during construction activity.

Mitigation Measures

Different options are available to control noise pollution. They are listed below:

➢ ***Noise Containment Measures***

- PVC Laminated Polyester Fireproof Mesh Sheet can be used with hard barricade to reduce the noise levels and check the noise levels outside the barricade periodically for different type of construction activities through a hand-held noise meter.
- High noise activities should cease between 22:00 and 06:00 hrs.

➢ ***Noise Reduction Measures***

- Equipment and vehicle noise can be reduced at source by regular maintenance & repair of construction machinery and equipment.
- Mufflers or silencers should be mandatory to be equipped by all project-related vehicles.

5.3.4.4 Surface and Ground Water Quality

The potential spills from construction equipment fuel, electrical equipment such as switch gears and transformers, construction vehicles during construction may unlikely result in contamination of groundwater under normal conditions. However, in conditions like post-monsoon season when groundwater table rise, contamination can occur. Also, inadequate storage at construction site and disposal to nearby areas of waste material will result in contamination of land, nuisance to the nearby community. Estimation water consumption from construction and labor camps will be 16000-24000 gallons per day.

No surface water body exists within 500m of project site; therefore, no contamination is envisaged.

Mitigation Measures

- It will be ensured that the wastes generated from construction activities should be stored in a proper interim location onsite which should be adequately barricaded and covered to avoid ingress of storm water.
- Excavation material /civil works related solid waste should be reused or disposed to the approved disposal site.
- Porta cabins will be provided for worker residence as well as for shelter for labor during construction and provision of water. Septic tank with soakage pit will be constructed for wastewater disposal.
- During construction phase, water tankers will be used.

5.3.4.5 Waste Management

Typical solid waste generated during construction include waste concrete, empty cement bags, excavated soil, rejected or malfunctioned solar panels etc. The solid waste has the potential to cause negative impact on the surroundings if not properly managed and disposed of. It is likely to block nearby drainage channels that can ultimately cause localized flooding during the monsoon and nuisance to the communities.

Poor waste management practices would result in short term negative impact on the aesthetics of the surrounding. It can also impact air quality.

Mitigation Measures

- All hazardous waste such as oil-waste will be handled and disposed through incineration via EPA certified hazardous waste contractor hired by CC.
- Recycling of solid waste will be carried out as far as possible and practical like cement bags, empty drums, discarded bricks etc.
- Rejected or malfunctioned solar panels will be sent back to the distributor/equipment manufacturer as no PV end-of-life treatment/recycling or disposal facility exist in the country as of today and the panels should not be disposed of without disbanding and untreated in the landfills/dumpsites.
- No wastes should be dumped indiscriminately at any location outside the site boundary/designated disposal site.
- Training should be provided to working personnel for identification, segregation, and management of waste.
- The site-specific waste management plan will be developed by CC.

Waste Segregation

All hazardous waste if found shall be segregated from nonhazardous wastes at the point of generation of waste. During construction phase, suitable containers with following color coding shall be kept to collect and segregate common wastes at all facilities:

Waste material	Color code
Concrete/ Campsite Debris	Blue
Metal	Green

Plastic	White
Oily Rags	Black
Used Oil	Red
Rubbish/Trash	Yellow

Recycling

Recycling and reuse minimize the quantity of waste requiring disposal. Some of the wastes can be reused within the construction site while others can only be recycled (Table 6.2). There is a great recycling potential for few of these wastes in the recycling market. Waste shall be sold to the third-party contractors/ companies, who have proper recycling facilities.

CC will suggest/recommend recycling of the paper, glass, plastic wastes in their respective processing units. Iron/steel waste would be sent to re-rolling mills.

Table 5.2: Waste management options (different categories)

S#	Waste Type	Category	Disposal Options
1.	Septic Tank Sludge	Non-hazardous	Disposed in Landfill site.
2.	Excavation Material	Non-hazardous	Reuse for backfill
3.	Construction debris including Scrap	Non-hazardous	Recycle, reuse or sell to third party contractor.
4.	Metals	Non-hazardous	Store cuttings in designated area for reuse. Remove surplus materials and use them at other sites, where feasible.
5.	Concrete	Non-hazardous	Store unused concrete blocks for later reuse. Recycle, reuse or sell to third party contractor.
6.	Bricks	Non-hazardous	Reuse for footings and broken bricks.
7.	Plastic and vinyl	Non-hazardous	Recycle, reuse or sell to third party contractor.
8.	Corrugated Cardboard	Non-hazardous	Recycle, reuse or sell to third party contractor.
9.	Woods	Non-hazardous	Recycle
10.	Empty Drums and Containers	Non-hazardous	Disposed them off through recycler.
11.	Oil waste (fuel oil, transformer oil, switchgear oil)	Hazardous	Handled and disposed through incineration via EPA certified waste contractor hired by CC.
12.	PV modules	Hazardous	Extract recyclable content and then disposal in landfill site approved by authorities.
13.	Sanitary Wastewater	Non-hazardous	Treat wastewater in septic tanks before disposal.
14.	Trash	Non-hazardous	1. Segregate glass, metal, plastic from trash. 2. Recycle all recyclable items. 3. Designed landfill.

The Waste Tracking Form, attached below shall be used to record this information by CC, while waste is being dispatched outside construction site. It is the responsibility of respective EPA certified waste contractor to assign a suitable person to sign off the record of waste tracking before the waste is dispatched outside.

WASTE TRACKING FORM

Location of Generation:	
Reporting Team:	
Submitted by (Name):	
Submitted on (Date):	
Waste	**Disposal Location**
Excavation Material	
Concrete	
Bricks	
Metal	
Card board	
Wires	
Drums and Containers (Empty)	
Oil Contaminated Soil	
Sanitary Wastewater	
Sludge	
General Trash	

Checked and Signed: _____Dated: _____

5.3.4.6 Soil Contamination

Soil at the construction site can get contaminated from either spill, due to stagnant water or degradation due to activities in the microenvironment of the site.

Mitigation Measures

- Fuel oils, Transformer oils and lubricants for construction machinery will be stored in covered diked areas, underlain with HDPE membrane.
- Washing and maintenance of vehicles will be restricted onsite and contractor is mandated to get entry of well-maintained and cleaned machinery.
- Regular inspections will be carried out to detect leakages in construction vehicles and equipment.
- Appropriate implements such as shovels, plastic bags and absorbent materials will be made available near fuel and oil storage areas for removal of oil and contaminated soil.

5.3.4.7 Traffic Management

Project site is located off M10 Highway. The project site is not frequented with vehicular traffic. Therefore, traffic disruption is not envisaged. However, adequate vehicular traffic management will be undertaken to avoid nuisance to nearby communities.

Mitigation Measures

- Traffic management plan will be introduced to manage smooth flow of vehicular traffic and to avoid nuisance to nearby villages and congestion at the connecting point to M10 Highway.
- Appropriate Sign postings may be installed to alert populace of all potential hazards including limited access to construction sites.
- Movement of construction material to the project sites should be planned in a way that it will not hamper major transport activity in the micro and macro environment. The transfer of material should not be done during late hours.

5.3.4.8 Impacts on Flora

The project site does not have any significant flora. Therefore, no significant impacts are envisaged on the flora during the project construction and operation phase.

Mitigation Measures

- No mitigation measures will be required.

5.3.4.9 Impacts on Local Resources

During project execution, supplies of equipment, material, etc. will be required. As the project area is under developed and has limited commercial activities, supplies are likely to be sourced from population centers such as Hub and Karachi. These centers are far well-developed than the project area and have substantially more commercial and industrial activities and resources. Additionally, supplies for the project will mainly be required during construction phase, which has the limited time period of several months. Therefore, residual adverse impacts of project supplies on local resources are not likely.

5.3.4.10 Labor Issues

- The construction works involving earthworks, excavation, erecting structures, etc. poses an inherent risk of injury to labor from accidents.
- Poor housekeeping practices may lead to stagnant water as breeding grounds for insect vectors (causing malaria etc.).
- Hazards from handling equipment, ergonometric stress, lifting heavy materials etc. may cause injury to the labor.
- Electrical equipment and substation pose electrocution hazard.

Mitigation Measures

Site-specific labor health and safety hazards are also critical to identify based on job safety analysis or comprehensive hazard or risk assessment. Health and safety management planning should include the adoption of a systematic and structured approach for prevention and control of physical, electrical, chemical, and biological health and safety hazards. Use of PPE should be made mandatory. Only trained and experience crane, forklift, etc. operators should be hired. CC shall ensure that Job Hazard Analysis (JHA) is performed prior to commencing jobs. It shall also be ensured that the JHA is reviewed after the following:

- Whenever work is stopped
- Every time work conditions or the job scope changes
- Persons working the job shall review and acknowledge the JHA by their signature

5.3.4.11 Crane and Lifting Operations

For all Crane & Lifting Operations CC shall ensure full compliance with standard operating procedures. CC shall develop a site-specific pre-lift checklist which includes the following at minimum:

- Crane rigging capacity adequately for load
- Condition of slings
- Rigging condition adequate for load
- Area of swing or travel unobstructed
- Multiple crane use
- Power line approach distance maintained
- Stability and footing
- Taglines and spotters
- Illumination and weather
- Signal operator
- Job hazard analysis and other permits

All lifting and rigging activities shall be supervised and conducted by a competent person or team, CC shall maintain a lifting gear registry for all lifting gear on-site inclusive of a listing of all lifting gear, copies of equipment certificates (manufacturer, safe working load, serial number) and the inspection/recertification frequency.

5.3.4.12 Forklifts and Non-Road Vehicles

CC should ensure forklift and non-road vehicles are fit for purpose and operated according to manufacturer's requirements. Only competent operators are permitted to operate forklifts and non-road vehicles.

At minimum, all forklifts and non-road vehicles shall be equipped with following equipment:

- Seat belts
- Horn
- Emergency Brake
- Wheel chock
- Labeled Controls
- Fire Extinguishers
- First Aid Kit
- Back-up Alarm

5.3.4.13 Scaffolding

CC is responsible to establish periodic inspection, certification and recertification program for scaffold works. Only qualified worker is authorized to erect, inspect and certify scaffold. All scaffolds should have a guardrail system on each open side, up to the access point. It should be equipped with toe boards having suitable access ladder.

5.3.4.14 Over-exertion

Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries at construction site.

Mitigation Measures

Recommendations for their prevention and control include:

- Workers will be trained with lifting and materials handling techniques before the construction of the project, including the placement of weight limits above which mechanical assists or two-person lifts are necessary.
- Work site layout will be planned to minimize the need for manual transfer of heavy loads.
- Tools will be selected and work stations would be designed to reduce force requirements and holding times, which promote improved postures, including, where applicable, user adjustable work stations.
- Administrative controls, such as job rotations and rest or stretch breaks will be implemented into the work processes.

5.3.4.15 Slips and Falls

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction site.

Mitigation Measures

Recommended methods for the prevention of slips and falls from, or on, the same elevation include:

- Good house-keeping practices, such as the sorting and placing loose construction materials in established areas, would be implemented.
- Excessive waste debris and liquid spills will be cleaned up regularly.
- Electrical cords and ropes will be located in common areas and marked corridors.
- Slip retardant footwear will be used.

5.3.4.16 Struck by Objects

Construction activities of the project may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities.

Mitigation Measures

Techniques for the prevention and control of these hazards include:

- Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap.
- Temporary fall protection measures in scaffolds and out edges of elevated work surfaces would be used, such as hand rails and toe boards to prevent materials from being dislodged.
- Appropriate PPE such as safety glasses with side shields, face shields, hard hats, and safety shoes, would be wore.

5.3.4.17 Moving Machinery

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise.

Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving.

Mitigation Measures

Techniques for the prevention and control of these impacts include:

- The location of vehicle traffic, machine operation, walking areas, and controlling vehicle traffic will be planned and segregated through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic.
- The visibility of personnel will be ensured through the use of high visibility vests when working in or walking through heavy equipment operating areas as well as training of workers to verify eye contact with equipment operators before approaching the operating vehicle.
- Inspected and well-maintained lifting devices will be used that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

5.3.4.18 Electrocution Hazard

Subproject involves generation of electricity and its evacuation through substation and therefore poses electrocution hazard to the workers. An electrical hazard can be defined as a serious workplace hazard that exposes workers to any of the following:

- Burns
- Electrocution
- Shock
- Arc flash or arc blast
- Fire
- Explosions

List of potential electrical hazard at site is as follows;

- Improper grounding
- Exposed electrical parts
- Inadequate wiring
- Damaged insulation
- Overload circuits
- Damaged tools and equipment

Mitigation Measures

- Use of ground-fault circuit interrupters
- Periodic inspection of extension cords and portable tools
- Use power tools and equipment as designed
- Proper lockout/tagout procedures will be followed
- Safety signs for electrical hazard will be placed
- Ensuring proper guarding of electrical equipment and facilities

5.3.4.19 Other Site Hazards

Construction of site may pose a risk of exposure to dust, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms.

Mitigation Measures

- Only authorized personal should be allowed at the construction site
- Identify and minimize, so far as reasonably practicable, the causes of potential hazards to workers, including communicable diseases and vector borne diseases;
- Avoid stagnation of water and initiate drainage/cleanup of stagnant water;
- Provide for the provision of appropriately stocked first-aid equipment at work sites;
- Provide for appropriate personal protective equipment (PPE) to minimize risks, such as but not limited to appropriate outerwear, boots and gloves; safety helmets;
- Provide training for workers for the use of PPE;
- WB Group's Environment, Health and Safety (EHS) Guidelines will be implemented;
- No bonded and child labor will be permitted at site;
- Major labor laws will be followed e.g., Minimum Wage, Hours of work, Overtime Payment.
- Also, laborers will be trained on appropriate interaction with local people;
- Include procedures for documenting and reporting accidents, diseases, and incidents; and
- All safety precautions will be taken to address safety hazards for the nearby community. These precautions may include safety/warning signage, safety barrier around the construction site.
- Lighting provided for labor during night time work should be adequate.
- CC will include appropriate clauses to protect environment and public health. The EMP will be included in the bidding document;

Summary of Recommended Personal Protective Equipment According to Hazard		
Objective	**Workplace Hazards**	**Suggested PPE**
Eye and face protection	Flying particles, molten metal, liquid chemicals, gases or vapors, light radiation.	Safety Glasses with side-shields, protective shades, etc.
Head protection	Falling objects, inadequate height clearance, and overhead power cords.	Plastic Helmets with top and side impact protection.
Hearing protection	Noise, ultra-sound.	Hearing protectors (ear plugs or ear muffs).
Foot protection	Falling or rolling objects, pointed objects. Corrosive or hot liquids.	Safety shoes and boots for protection against moving & falling objects, liquids and chemicals.
Hand protection	Hazardous materials, cuts or lacerations, vibrations, extreme temperatures.	Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc.
Respiratory protection	Dust, fogs, fumes, mists, gases, smokes, vapors.	Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapors and gases). Single or multi-gas personal monitors, if available.
	Oxygen deficiency	Portable or supplied air (fixed lines). On-site rescue equipment.
Body/leg protection	Extreme temperatures, hazardous materials, biological agents, cutting and laceration.	Insulating clothing, body suits, aprons etc. of appropriate materials.
Source: IFC Environmental, Health, and Safety General Guidelines		

COVID-19 Prevention

Prevention measures are listed below;

- Assess the hazards to which the workers may be exposed; evaluate the risk of exposure; and select, implement, and ensure workers use controls to prevent exposure.
- Conducting a job hazard analysis can help to determine whether work activities require close contact (within 6 feet) between workers, visitors, or other members of the public.
- When a job hazard analysis identifies activities with higher exposure risks, and those activities are not essential, consider delaying them until they can be performed safely.
- Use closed doors and walls, whenever feasible, as physical barriers to separate workers from any individuals experiencing signs and/or symptoms consistent with COVID-19.
- Use administrative controls, when feasible, to reduce or eliminate the risk of exposure.
- Training for employees on the spread of the disease in the geographic areas in which they work.

- Screening calls when scheduling indoor construction work to assess potential exposures and circumstances in the work environment, before worker entry.
- Appropriate cleaning practices (i.e., washing hands frequently with soap and water for at least 20 seconds, or, if soap and water are not immediately available, using alcohol-based hand sanitizer that contains at least 60% alcohol and rubbing hands until they are dry; sanitizing all surfaces workers will touch).
- The proper way to cover coughs and sneezes following Ministry of Health and WHO recommendations (i.e., sneezing or coughing into a tissue or into the upper sleeve).
- Alternatives to shaking hands upon entry, and the importance of workers not touching their own faces (mouth, nose, eyes).
- Wearing masks over their noses and mouths to prevent them from spreading the virus.
- The need to continue using other normal control measures, including PPE, necessary to protect workers from other job hazards associated with construction activities.
- To the extent possible, screen all visitors on all construction sites in advance of their arrival on the job site for signs and symptoms of COVID-19.
- Adopt staggered work schedules, e.g., provide alternating workdays or extra shifts, to reduce the total number of employees on a job site at any given time and to ensure physical distancing.
- Keep in-person meetings (including toolbox talks and safety meetings) as short as possible, limit the number of workers in attendance, and use social distancing practices.
- Ensure clean toilet and handwashing facilities. Clean and disinfect portable job site toilets regularly. Fill hand sanitizer dispensers regularly. Disinfect frequently touched items (i.e., door pulls and toilet seats) regularly.

5.3.5 Project Operation Impacts

Solar PV technology is a clean energy generation technology which does not produce air emissions, effluent generation and noise during operations. However, some potential impacts during project operations are discussed below and mitigation measures have been given where required.

5.3.5.1 Wastewater

Wastewater during the operation phase will mainly comprise of sewage and residual water from cleaning of solar PV panels. Both are wastewater streams are considered non-hazardous and its potential negative impacts will be mitigated as follows;

Mitigation Measures

- Adequate separate drainage lines will be provided for the flow of sewage and residual water from panel cleaning.
- Sewage water will be discharged through multi-chamber Septic Tank connected with soakage pit. Alternatively, sewage water can be collected in a concrete-line pit and can be remove on periodic basis through waste contractor for off-site disposal.
- Wastewater from solar panels cleaning can be collected in settling pit and be reused to the extent feasible or it can also be used for dust suppression on exposed surfaces, which will reduce the water requirement for the project during operations. Alternatively, the residual water can be disposed through Septic Tank connected with soakage pit.

- If RO plant is used for groundwater desalination, RO reject will be collected in the concrete-lined evaporation pond and will not be discharged outside the project boundary. Mineral residues after evaporation can be disposed offsite through waste contractor or can be sold if commercially viable. An alternative would be to bore a rejection well and RO brine may be injected deep underground.

5.3.5.2 Solid Waste Disposal

During operations, solid waste will comprise of broken/disused electrical and electronic equipment such as PV panels, batteries, inverters, transformers; food waste, sewage sludge, etc. PV panels and batteries contain certain number of heavy metals such as Mercury and Cadmium which are considered toxic for environment. Waste will be segregated before disposal.

Mitigation Measures

- Several components of the solar panels can be recycled such as glass, plastic and aluminum can be recycled. However, at present, no such facility exists in the country. Disposal of broken and dysfunctional panels to landfills/dumpsites is also not recommended due to the potential of soil and groundwater contamination due to constituents of solar cells. Therefore, the disused panels will be returned to the supplier/manufacturer.
- Disused dry batteries will be returned to the supplier/manufacturer for possible recycling.
- Other electrical equipment as transformers and inverters will be returned to the suppliers/manufacturers.
- No hazardous waste such as food, packaging, sewage sludge etc. will be disposed through waste contractor.

5.3.5.3 Community Health and Safety

Potential impacts on the community during the operations are minimal as the solar PV plant does not have air emissions, noise generation and effluent discharge, however electrocution hazard remains.

Mitigation Measures

- Entry/exit gate(s) of the site will be clearly marked.
- Entrance in the site will only be allowed to the authorize personnel and to the visitors after registration at entrance.
- Site will properly be barricaded through wall/fence of adequate height to minimize chances of trespassing, thereby avoiding the incidents such as electrocution.
- Electrical hazard signs and posters will be adequately marked on the outer face of the barricading wall/fence to alert the passerby.
- Unskilled staff for operational phase will mainly be sourced from the area to avoid any community conflict due to influx of outsiders.

5.3.5.4 Occupational Health and Safety

There will be significantly lower requirement of onsite staff than construction phase to ensure the smooth plant operations after commissioning. Electrocution will be the main hazard for the onsite workers during operations.

Mitigation Measures

- Electrical equipment will adequately be grounded for workers safety.
- Electrocution hazard signs will be displayed, particularly for the PV panel area and substation.
- Staff will be required to wear necessary PPE once they are out of their campsite for routine inspection, surveillance and/or monitoring.
- Maintenance at the site will be duly be authorized and be carried out with necessary safety precautions such use of PPE, adequate grounding, etc.

5.3.5.5 Impacts due to spill and leakage of transformer oil, liquid dielectric

Potential impact for spills and leakage of dielectric includes soil and groundwater contamination if the equipment is mounted on soft surface and fire hazard as the liquid dielectric is usually flammable.

Mitigation Measures

- Transformers and associated equipment with liquid dielectric will be concrete footing with adequate drain and collection pit in case of spill to avoid soil contamination and ingress into soil.
- Leakages will be prevented through periodic maintenance.
- Spilled oil and dielectric will be disposed through incineration by waste contractor.

5.3.5.6 Visual Impacts

Project site is the part of vast expense of barren land. Ground-mounted PV panels will raise only couple of meters from ground so the project is unlikely to cause major visual obstruction for the general landscape.

Mitigation Measures

- Visual impact of the solar plant will be minimized through adequate landscaping at site.

5.3.5.7 Impact of Sulfur Hexafluoride (SF6) Leak

SF6 is a non-toxic and non-flammable but a potent greenhouse gas. It is used as gas-dielectric in electrical equipment such as switchgear. Leakage of SF6 in large quantities pose the risk of suffocation in confined and unventilated spaces. Risk of leakage is low with modern robust electrical equipment.

Mitigation Measures

- SF6 carrying equipment must not be dropped or rolled and must be protected from overheating.
- Leakage detection devices can be installed in the substation area. Handheld detectors can also be used.
- Gas mask is also recommended for the authorize personnel for operation and maintenance to avoid risk of asphyxiation from accidental release of gas in large quantities.

5.3.5.8 Impacts of Electromagnetic Fields (EMF)

As with the other electrical and electronic equipment, Solar PV systems produce Electromagnetic Fields which is the function of electric field and magnetic field. Studies[15][16] have shown the EMF values from

[15] https://pubmed.ncbi.nlm.nih.gov/26023811/
[16] https://nccleantech.ncsu.edu/wp-content/uploads/2019/10/Health-and-Safety-Impacts-of-Solar-Photovoltaics-PV.pdf

PV systems are well below the guideline limits by ICNIRP[17], therefore it will not have negative health impacts for project staff and nearby communities.

5.3.5.9 Flooding

Project area due to minor undulations, would be prone to floods during heavy precipitation events.

Mitigation Measures

- Improvements in forecasts and warnings
- Sustainable and long-term mitigation policies
- Automated Local Emergency Response in Real Time (ALERT) systems will be developed.

Figure 5.1: Flash Flooding Risk Management Plan[18]

[17] ICNIRP Guidelines. Retrived from https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf
[18] EU-Directives-2007-EU-flood-Risk-Management-Plan

Chapter 6 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

6.1 Introduction

6.1.1 General

This section discusses the implementation and management of mitigation measures that are required for proposed project that includes progressive report and techniques to assure that all necessary environmental protection measures are carried out in the future as planned and to reduce residual impact to acceptable levels and achieve the expected outcomes of the project. The Environmental Management and Monitoring Plan (EMMP) are based on the type, extent and duration of the identified environmental impacts. The EMMP has been prepared following the regulatory requirements and guidelines.

Environmental management and monitoring are mandatory activity to be undertaken by the project developer over the entire project cycle showing its commitment towards meeting environmental regulations/standards as well as maintaining health and safety standards.

The environmental management and monitoring programs are implemented from the very early stages of planning and execution phases of the project. In fact, the authorization of the project is the point of initiation of environmental management plan. The monitoring data, observations recorded and test results / analyses are vital and formulate legal documents to be kept in safe custody and may be provided to competent authority as and when required in accordance to Sindh Environmental Protection Act 2014.

EMMP is a dynamic and a live document that is under constant review having periodic revisions and may be updated as required. Any amendments in the procedures, information is notified to the concerned personnel after the approval from the competent authority for subsequent implementation. It also highlights the responsible personnel to work for the implementation of this EMMP.

The Sindh Solar Energy Project (SSEP) will be responsible for implementing the EMMP and ensuring that all personnel management are informed about the EMMP and the requirement to implement the procedures it contains. The EMMP is intended as a quick reference for Project personnel and regulators to monitor compliance

6.1.2 Objectives of EMMP

The EMMP will serve as a principal execution module of the project that would not only mitigate adverse environmental impacts during the designing, construction, operational and maintenance phase of the project but also ensures that environmental standards and good housekeeping is maintained. Continuous environmental monitoring is exercised to ensure that preventive measures are in place and are effective; to sustain environmental integrity. Some of the key objectives of the EMP are to:

- Outline mitigation measures recommended in the IEE and define the responsibility and implementation of these measures;
- To outline functions and responsibilities of personnel;
- To state and implement standards and guidelines which are required under environmental legislations particular in context to the project,

- Facilitates the implementation of the mitigation measures by providing the technical details of each project impact, and proposing implementation schedule of the proposed mitigation measures;
- Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented; and
- Identify training requirements at various levels and provide a plan for the implementation of training sessions

It is important that the recommendations and mitigation measures are carried out according to the spirit of the environmental assessment process and in line with the guidelines. The EMMP are presented in Table 6.1 and 6.2. Screening of potential environmental and social impacts has played a vital role in reconfirming typical mitigation measures and in identifying any different approaches based on the feasibility and detailed design assumptions and any alternatives available at this stage.

6.1.3 Legislation and Guidelines

Legislation and guidelines pertaining to this project have been discussed at length in chapter 3 of this IEE study. It shall ensure that the project activities during designing, construction and operation phases of the project would follow the relevant environmental legislations and guidelines. The staff of the proponent and contractor should also be aware of these laws.

6.2 Structure of EMP

The environmental management plan is divided into the following core components:

- Organizational Structure and Roles and responsibilities;
- Implementation of Environmental Management Plan
- Mitigation matrix for each project phase;
- Monitoring plan for the project;
- Worker's Health and Safety Plan
- Waste management plan
- Equipment Maintenance
- Emergency Response Plan
- Site Restoration
- Change Management Plan

6.3 Institutional Framework for the Implementation of EMMP

This Framework illustrates the roles & responsibilities required for the implementation of EMMP. Environmental management during construction of proposed project would be performed by CC in supervision of the SSEP. In O&M phase, the implementation of EMMP would be the responsibility of SSEP and the same will ensure that all activities during each phase will be in compliance with the EMMP and SEQS.

SSEP

SSEP would perform the following roles and responsibilities:

- Will be responsible for the successful execution of the project;
- Ensure that the project complies with regulatory requirements;

- Ensure that EMMP is followed and staff is properly trained;
- Keep in place emergency and rescue plans for safety of staff and general public;
- Improve the coordination and exchange of information between management, employees and contractors etc.;
- Ensure the health and safety of employees;

CC

Some roles and responsibilities of Construction Contractor are as under:

- Ensure that the project activities are undertaken in an environment friendly manner and EMMP is implemented;
- Evaluate compliance with SEQS, national and international guidelines for environmental protection;

6.4 Environmental Mitigation and Monitoring Plan

The Mitigation and Monitoring Plan has been tabulated in tables 6.1, 6.2 and 6.3. The plan will be used as a management and monitoring tool for implementation of the mitigation measures. The matrix lists down the following.

- Environmental Impacts for various project phases;
- The mitigation measures recommended in the IEE;
- The person/organization directly responsible for adhering to or executing the required mitigation measures;
- The parameters which will be monitored to ensure compliance with the mitigation measures; and
- The timing at which the mitigation or monitoring has to be carried out.
- The person/organization responsible to execute monitoring plan.

It is highlighted that although responsibilities for executing and monitoring mitigation measures have been delegated to different persons/organizations, SSEP holds the primary and overall responsibility for ensuring full implementation of the EMP.

6.5 Environmental Training

An environmental training program will be prepared to address the need of contractor's site staff and build their capacity to effectively implement project-specific EMMP. HSE officer (Contractor) will coordinate with contractors to organize training for their staff and to help them establish system /infrastructure for future sustainability. In addition to the training arranged and imparted by the HSE officer (Contractor) for complete project team, the contractor will also plan small training sessions for workers involved in specific jobs. Cost of trainings and mitigation measures will be deemed included in contract cost. Environmental Training Plan is provided in Table 6.3.

6.6 Emergency Response Plan

Emergency procedures will be prepared to include all events which have the tendency to create an emergency situation at the solar power plant. It is advisable that emergency procedures are prepared in conjunction with the emergency services such as fire brigade.

The procedures will be readily available to all personnel involved, regularly practiced and checked periodically that they are up to date. Employees likely to be affected will be provided with the knowledge of the actions required to minimize the adverse effects.

The emergency procedures will consider:

- the properties of the raw materials and excipients, solvents used;
- concerns associated with the exposure to the product
- the quantities involved;
- the plant components may cause electric shock hazard

6.6.1 Contingency Planning – Incidents and Emergencies

A. Fire Contingency Plan

Because flammable / combustible materials, and electrical appliances are present at the site, fire is an ever-present hazard. All personnel and subcontractors are not trained professional fire-fighters. Therefore, if there is any doubt that a fire cannot be quickly contained and extinguished, personnel will notify the Site supervisor and vacate the area. The site supervisor will immediately notify the local Fire Department.

The following procedures will be followed to prevent the possibility of fires and resulting injuries:

- Sources of ignition will be kept away from where flammable materials are handled or stored.
- “No Smoking" signs will be posted at visible areas where flammable materials are present.
- Fire extinguishers will be placed in all areas where a fire hazard may exist.
- Before workers begin operations in an area, the area supervisor will give instruction on exit procedures and assembly points. Exit routes will be displayed through signage in work areas and exit points will be clearly marked.

The following procedures will be implemented in the event of a fire:

- Anyone who sees a fire will notify the supervisor who will then contact the Site Superintendent and the HSE Officer. The HSE Officer will activate the emergency alarm and contact the local Fire Department.
- When the emergency siren sounds, workers will disconnect electrical equipment in use (if possible) and proceed to the nearest fire exit.
- Work crews will comprise of pairs of workers (buddy system) who join each other immediately after hearing the fire alarm and remain together throughout the emergency. Workers will assemble at a predetermined rally point for a head count.
- When a small fire has been extinguished by a worker, the site superintendent and the Health and Safety Officer will be notified.

i. Responsibilities of Fire Safety Officer (Contractor)

The Fire Safety Officer will supervise and perform firefighting activities.

- Responsible for Head Count in the assembly area.

- Conduct Fire drills for the employees and reports the outcomes, suggestions and action plan of such drills.
- Responsible for maintenance and documentation of all fire extinguishers.
- Develop and regularly review building fire exit plans.
- Inspect and test new and existing fire protection systems, fire detection systems and fire safety equipment to ensure that they are operating optimally.
- Action by Staff Detecting the fire or smoke

If any person smells a burning odor or hear any one shouting "Fire, Fire" or sees the fire/smoke, he/she will immediately inform the telephone operator and will:

- Give his/ her name
- Location of Fire
- Type of Fire

Receptionist (Telephone Operator) will

- immediately inform Administration Manager, during and after working hours.
- call security in-charge
- call fire safety officer (contractor).
- call Police and City Government only if told by Security in-charge or fire officer.

Staff on duty will restrict fire by closing doors and windows of affected area, if possible and turn electrical mains to OFF position. If the fire is contained and small, rush towards the nearest fire extinguisher and try to extinguish the fire.

B. Evacuation Procedures

In the event of on-site evacuation of personnel is necessary, the following actions will be taken:

- The emergency signal will be activated (one single long blast on the air horn).
- No further entry of visitors or contractors will be permitted.
- Shut off all machinery if safe to do so.
- All on-site personnel, visitors, and contractors will assemble at the entrance of the site for a head count and await further instruction from the Site Superintendent.
- All persons will be accounted for by their immediate crew leaders (e.g., area supervisor). Crew leaders will determine the safest exits for employees and will choose an alternate exit if the first choice is inaccessible.
- During exit, the crew leader will try to keep the group together. Immediately upon exit, the crew leader will account for all employees in his crew.
- Upon completion of the head count, the crew leader will provide the information to the Site Superintendent.

C. Evacuation Responsibility

The decision will be made by the Emergency Rescue team which includes Fire Safety Officer (contractor) & Site In-charge and will be communicated to the Project Manager.

Emergency rescue team will inform the Project Manager and decide if partial or full evacuation is required. Also liaise to mitigate the situation and return the area to normal as soon as possible.

The emergency response team members involved are as follows:

i. Actions by Site Incharge (Contractor)

- Manager Administration and the Security officer in co-ordination with specific area in-charge will arrange for evacuation.
- If the fire goes beyond the control of management, the local Fire brigade to be summoned in consultation with Manager Administration.
- He will conduct root cause analysis and log the same on the prescribed incident report form.
- Security in charge will inform Manager Administration as soon as fire is confirmed by him personally.
- Call Fire Department immediately.
- Advise telephone operator to inform all head of departments/in-charges.

ii. Senior Management/Administration

- Should reach the place of fire as soon as the news is confirmed.
- Manager Administration will inform all areas of the Grid Station operations if needed.
- Media Handling
- A debriefing session at the end of the disaster.

iii. House Keeping

- Open all windows and doors for ventilation.
- Remove obstacles on the way to the fire exit.

6.6.2 Fire Detection & Warning

Portable Fire extinguishers will be used in buildings and as protection during "Hot Work" activities throughout the site. As construction progresses and systems are commissioned within specific buildings, personnel will be informed of the different alarm sounds.

Following types of fire extinguishers are generally used:

- ABC (Dry Chemical): Red or Orange in color. All-purpose dry chemical may be used on any type of fire
- CO2: Red in color, Big Black horn on hose. Good for Oil, Grease & Electrical fires.
- Water: Completely red with no color band. Suitable for paper, textiles, wood, most plastics & rubber.

Large office accommodation will be protected by the use of hard-wired smoke detection devices with battery backup.

A suitable means of raising the alarm, in the event of a fire or other emergency at the facility, will be established. The alarm system will be appropriate to ensure all personnel can be notified immediately

of any emergency situation and evacuation, or other actions required. The alarm system will be tested on a regular basis.

6.6.3 Fire Fighting Equipment

The following firefighting equipment will be maintained in good order in the facility:

- Fire Extinguishers of adequate size and Type
- Sand buckets
- Rescue gear (includes stretchers, turnout gear, fire rescue gloves, emergency light, fire boots, fire hoods, etc.)
- Equipment will be maintained and tested to ensure serviceability in the event of a fire.
- Tests will be conducted monthly.

The facility fire suppression system will be prioritized and made serviceable as soon as practical during construction.

6.6.4 Fire Drills

The Fire Safety Coordinator/ Officer will ensure that monthly drills are carried out that ensure all personnel are familiar with the evacuation procedure and their respective muster points.

Simulated fire emergencies will be carried out to ensure the readiness and competency of the fire brigade to fight a major fire. During the drill, equipment will be tested. In the event any equipment should fail it will be immediately replaced.

Review of brigade competency will be determined during the drills. Brigade members will be retrained if any evidence of in-competency exists.

6.7 Waste Management Plan

The waste management plan will be prepared and implemented by the construction contractor for the proposed solar PV project in order to ensure timely collection, handling and disposal of the waste generated during the construction phase. Waste management at the power plant would:

- reduce risk exposure to a minimum,
- protect employees,
- bring the organization into compliance with EPA's requirement

Table 6.1: Environmental Mitigation and Monitoring Plan during Pre-Construction/Design Stage

S#	Environmental Effect	Potential Significance	Pre-Construction Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
1.	Compliance with provincial and national environmental regulations	Medium	✓This EMMP to be made part of the bidding/tender documents. ✓The bid documents shall note that Pakistani laws and regulations relating to the environment will be followed during the construction phase.	CC	Tender documents		SSEP
2.	Impact on ecology	Medium	✓ Onsite activities will be so planned that the natural drainage pattern is not disturbed. ✓ Rainwater drainage system will be connected with natural drainage so as not to alter the site natural drainage pattern.	CC	Visual impact and count of floral/faunal species at project site	Once pre-construction	SSEP
3.	Impact on Cultural/archaeological sites	Low	✓ No mitigation measures required as no such sites are located at project site and within 1km of project.	-	-	-	-
4.	Land Acquisition and Encroachments	Medium	✓ The project is located on land of GoS. No land acquisition is involved.	CC	Land documents and land survey	Pre-construction	SSEP

Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
1.	Social Impacts	Medium	✓ Extensive consultation with stakeholders will be carried out and their feedback; concerns and input will be taken into account in the project planning and execution. ✓ It will be ensured that the construction site is appropriately cordoned off with hard barricade. ✓ Traffic management will be ensured taking in consideration the nearby community, their access and movement and privacy and optimal access routes to the site from M10.	CC	Visual observations, feedbacks from project personnel and community	As required keeping in view site conditions	SSEP
2.	Air Quality deterioration due to dust and exhaust emissions	Medium	✓The exposure of construction workers to dust should be minimized by provision of dust masks and mandating the workers to wear them. ✓Truck loads should be covered with tarpaulin. ✓Construction site including soil and material piles at the site should be barricaded to avoid material escape, generation of dust. ✓Ready-mix can be used in the stages of the project wherever and whenever required and deemed appropriate. ✓Construction operations should be carefully planned and scheduled. ✓Careful handling and working under moist conditions and monsoon season will be avoided as much as possible. ✓Construction machinery, vehicles should be properly tuned and kept in good working condition, minimizing exhaust and vehicular emissions. It should be ensured that exhausts from these equipment and vehicles comply with relevant SEQS.	CC	Ambient Air Quality parameters (SPM, NO, NO2, SO2, PM10, CO, PM2.5, O3, Lead) – Mobile air quality Van will be used. Vehicular Emissions for Construction Vehicles and equipment exhaust (Smoke, CO, NOx, SOx, PM, Noise) – Exhaust	Quarterly	SSEP

Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			✓Excessive engine idling should be discouraged and machinery causing excessive pollution (i.e. visible clouds of smoke) should be banned from sites. ✓Open burning of solid wastes, whether hazardous or nonhazardous, is not considered good practice and should be avoided, as the generation of polluting emissions from this type of source cannot be controlled effectively. ✓Use of water suppression for control of loose materials on exposed surfaces. Oil and oil by-products are not a recommended method to control dust. ✓Water should be sprinkled daily or whenever there is dust problem on all exposed surfaces to suppress emission of dust.		analyzers will be used. Monitoring conducted as per SEQS.		
3.	Noise	Medium	✓ PVC Laminated Polyester Fireproof Mesh Sheet can be used with hard barricade to reduce the noise levels and check the noise levels outside the barricade periodically for different type of construction activities through a hand-held noise meter. ✓ High noise activities should cease between 22:00 and 06:00 hrs. ✓ Equipment and vehicle noise can be reduced at source by regular maintenance & repair of construction machinery and equipment. ✓ Mufflers or silencers should be mandatory to be equipped by all project-related vehicles.	CC	Noise monitoring at project site	Monthly	SSEP
4.	Surface and groundwater quality	Medium	✓ It will be ensured that the wastes generated from construction activities should be stored in a proper interim location onsite which should be	CC	Water sampling at project site if groundwater is used	Monthly	SSEP

Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			adequately barricaded and covered to avoid ingress of storm water. ✓ Excavation material /civil works related solid waste should be reused or disposed to the approved disposal site. ✓ Porta cabins will be provided for worker temporary residence as well as for shelter for labor during construction and provision of water. Septic tank with soakage pit will be constructed for wastewater disposal.				
5.	Waste Management	Medium	✓ All hazardous waste such as oil-waste will be handled and disposed through incineration via EPA certified hazardous waste contractor hired by CC. ✓ Recycling of solid waste will be carried out as far as possible and practical like cement bags, empty drums, discarded bricks etc. ✓ No wastes should be dumped indiscriminately at any location outside the site boundary/designated disposal site. ✓ Training should be provided to working personnel for identification, segregation, and management of waste. ✓ The site-specific waste management plan will be developed by CC.	CC	Visual observation and waste disposal certificates	Daily/as required	SSEP
6.	Soil Contamination	Medium	✓ Fuel oils, Transformer oils and lubricants for construction machinery will be stored in covered dyked areas, underlain with HDPE membrane. ✓ Washing and maintenance of vehicles will be restricted onsite and contractor is mandated to	CC	Visual observation and track record of disposal of contaminated media	As required	SSEP

Table 6.2: Environmental Mitigation and Monitoring Plan during Construction Phase

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			get entry of well-maintained and cleaned machinery. ✓ Regular inspections will be carried out to detect leakages in construction vehicles and equipment. ✓ Appropriate implements such as shovels, plastic bags and absorbent materials will be made available near fuel and oil storage areas for removal of oil and contaminated soil.				
7.	Traffic management	Low	✓Traffic management plan will be introduced to manage smooth flow of vehicular traffic and to avoid nuisance to nearby villages and congestion at the connecting point to M10. ✓Appropriate sign postings, warning signs, diversion signs and barriers will be installed to alert public of all potential hazards including limited access to construction sites. ✓Movement of construction material to the project site should be planned in that way it will not hamper major transport activity in the micro and macro environment. The transfer of material should not be carried out during sleeping hours.	CC	Flow of usual traffic	Daily/as required	SSEP
8.	Impacts on Flora	Low	✓ Adequate greening of the site with local plant species will be carried out in accordance with the local climate and soil conditions.	CC	Visual observations, records of plantation	As required	SSEP

Table 6.3: Environmental Mitigation and Monitoring Plan during operation phase

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
1.	Solid Waste (Electrical & Electronic equipment waste, food waste, general waste, sewage sludge)	Medium	✓Several components of the solar panels can be recycled such as glass, plastic and aluminum can be recycled. Other stuff will be disposed in an approved landfill/dumpsite. ✓Disused dry batteries will be returned to the supplier/manufacturer for possible recycling. Disposal through landfills is not recommended as the batteries may contain some quantity of heavy metals such as Mercury, Cadmium and Lead which are considered toxic for environment. ✓No hazardous waste such as food, packaging, sewage sludge etc. will be disposed through waste contractor.	SSEP	Visual Monitoring onsite, waste record register and waste disposal certificates	Daily/as required	Third-party consultant
2.	Community Health and Safety	Medium	✓Entry/exit gate(s) of the site will be clearly marked. ✓Entrance in the site will only be allowed to the authorize personnel and to the visitors after registration at entrance. ✓Site will properly be barricaded through wall/fence of adequate height to minimize chances of trespassing, thereby avoiding the incidents such as electrocution. ✓Electrical hazard signs and posters will be adequately marked on the outer face of the barricading wall/fence to alert the passerby. ✓Unskilled staff for operational phase will mainly be sourced from the area to avoid any community conflict due to influx of outsiders.	SSEP	Visual Monitoring and community feedback	Continuous/as required	Third-party consultant
3.	Occupational Health and Safety	Medium	✓Electrical equipment will adequately be grounded for workers safety.	SSEP	Visual inspection at the project site, incident records	Daily/as required	Third-party consultant

Table 6.3: Environmental Mitigation and Monitoring Plan during operation phase

S#	Environmental Effect	Potential Significance	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility
			✓Electrocution hazard signs will be displayed, particularly for the PV panel area and substation. ✓Staff will be required to wear necessary PPE once they are out of their campsite for routine inspection, surveillance and/or monitoring. ✓Maintenance at the site will be duly be authorized and be carried out with necessary safety precautions such use of PPE, adequate grounding, etc.				
4.	Ground Water Quality deterioration and soil contamination due to leaks or spills from Transformer oil, liquid dielectric	Low	✓Transformers and associated equipment with liquid dielectric will be concrete footing with adequate drain and collection pit in case of spill to avoid soil contamination and ingress into soil. ✓Leakages will be prevented through periodic maintenance. ✓Spilled oil and dielectric will be disposed through incineration by waste contractor.	SSEP	Visual inspection, track record of disposal of contaminated media	As required	Third-party consultant
5.	Sulfur hexafluoride (SF6) leak	Low	✓SF6 carrying equipment must not be dropped or rolled and must be protected from overheating. ✓Leakage detection devices can be installed in the substation area. Handheld detectors can also be used. ✓Gas mask is also recommended for the authorize personnel for operation and maintenance to avoid risk of asphyxiation from accidental release of gas in large quantities.	SSEP	Not required as per SEQS	-	-

Table 6.4: Training Plan

Staff	Responsibilities	Areas	Schedule
Project staff	Contractor/HSE Officer	• Findings of IEE • Mitigation Measures • EMP • Waste disposal procedures • Camp Operation • Social and Cultural values of the Project areas • Environmental sensitivity of the Project area • Flora and Fauna of the area • Emergency Response Plan • Community Issues	✓Prior to start of Project activities
Drivers	Contractor/HSE Officer	• Road safety • Road restrictions • Defensive driving	✓Before and during construction activities
Camp/Site Staff	Safety Officer	• Waste Disposal • Housekeeping	✓ Before and during construction activities

Table 6.5: Estimated Cost of EMP Implementation

Activity	Cost (PKR)	Remarks
Training Program	500,000	Refer table above
	Environmental Monitoring	
Ambient Air (construction)	(40,000*4) = 160,000	Cost for 1-year monitoring at 1 location @Rs.40,000 per monitoring per location per quarter
Exhaust Emissions (construction)	(1500*6*5*4) = 180,000	Cost for 1-year monitoring at 5 locations for 6 parameters @Rs.1500 per parameter
Noise (construction)	(1000*5*12) = 60,000	Cost for 1-year monitoring at 5 locations @Rs.1000 per location per month
Waste management (construction)	120,000	Estimated cost of 1-year monitoring
Soil contamination (construction)	120,000	Estimated cost of 1-year monitoring
Traffic Management (construction)	120,000	Estimated cost of 1-year monitoring
Ecology (construction)	120,000	Estimated cost of 1-year monitoring
Solid waste (operation)	120,000	Estimated cost of 1-year monitoring
Community and Occupational Health and Safety	240,000	Estimated cost of 1-year monitoring
Soil contamination (construction)	120,000	Estimated cost of 1-year monitoring
Cost of Mitigation (construction)	1,000,000	Initial estimates
Cost of Mitigation (construction)	500,000	Initial estimates
Reporting	500,000	Initial estimates
Sub total	4,460,000	-
Contingency (5%)	223,000	-
Grand total	4,083,000	-

Chapter 7 CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

This Environmental Impact Assessment study was carried out to identify the environmental and socioeconomic impacts of the proposed "120MW Solar Power Plant in Deh Halkani and Deh Band Murad, District West, Karachi" project.

During the study, environmental and socioeconomic baseline information was collected from variety of sources including visit of project area, previous environmental reports and studies conducted in the area, published literature and field surveys. All this information was used to compose the profile of the physical, biological and socioeconomic environment of the area which is likely to be affected by the proposed project activities. Information for the project description was provided by the project's developer.

On the basis of the established baseline and the proposed activities described as under project description, the potential environmental impacts were identified on the project area's physical, biological and socioeconomic environments. In summary the potential impacts during the construction phase of the proposed project include the generation of dust and gaseous emissions, noise, construction waste, health and safety and socioeconomic effects. Similarly, the key environmental and social issues during the operation phase included those arising from liquid and solid waste disposal and electrocution hazard.

The IEE process finds that the impacts of the project activities at the design, construction and operation stages have been adequately addressed and mitigation measures have been duly proposed wherever needed. Adoption of mitigation measures will ensure the reduction of any possible impacts on the micro and macroenvironment as well as socio-economic conditions, to acceptable levels. The development of this project will be made compatible with the requirements of the Sindh Environmental Protection Act 2014, Sindh EPA (Environmental Assessment) Regulations 2021 and Sindh Environmental Quality Standards (SEQS); as well as other regulatory requirements of the Government of Sindh. The issues of environment, health & safety has been duly incorporated in the design, construction & operations phases of the project.

The SSEP shall remain cognizant of the social development of its project surrounding and will contribute to the uplift of the overall social and economic health of the communities around it. To help build a viable society, the SSEP shall facilitate the surrounding communities in conserving energy, environmental protection, health, education, skill development, poverty alleviation and other pertinent areas of social development.

On the basis of the findings of the IEE Study, it is possible to conclude that:

- Construction and Operation of Solar Power Plant, on adoption of the mitigation measures, have no broad scale significant adverse impacts on the physical as well as socio-economic composition of the microenvironment and macroenvironment of the project area;
- The likely impact of construction and operation of the grid station and transmission lines will be appropriately mitigated through proven technologies, careful planning and stringent monitoring practices;
- The project will assist in meeting the forecasted demand for energy;
- Employment opportunities will be generated for short to medium term;
- The proposed project; after commissioning will become an integral part of the microenvironment.

Mitigation will be assured by a robust plan of environmental monitoring conducted to ensure that all advised measures are provided as intended, and to determine whether the environment is protected as envisaged. This will include observations on and off site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be informed to the developer for due implementation, and the resultant remedies being reported to the provincial EPA.

7.2 Recommendations

The study recommends and confirms that the project developer shall adopt all environmental management processes in full, as prescribed by the national and international laws and guidelines and given in the IEE document. Following essentials recommendations which are also the part of EMP as mitigation measures will be followed by project developer in letter and spirit:

- Communities in the project area shall be intimated prior to commencing project activities;
- For cutting of trees, compensatory plantation shall be provided at a ratio of 1:3;
- A Comprehensive Waste Management Plan for construction and operation phases should be developed;
- Wastes should be routinely collected from the designated area and disposed in an environmentally friendly manner;
- Protective measures against high noise intensity, soil erosion, traffic problem, land pollution and water contamination will be taken care of;
- Emergency response plan should be prepared and implemented during construction and operation phases;
- Preventive and protective measures including modification, substitution, or elimination of hazardous conditions, with particular attention to live power lines, working at height, EMF, high noise levels, and exposure to chemicals will be made; and
- The Project will thus respond to all aspects of sustainability: Economic, social and environmental and will thus be a sustainably viable project.
- The study therefore recommends that the IEE report should be approved with the provision that the suggested mitigation measures will be adopted and the Environmental Management Plan will be followed in letter and spirit.

7.3 References

- Geological Survey of Pakistan
- IFC General EHS Guidelines
- Pakistan Meteorological Department (PMD)
- Pakistan Bureau of Statistics. Census data 2017.
- PSLM-Survey 2014-15
- Solargis. Energy Sector Management Assistance Program. World Bank Group
- State of Industry Report 2020, NEPRA
- Study of Information Collection and Verification Survey for Renewable Energy Introduction and Grid Stabilization (2016)

ANNEXURES

ANNEXURE – I

Sindh Environmental Protection Act, 2014

EXTRAORDINARY **Registered No. M324**

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PART-IV

PROVINCIAL ASSEMBLY OF SINDH
NOTIFICATION
KARACHI, THE 20TH MARCH, 2014.

NO.PAS/Legis-B-06/2014- The Sindh Environmental Protection Bill, 2014 having been passed by the Provincial Assembly of Sindh on 24th February, 2014 and assented to by the Governor of Sindh on 19th March, 2014 is hereby published as an Act of the Legislature of Sindh.

THE SINDH ENVIRONMENTAL PROTECTION ACT, 2014.

SINDH ACT NO. VIII OF 2014.

AN
ACT

to provide for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution, and promotion of sustainable development.

WHEREAS it is expedient to provide for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution, promotion of sustainable development, and for matters connected therewith and incidental thereto; **Preamble.**

PART-I

It is hereby enacted as follows:-

1. (1) This Act may be called the Sindh Environmental Protection Act, 2014 **Short title and commencement.**

(2) It extends to the whole of the Province of Sindh.
(3) It shall come into force at once.

Definitions.

2. In this Act, unless there is anything repugnant in the subject or context-

(i) "adverse environmental effect" means impairment of, or damage to, the environment and includes—

(a) impairment of, or damage to, human health and safety or to biodiversity or property;

(b) pollution; and

(c) any adverse environmental effect as may be specified in the rules or regulations made under this Act;

(ii) "Agency" means the Sindh Environmental Protection Agency established under section 5 of this Act;

(iii) "agricultural waste" means waste from farm and agricultural activities including poultry, cattle farming, animal husbandry residues from the use of fertilizers, pesticides and other farm chemicals and agricultural runoff;

(iv) "air pollutant" means any substance that causes pollution of air and includes soot, smoke, dust particles, odor, light, electro-magnetic, radiation, heat, fumes, combustion exhaust, exhaust gases, noxious gases, hazardous substances and radioactive substances;

(v) "biodiversity" or "biological diversity" means the variability among living organisms from all sources, including inter-alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems;

(vi) "biosafety" means the mechanism developing through policy and procedure to ensure human health and the environmentally safe application of biotechnology;

(vii) "Council" means the Sindh Environmental Protection Council established under section 3 of this Act;

(viii) "discharge" means spilling, leaking, pumping, depositing, seeping, releasing, flowing-out, pouring, emitting, emptying or dumping into the land, water or atmosphere;

(ix) "ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit;

(x) "effluent" means any material in solid, liquid or gaseous form or combination thereof being discharged from industrial activity or any other source and includes a slurry, suspension or vapour;

(xi) "emission standards" means the permissible standards established by the Agency for emission of air pollutants and noise and for discharge of effluent and waste;

(xii) "environment" means-
(a) air, water, land and natural resources;
(b) all layers of the atmosphere;
(c) all organic and inorganic matters and living organisms;
(d) ecosystems and ecological relationships;
(e) buildings, structures, roads, facilities and works;
(f) all social and economic conditions affecting community life; and
(g) the inter-relationship between any of the factors in sub-clause (a) to (f) made under this Act;

(xiii) "environmental aspect" means an organization's activities or services that can interact with the environment;

(xiv) "environment audit" means a systemic scrutiny of environmental performance of an organization, factory, company or manufacturing and production unit regarding to its operations;

(xv) "environmental impact assessment" means an environmental study comprising collection of data, prediction of qualitative and quantitative impacts, comparison of alternatives, evaluation of preventive, mitigation and compensatory measures, formulation of environmental management and training plans and monitoring arrangements, and framing of recommendations and such other components as may be prescribed;

(xvi) "Environmental Management Plan" means a site specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment and comply with the environmental legislation;

(xvii) "Environmental Protection Order" means an order passed under Section 21 made under this Act.

(xviii) "Environmental Protection Tribunal" means the Environmental Protection Tribunal constituted under section 25 of this Act ;

(xxix) "Environmental Review" means a quantitative and qualitative assessment of documents submitted by proponent, comments from public and Government agencies or organizations;

(xx) "factory" means any premises in which industrial activity is being undertaken;

(xxi) "genetically modified organism" means any organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology and which does not occur naturally through mating and or recombination and includes both living and non-living modified organisms;

(xxii) "Government" means the Government of Sindh;

(xxiii) "Government Agency" includes:-

(a) A department, attached department or any other office of Government; and

(b) A development authority, local authority, company body corporate established or control by Government;

(xxiv) "Court" means the Court of the Judicial Magistrate First Class;

(xxv) "hazardous substance" means-

(a) a substance or mixture of substances, other than a pesticide as defined in the Agricultural Pesticides Ordinance, 1971 (II of 1971), which, by reason of its chemical activity or toxic, explosive, flammable, corrosive, radioactive or other characteristics, causes, or is likely to cause, directly or in combination with other matters an adverse environmental effect; and

(b) any substance which may be prescribed as a hazardous substance;

(xxvi) "hazardous waste" means waste which is or which contains a hazardous substance or which may be prescribed as hazardous waste, hospital waste, nuclear waste, obsolete pesticides and persistent organic pollutants;

(xxvii) "hospital waste" means waste medical supplies and materials of all kinds, and waste blood, tissue, organs and other parts of the human and animal bodies, from hospitals, clinics, laboratories and veterinary facilities;

(xxviii) "industrial activity" means any operation or process for manufacturing, making, formulating, synthesising, altering, repairing, ornamenting, finishing, packing or otherwise treating any article or substance with a view to its use, sale, transport, delivery or disposal, or for mining, for oil and gas exploration and development, or for pumping water or sewage, or for generating, transforming or transmitting power or for any other industrial or commercial purposes;

(xxix) "industrial waste" means waste resulting from an industrial activity;

(xxx) "initial environmental examination" means a preliminary environmental review of the reasonably foreseeable qualitative and quantitative impacts on the environment of a proposed project to determine whether it is likely to cause an adverse environmental effect for requiring preparation of an environmental impact assessment;

(xxxi) "local authority" means any agency set up or designated by Government, by notification in the official Gazette, to be a local authority for the purposes of this Act;

(xxxii) "local council" means a local council constituted or established under a law relating to local government;

(xxxiii) "motor vehicle" means any mechanically propelled vehicle adapted for use upon land whether its power of propulsion is transmitted thereto from an external or internal source, and includes a chassis to which a body has not been attached, and a trailer, but does not include a vehicle running upon fixed rails;

(xxxiv) "municipal waste" includes sewage, refuse, garbage, waste from abattoirs, sludge and human excreta and the like;

(xxxv) "noise" means the intensity, duration and character of sounds from all sources, and includes vibration;

(xxvi) "non degradable plastic products" means a plastic product which are made from the non-biodegradable substances;

(xxxvii) "nuclear waste" means waste from any nuclear reactor or nuclear plant or other nuclear energy system, whether or not such waste is radioactive;

(xxxviii) "Oxo-biodegradable Plastic Products" means a plastic product made of a polymer by adding a pro-degrading additive containing a transition metal salt, except cobalt, which cause the plastic to degrade and bio-grade from oxidative and cell mediated phenomena either simultaneously or successfully;

(xxxix) "person" means any natural person or legal entity and includes an individual, firm, association, partnership, society, group, company, corporation, co-operative society, Government Agency, non-governmental organization, community-based organization, village organization, local council or local authority and, in the case of a vessel, the master or other person having for the time being the charge or control of the vessel;

(xl) "pollution" means the contamination of air, land or water by the discharge or emission of effluent or wastes or air pollutants or noise or other matter which either directly or indirectly or in combination with other discharges or substances alters unfavorably the chemical, physical, biological, radiational, thermal or radiological or aesthetic properties of the air, land or water or which may, or is likely to make the air, land or water unclean, noxious or impure or injurious, disagreeable or detrimental to the health, safety, welfare or property of persons or harmful to biodiversity;

(xli) "prescribed" means prescribed by rules made under this Act;

(xlii) "project" means any activity, plan, scheme, proposal or undertaking involving any change in the environment and includes-

(a) construction or use of buildings or other works;

(b) construction or use of roads or other transport systems;

(c) construction or operation of factories or other installations;

(d) mineral prospecting, mining, quarrying, stone-crushing, drilling and the like;

(e) any change of land use or water use; and

(f) alteration, expansion, repair, decommissioning or abandonment of existing buildings or other works, roads or other transport systems, factories or other installations;

(xliii) "proponent" means the person who proposes or intends to undertake a project;

(xliv) "regulations" means regulations made under this Act;

(xlv) "rules" means rules made under this Act;

(xlvi) "sewage" means liquid or semi-solid wastes and sludge from sanitary conveniences, kitchens, laundries, washing and similar activities and from any sewerage system or sewage disposal works;

(xlvii) "Schedule Plastic Products" means all types of flexible plastic packaging and disposable plastic products made of Polythene, Polypropylene, Polystyrene and Poly-ethylene Terephthalate (PET), used for food and non-food items, like shopping bags, garbage bags, snacks packs, water and milk packaging, shrink wraps, bubble pellet wraps, films, liners, woven or non-woven bags, mulch films;

(xlviii) "Sindh Environmental Quality Standards" means standards established by the Agency under clause (e) of sub-section(1) of section 6 and approved by the Council under clause (c) of sub-section(1) of section 4 made under this Act;

(xlix) "standards" means qualitative and quantitative standards for discharge of effluent and wastes and for emission of air pollutants and noise either for general applicability or for a particular area, or from a particular production process, or for a particular product, and includes the Sindh Environmental Quality Standards, emission standards and other standards established under this Act and the rules and regulations;

(l) "strategic environmental assessment" mean an analysis of a proposed policy, legislation, plan or programme to determine whether the principles of sustainable development have been integrated therein and to identify its likely environmental effects and such components as require an initial environmental examination or environmental impact assessment;

(li) "sustainable development" means development that meets the needs of the present generation without compromising the ability of future generations to meet their needs;

(lii) "trans-boundary environmental impacts" means environmental impact arising from beyond the boundaries or limits of Sindh province and causing any adverse environmental impact or pollution in the air, land, water and coaster water of Sindh province;

(liii) "waste" means any substance or object which has been, is being or is intended to be, discarded or disposed-of, and includes liquid waste, solid waste, waste gases, suspended waste, industrial waste, agricultural waste, nuclear waste, municipal waste, hospital waste, used polyethylene bags and residues from the incineration of all types of waste.

(liv) "waters (coastal waters, internal waters, territorial waters and historical waters)" means such limits of the waters adjacent to the land territory as may be specified in the Territorial Waters and Maritime Zones Act, 1976 (LXXXII of 1976).

PART-II

THE SINDH ENVIRONMENTAL PROTECTION COUNCIL.

Establishment of the Sindh Environmental Protection Council.

3. (1) The Government of Sindh shall, by notification in the official Gazette, establish a Council to be known as the Sindh Environmental Protection Council consisting of-

(i)	Chief Minister or such other person as the Chief Minister may nominate in this behalf.	**Chairperson**
(ii)	Minister-in-charge of the Environment Protection Department.	**Vice Chairperson**
(iii)	Additional Chief Secretary, Planning and Development Department, Government of Sindh.	**Ex-officio Member**
(iv)	Secretaries of the Environment, Finance, Public Health Engineering, Irrigation, Health, Agriculture, Local Government, Industries, Live Stock and Fisheries, Forest and Wildlife, Energy, Education, Departments of Government of Sindh and the divisional commissioners of Sindh.	**Ex-officio Members**

(v)	Such other persons not exceeding twenty- five as Government may appoint from representatives of the Chambers of Commerce and Industry and industrial associations, representatives of the Chambers of Agriculture, the medical and legal professions, trade unions, non-governmental organizations concerned with the environment and sustainable development, and scientists, technical experts and educationists.	**Non-official Members**
(vi)	Director General, Sindh Environment Protection Agency	Member / Secretary
(vii)	**Two Members of the Provincial Assembly of Sindh amongst the eleven Members of the Standing Committee on Environment nominated by the Speaker**	**Members**

2) The Members of the Council, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.

(3) A non-official member, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-appointment but shall not hold office for more than two terms.

(4)The Council shall frame its own Rules of Procedure.

(5) The Council shall hold meetings, as and when necessary, but not less than two meetings, shall be held in a year.

(6) The Council may constitute committees of its members and entrust them with such functions as it may deem fit, and the recommendations of the committees shall be submitted to the Council for approval.

(7) The Council, or any of its committees, may invite any technical expert or representative of any Government Agency or non-governmental organization or other person possessing specialized knowledge of any subject for assistance in performance of its functions.

Functions and Powers of the Council.

4. (1) The Council shall-

(a) co-ordinate and supervise the enforcement of the provisions of this Act and other laws relating to the environment in the Province;

(b) approve comprehensive provincial environmental and sustainable development policies and ensure their implementation within the framework of a conservation strategy and sustainable development plan as may be approved by Government from time to time;

(c) approve the Sindh Environmental Quality Standards;

(d) provide guidelines for the protection and conservation of species, habitats, and biodiversity in general and for the conservation of renewable and non-renewable resources;

(e) coordinate integration of the principles and concerns of sustainable development into socio-economic and development policies, plans and programmes at the provincial, district and local levels;

(f) consider the annual Sindh Environment report and give appropriate directions thereon and cause it to be laid before the Provincial Assembly;

(g) deal with inter-provincial and federal-provincial issues, and liaise and coordinate with other Provinces through appropriate inter-provincial forums regarding formulation and implementation of standards and policies relating to environmental matters with an inter-provincial impact;

(h) provide guidelines for biosafety and for the use of genetically modified organisms; and

(i) assist the Federal Government or Federal Agency in implementation and or administration of various provision of United Nation Convention on Laws on Seas, 1980 (UNCLOS) in coastal waters of the province.

(2). The Council may, either itself or on the request of any person or organization, direct the Agency or any Government Agency to prepare, submit, promote or implement projects for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, and the sustainable development of resources or to undertake research in any specified aspect of environment.

PART-III
THE SINDH ENVIRONMENTAL PROTECTION AGENCY

Establishment of the Sindh Environmental Protection Agency.

5. (1) Government shall, by notification in the Official Gazette, establish the Sindh Environmental Protection Agency, to exercise the powers and perform the functions assigned to it under the provisions of this Act and the rules and regulations made thereunder.

(2) The Agency shall be headed by a Director General who shall be appointed by Government on such terms and conditions as it may determine.

(3) The Agency shall have such administrative, technical and legal staff as Government may specify, to be appointed in accordance with such procedure as may be prescribed.

(4) The powers and functions of the Agency shall be exercised and performed by the Director General.

(5) The Director General may, by general or special order, delegate any of these powers and functions to staff appointed under sub-section (3).

(6) For assisting the Agency in the discharge of its functions Government shall establish Advisory Committees for various sectors and appoint as members thereof eminent representatives of the relevant sector, educational institutions, research institutes and non-governmental organizations.

Functions of the Agency.

6. (1) The Agency shall –

(a) administer and implement the provisions of this Act and the rules and regulations;

(b) prepare, in co-ordination with the appropriate Government Agency or local council and, in consultation with the concerned Advisory Committees where established, environmental policies for the approval of the Council;

(c) take all necessary measures for the implementation of the environmental policies approved by the Council;

(d) prepare and publish an annual Sindh Environment Report on the state of the environment in the province;

(e) prepare or revise and establish the Sindh Environmental Quality Standards with approval of the Council:

Provided that before seeking approval of the Council, the Agency shall publish the proposed Sindh Environmental Quality Standards for public opinion in accordance with the prescribed procedure;

(f) ensure enforcement of the Sindh Environmental Quality Standards;

(g)where the quality of ambient air, water, land or noise so requires, the Agency may, by notification in the Official Gazette establish different standards for discharge or emission from different sources and for different areas and conditions as may be necessary:

Provided that where these standards are less stringent than the Sindh Environmental Quality Standards; prior approval of the Council shall be obtained;

(h) establish systems and procedures for surveys, surveillance, monitoring, measurement, examination, investigation, research, inspection and audit to prevent and control pollution, and to estimate the costs of cleaning up pollution and rehabilitating the environment in various sectors;

(i) take measures to promote research and the development of science and technology which may contribute to the prevention of pollution, protection of the environment, and sustainable development;

(j) issue licences, approval for the consignment, handling, transport, treatment, disposal of, storage, handling or otherwise dealing with hazardous substances;

(k) certify laboratories as approved laboratories for conducting tests and analysis and one or more research institutes as environmental research institutes for conducting research and investigation for the purposes of this Act;

(l) identify the needs for and initiate legislation in various sectors of the environment;

(m) provide assistance to relevant Federal and Provincial Government Agencies in the management of environment accidents and natural and environmental disasters, including conduct of inquiry thereto;

(n) render advice and assistance in environmental matters including such information and data available with it as may be required for carrying out the purposes of this Act:

Provided that the disclosure of such information shall be subject to the restrictions specified in Part XI (Access to Information);

(o) assist Government Agencies, local councils, local authorities and other persons to implement schemes for the proper disposal of wastes so as to ensure compliance with the Sindh Environmental Quality Standards;

(p) provide information and guidance to the public on environmental matters;

(q) recommend environmental courses, topics, literature and books for incorporation in the curricula and syllabi of educational institutions;

(r) promote public education and awareness of environmental issues through mass media and other means including seminars and workshops;

(s) establish and maintain mechanisms, including its own website, to disseminate information, subject to the provisions of this Act, regarding policies, plans and decisions of the Government, the Council and the Agency, relating to the environment;

(t) specify safeguards for the prevention of accidents and disasters which may cause pollution, collaborate with the concerned persons in the preparation of contingency plans for control of such accidents and disasters, and co-ordinate implementation of such plans;

(u) review and approve mitigation plans and give guidance and directions, where necessary, relating to clean up operations ordered under this Act;

(v) encourage the formation and working of non-governmental organizations, community organizations and village organizations to prevent and control pollution and promote sustainable development;

(w) take or cause to be taken all necessary measures for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution and promotion of sustainable development; and

(x) perform any function that the Council may assign to it.

(2) The Agency may-

(a) undertake inquiries or investigation into environmental issues, either of its own accord or upon complaint from any person or organization;

(b) request any person to furnish any information or data relevant to its functions;

(c) initiate, with the approval of Government, requests for foreign assistance in support of the purposes of this Act and enter into arrangements with foreign agencies or organizations for the exchange of material or information and participate in international seminars or meetings;

(d) recommend to Government and the Council the adoption of financial and fiscal programmes, schemes or measures for achieving environmental objectives and goals and the purposes of this Act, including -

(i) taxes, duties, cesses and other levies; and

(ii) incentives, prizes, awards, rewards, subsidies, tax exemptions, rebates and depreciation allowances;

(e) establish and maintain laboratories to help in the performance of its functions under this Act and to conduct research in various aspects of the environment and provide or arrange necessary assistance for the establishment of similar laboratories in the private sector;

(f) arrange, in accordance with such procedure as may be prescribed, financial assistance for projects designed to facilitate in discharge of its functions; and

(g) acquire assistance of concerned authorities of district administration and other relevant agencies, departments and police assistance for enforcement of this Act.

Powers of the Agency.

7. Subject to the provisions of this Act, the Agency may-

(a) lease, purchase, acquire, own, hold, improve, use or otherwise deal in and with any property both moveable and immovable;

(b) sell, convey, mortgage, pledge, exchange or otherwise dispose of its property and assets;

(c) fix and realize fees, rates and charges for rendering any service or providing any facility, information or data under this Act or its rules and regulations;

(d) enter into contracts, execute instruments, incur liabilities and do all acts or things necessary for proper management and conduct of its business;

(e) appoint, with the approval of Government and in accordance with such procedures as may be prescribed, such advisers, experts and consultants as it considers necessary for the efficient performance of its functions on such terms and conditions as it may deem fit;

(f) summon and enforce the attendance of any person and require him to supply any information or document needed for the conduct of any enquiry or investigation into any environmental issue;

(g) Director General may authorize any officer or official to enter and inspect or under a search warrant issued by Environmental Protection Tribunal or a Court, search at any time, any land, building, premises, vehicle or vessel or other place where or in which there are reasonable grounds to believe that an offence under this Act has been, or is being, or likely to be committed;

(h) take samples of any materials, products, articles or substances or of the effluent, wastes or air pollutants being discharged or emitted or of air, water or land in the vicinity of the discharge or emission;

(i) arrange for the testing and analysis of samples at a certified laboratory;

(j) confiscate any article used in the commission of the offence where the offender is not known or cannot be found within a reasonable time:

Provided that the powers under clauses (f), (g), (h) (i), and (j) shall be exercised in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898) or the rules and regulations and under the direction of the Environmental Protection Tribunal or a Court; and

(k) establish the Sindh Environmental Co-ordination Committee comprising the Director-General as its Chairman and such other persons as Government shall appoint as its members to exercise such powers and perform such functions as shall be delegated or assigned to it by Government for carrying out the purposes of this Act and for ensuring coordination among Government Agencies in implementation of environmental policies.

PART-IV
SINDH SUSTAINABLE DEVELOPMENT FUND

Establishment of the Sindh Sustainable Development Fund.

8. (1) There shall be established a Sindh Sustainable Development Fund.

(2) The Sindh Sustainable Development Fund shall be derived from the following sources, namely—

(a) allocations and grants made or loans advanced by the Government of Sindh or by the Federal Government;

(b) aid and assistance, grants, advances, donations and other non-obligatory funds received from foreign governments, national or international agencies, and non-governmental organizations; and

(c) voluntary contributions from private, corporate, multinational organizations and other persons.

(d) Any fees generated under the provision of this act including the fines imposed against contraventions including penalties.

(3)The Sindh Sustainable Development Fund shall be utilized, in accordance with such procedures as may be prescribed for -

(a) providing financial assistance to projects designed for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, the sustainable development of resources and for research in any specified aspect of the environment; and

(b) any other purposes which, in the opinion of the Board, will help achieve environment objectives and the purposes of this Act.

Management of the Sindh Sustainable Development Fund.

9. (1)The Sindh Sustainable Development Fund shall be managed by a Board known as the Provincial Sustainable Development Fund Board consisting of—

(i)	Additional Chief Secretary, Planning and Development Department, Government of Sindh,	**Chairperson**
(ii)	Such officers of Government, not exceeding five (05), as Government may appoint including Secretaries of the Environment, Finance, Industries and Local Government Departments, Government of Sindh.	**Ex-officio Members**
(iii)	Such non-official persons, not exceeding five(05), as Government may appoint, including representatives of the Chambers of Commerce and Industry, non-governmental organizations and major donors.	**Non-official Members**
(iv)	Director General, Sindh Environmental Protection Agency.	**Secretary/ Member**

(2) The members of the Board, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.

(3) A non-official member of the Board, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-nomination, but shall not hold office for more than two terms.

(4) The Board shall frame its own rules of procedure with the approval of Government.

(5) In accordance with such procedures and such criteria as may be prescribed, the Board shall have the power to —

(a) sanction financial assistance for eligible projects;

(b) invest moneys held in the Sindh Sustainable Development Fund in such profit-bearing Government bonds, saving schemes and securities as it may deem suitable; and

(c) take such measures and exercise such powers as may be necessary for utilization of the Sindh Sustainable Development Fund for the purposes specified in sub-section (3) of section 8.

(6) The Board shall constitute committees of its members to undertake regular monitoring of projects financed from the Sindh Sustainable Development Fund and to submit progress reports to the Board which shall publish an Annual Report incorporating its annual audited accounts and performance evaluation based on the progress reports.

Accounts.

10. (1) The Agency shall maintain proper accounts of the Sindh Sustainable Development Fund and other relevant records and prepare annual statement of accounts in such form as may be prescribed.

(2) The accounts of the Sindh Sustainable Development Fund shall be audited annually by the Auditor General of Pakistan.

PART-V
PROHIBITIONS AND ENFORCEMENT

Prohibition of certain discharges or emissions and compliance with standards.

11. (1) Subject to the provisions of this Act and the rules and regulations, no person shall discharge or emit or allow the discharge or emission of any effluent, waste, pollutant, noise or any other matter that may cause or likely to cause pollution or adverse environmental effects, as defined in section 2 of this Act, in an amount, concentration or level which is in excess to that specified in Sindh Environmental Quality Standards; or, where applicable, the standards established under Section 6(1)(g)(i); or direction issued under Section 17, 19, 20 and 21 of this Act; or any other direction issued, in general or particular, by the Agency.

(2) All persons, in industrial or commercial or other operations, shall ensure compliance with the Environmental Quality Standards for ambient air, drinking water, noise or any other Standards established under section 6(1)(g)(i); shall maintain monitoring records for such compliances; shall make available these records to the authorized person for inspection; and shall report or communicate the record to the Agency as required under any directions issued, notified or required under any rules and regulations.

(3) Monitoring and analysis under sub-section (1) and (2), shall be acceptable only when carried out by the Environmental Laboratory certified by the Agency as prescribed in the rules.

Prohibition of import of hazardous waste.

12. No person shall import hazardous waste into Sindh province or its coastal, internal, territorial or historical waters, except acquiring prior approval of the Agency.

Handling of hazardous substances.

13. Subject to the provisions of this Act, no person shall import, generate, collect, consign, transport, treat, dispose of, store, handle or otherwise use or deal with any hazardous substance except-

(a) under a licence issued by the Agency; or

(b) in accordance with the provisions of any other law, rule, regulation or notification for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Government is a party.

Prohibition of action adversely affecting Environment.

14. (1) Subject to the provisions of this Act and the rules and regulations, no person shall cause any act, deed or any activity, including-

(a) recycling or reuse of hospital waste and infectious waste;

(b) disposal of solid and hazardous wastes at unauthorized places as prescribed;

(c) dumping of wastes or hazardous substances into coastal waters and inland water bodies;

(d) release of emissions or discharges from industrial or commercial operations as prescribed;

(e) recycling or reuse or recovery of hazardous wastes or industrial by-products in an unauthorized or non-prescribed manner or procedure; and

(f) any activity which may cause adverse environmental affect due to trans boundary projects of Province of Sindh.

which lead to pollution or impairment of or damage to biodiversity, ecosystem, aesthetics or any damage to environment and natural resources as defined in section 2 (xxxvi) of this Act.

(2) No person shall generate, handle, transport, dispose of or handle the hospital waste and infections waste except in accordance with the Hospital Waste Management Rules and in such manner as may be prescribed.

(3) No person shall import, manufacture, stockpile, trade, supply, distribute or sell any scheduled plastic product which is non-degradable. The scheduled plastic products must be oxo-biodegradable and the pro-degradant used must be approved by the Agency or any other department or agency and in such manner as prescribed.

Regulation of motor vehicles.

15. (1) Subject to the provisions of this Act, no person shall operate or manufacture a motor vehicle or class of vehicles from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the Sindh Environmental Quality Standards or, where applicable, the standards established under sub-clause (i) of clause (g) of sub-section (1) of section 6.

(2) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any motor vehicle or class of vehicles shall install such pollution control devices or other equipment or use such fuels or undergo such maintenance or testing as prescribed.

(3) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any manufacturer of motor vehicle or class of vehicles shall use such manufacturing standard or design or pollution control devices or other equipment or undergo such testing as may be prescribed.

(4) Where a direction has been issued by the Agency under sub-section (2) and (3) in respect of any motor vehicles or class of motor vehicles, no person shall operate or manufacture any such vehicle till such direction has been complied with.

Certified Environmental Laboratory.

16. (1) The monitoring, testing and analysis carried out in compliance or for the enforcement of any provisions of this Act.

(2) The laboratory or organization having any facility for environmental monitoring, testing and analysis. and intend to perform under sub-section (1) shall register with the Agency in accordance with the Environmental Laboratory Certification Rules as prescribed.

PART-VI
ENVIRONMENTAL EXAMINATIONS AND ASSESSMENTS

Initial environmental examination and environmental impact assessment.

17. (1) No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof.

(2) The Agency shall –

(a) review the initial environmental examination and accord its approval, subject to such terms and conditions as it may prescribe, or require submission of an environmental impact assessment by the proponent; or

(b) review the environmental impact assessment and accord its approval subject to such terms and conditions as it may deem fit to impose or require that the environmental impact assessment be re-submitted after such modifications as may be stipulated or decline approval of the environmental impact assessment as being contrary to environmental objectives.

(3) Every review of an environment impact assessment shall be carried out with public participation and, subject to the provisions of this Act, after full disclosure of the particulars of the project.

(4) The Agency shall communicate its approval or otherwise within a period of two months from the date that the initial environmental examination is filed, and within a period of four months from the date that the environmental impact assessment is filed complete in all respects in accordance with the regulations, failing which the initial environmental examination or, as the case may be, the environmental impact assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations:

(5) The provisions of sub-sections (1), (2), (3) and (4) shall apply to such categories of projects and in such manner as prescribed:

(6) The Agency shall maintain separate registers for initial environmental examination and environmental impact assessment projects, which shall contain brief particulars of each project and a summary of decisions taken thereon, and which shall be open for inspection to the public during office hours.

Strategic environmental assessment.

18. (1) All provincial government agencies, departments authorities, local councils and local authorities responsible for formulating policies, legislation, plans and programmes to be implemented in Sindh province which may cause any environmental impact in the jurisdiction of the province shall, before submitting the same to the competent authority for approval, forward to the Sindh Environmental Protection Agency a strategic environment assessment containing —

(a) description of the objectives and features of the proposed policy, legislation, plan or programme that are in consonance with the principles of sustainable development;

(b) assessment of the adverse environmental effects, if any, likely to be caused during implementation of the policy, legislation, plan or programme alongwith proposed preventive, mitigation and compensatory measures;

(c) analysis of possible alternatives; and

(d) identification of those components of the policy, legislation, plan or programme, if any, in respect of which specific environmental impact assessment need to be carried out in due course.

(2) The Agency shall, in consultation with the concerned Government Agencies and Advisory Committees where established, review the strategic environment assessment, within sixty (60) days of its filing, and prepare a report containing its comments and recommendations in respect thereof which shall be forwarded to the initiating Government Agency, authority, local council or local authority and duly considered by it and the competent authority before approval or otherwise of the proposed policy, legislation, plan or programme.

(3) The provisions of sub-sections (1), and (2) shall apply to such categories of policies, plans and programmes and in such manner as may be prescribed.

Environmental monitoring.

19. (1) The Agency shall carry out or arrange environmental monitoring of all projects in respect of which it has approved an initial environmental examination or environmental impact assessment to determine whether the actual environmental impact exceeds the level predicted in the assessment and whether the conditions of the approval are being complied with.

(2) For purposes of sub-section (1), the Agency may require the person in charge of a project to furnish such information as it may specify pertaining to the environmental impact of the project, including quantitative and qualitative analysis of -

(a) discharge of effluents, wastes, emissions of air pollutants, noise and any other matter or action that may be found offensive under section 14 from the project on daily, weekly, monthly or annual basis;

(b) ambient quality of the air, water, noise and soil before, during and after construction and during operation of the project.

(3) On review of the data collected by it and information provided, the Agency may issue such directions to the person in charge as it may consider necessary to ensure compliance with the conditions of the approval.

Environmental Audit and Review.

20. (1) The Agency shall from time to time require the person in charge of a project to furnish, within such period as may be specified, an environmental audit or environmental review report or environmental management plan containing a comprehensive appraisal of the environmental aspects of the project.

(2) The report of a project prepared under sub-section (1) shall include -

(a) analysis of the predicted qualitative and quantitative impact of the project as compared to the actual impact;

(b) evaluation of the efficacy of the preventive, mitigation and compensatory measures taken with respect to the project; and

(c) recommendations for further minimizing or mitigating the adverse environmental impact of the project.

(3) Based on its review of the environmental audit report, the Agency may, after giving the person in charge of the project an opportunity of being heard, direct that specified mitigation and compensatory measures be adopted within a specified time period and may also, where necessary, modify the approval granted by it under section 17.

PART-VII
ENVIRONMENTAL PROTECTION ORDER

Environmental Protection Order.

21. (1) Where the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of any provision of this Act, the rules or regulations or of the conditions of a licence, or is likely to cause, or is causing or has caused an adverse environmental effect, the Agency may, after giving the person responsible for such

discharge, emission, disposal, handling, act or omission an opportunity of being heard, by order direct such person to take such measures as the Agency may consider necessary within such period as may be specified in the order.

(2) In particular and without prejudice to the generality of the foregoing power, such measures may include —

(a) immediate stoppage, preventing, lessening or controlling the discharge, emission, disposal, handling, act or omission, or to minimize or remedy the adverse environmental effect;

(b) installation, replacement or alteration of any equipment or thing to eliminate, control or abate on a permanent or temporary basis, such discharge, emission, disposal, handling, act or omission;

(c) action to remove or otherwise dispose of the effluent, waste, air pollutant, noise, or hazardous substances;

(d) action to restore the environment to the condition existing prior to such discharge, disposal, handling, act or omission, or as close to such condition as may be reasonable in the circumstances, to the satisfaction of the Agency; and

(e) impose a penalty as prescribed.

(3) Notwithstanding the provisions of sub-section (1), in an emergency situation where, for reasons to be recorded, the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of the provisions of this Act and that circumstances of the case warrant immediate action in the public interest, it may pass an ad-interim order of the nature described in sub-sections (1) and (2) by providing reasonable opportunity of hearing.

PART-VIII
OFFENCES AND PENALTIES

Penalties.

22. (1) Whoever contravenes or fails to comply with the provisions of sections 11, 17, 18 and 21 or any order issued there under shall be punishable with a fine which may extend to five million rupees, to the damage caused to environment and in the case of a continuing contravention or failure, with an additional fine which may extend to one hundred thousand rupees for every day during which such contravention or failure continues:

Provided that if the contravention of the provisions of section 11 also constitutes a contravention of the provisions of section 15, such contravention shall be punishable under sub-section (2).

(2) Whoever contravenes or fails to comply with the provisions of sections 13, 14, 15 and 16 or any rule or regulation or conditions of any license, any order or direction, issued by the Agency, shall be punished with a fine, and in case of continuing contravention or failure with an additional fine which may extend to ten thousand rupees for every day during which such contravention continues.

(3) Where an accused has been convicted of an offence under sub-sections (1) and (2), the Environmental Protection Tribunal and Court shall, as the case may be, in passing sentence, take into account the extent and duration of the contravention or failure constituting the offence and the attendant circumstances.

(4) Where an accused has been convicted of an offence under sub-sections (1) or (2), the Environmental Protection Tribunal or Court, as the case may be, shall endorse a copy of the order of conviction to the concerned trade or industrial association, if any, or the concerned Provincial Chamber of Commerce and Industry or the Federation of Pakistan Chambers of Commerce and Industry.

(5) Where a person convicted under sub-sections (1) and (2) had been previously convicted for any contravention of this Act and its rules or regulations, the Environmental Protection Tribunal, as the case may be, may, in addition to the punishment awarded thereunder-

(a) sentence him to imprisonment for a term that may extend up to three years;

(b) order the closure of the factory;

(c) order confiscation of the facility, machinery and equipment, vehicle or substance, record, document or other object used or involved in contravention of the provisions of this Act;

(d) order such person to restore the environment at his own cost, to conditions existing prior to the contravention or as close to such conditions as may be reasonable in the circumstances to the satisfaction of the Agency; and

(e) order that compensation be paid to any person or persons for any loss, or damage to their health or property suffered by such contravention.

(6) The Director General or an officer generally or specially authorised by him in this behalf may, on the application of the accused, compound an offence under this Act with the permission of the Environmental Protection Tribunal or Court in accordance with such procedure as prescribed.

(7) Where the Director General is of the opinion that a person had contravened any provision of this Act, he may, subject to the rules, by notice in writing to that person require him to pay to the Agency a penalty in the amount set out in the notice for each day the contravention continues.

Offences by body corporate.

23. Where any contravention of this Act has been committed by a body corporate, and it is proved that such offence has been committed with the consent or connivance of, or is attributed to any negligence on the part of, any director, partner, manager, secretary or other officer of the body corporate, such director, partner, manager, secretary or other officer of the body corporate, shall be deemed guilty of such contravention along with the body corporate and shall be punished accordingly:

Provided that in the case of a company as defined under the Companies Ordinance, 1984 (XLVII of 1984), only the Chief Executive as defined in the said Ordinance shall be liable under this section.

Explanation.— For the purposes of this Section, "body corporate" includes a firm, association of persons and a society registered under the Societies Registration Act, 1860 (XXI of 1860), or under the Co-operative Societies Act, 1925 (VII of 1925).

Offences by Government Agencies, local authorities or local councils.

24. Where any contravention of this Act has been committed by any Government Agency, local authority or local council, and it is proved that such contravention has been committed with the consent or connivance of, or is attributable to any negligence on the part of, the Head or any other officer of Government Agency, local authority or local council, such Head or other officer shall also be deemed guilty of such contravention along with the Government Agency, local authority or local council and shall be liable to be proceeded against and punished accordingly.

PART-IX
ENVIRONMENTAL PROTECTION TRIBUNALS AND COURTS

Environmental Protection Tribunals.

25. (1) Government may, by Notification in the Official Gazette, establish as many Environmental Protection Tribunals as it considers necessary and, where it establishes more than one Environmental Protection Tribunal, it shall specify territorial limits within which, or the class of cases in respect of which, each one of them shall exercise jurisdiction under this Act.

(2) An Environmental Protection Tribunal shall consist of a Chairperson who is, or has been, or is qualified for appointment as a Judge of the High Court to be appointed after consultation with the Chief Justice of the High Court and two members to be appointed by Government, of which at least one shall be a technical member nominated from amongst the officers of the Agency with suitable professional qualifications and experience in the environmental field.

(3) For every sitting of the Environmental Protection Tribunal, the presence of the Chairperson and not less than one Member shall be necessary.

(4) A decision of an Environmental Protection Tribunal shall be expressed in terms of the opinion of the majority of its members, including the Chairperson, or if the case has been decided by the Chairperson and only one of the members and there is a difference of opinion between them, the decision of the Environmental Protection Tribunal shall be expressed in terms of the opinion of the Chairperson.

(5) An Environmental Protection Tribunal shall not, merely by reason of a change in its composition, or the absence of any member from any sitting, be bound to recall and rehear any witness who has given evidence, and may act on the evidence already recorded by, or produced, before it.

(6) An Environmental Protection Tribunal may hold its sittings at such places within its territorial jurisdiction as the Chairperson may decide.

(7) No act or proceeding of an Environmental Protection Tribunal shall be invalid by reason only of the existence of a vacancy in, or defect in the constitution, of, the Environmental Protection Tribunal.

(8) The terms and conditions of service of the Chairperson and members of the Environmental Protection Tribunal shall be such as may be prescribed.

Jurisdiction and powers of Environmental Protection Tribunals.

26. (1) An Environmental Protection Tribunal shall exercise such powers and perform such functions as are, or may be, conferred upon or assigned to it by or under this Act or the rules and regulations.

(2) All contraventions punishable under sub-section (1) of section 22 shall exclusively be triable by an Environmental Protection Tribunal.

(3) An Environmental Protection Tribunal shall not take cognizance of any offence triable under sub-section (2) except on a complaint in writing by—

(a) the Agency or any Government Agency or Local Council; and

(b) any aggrieved person, who has given notice of not less than thirty days to the Agency, of the alleged contravention and of his intention to make a complaint to the Environment Protection Tribunal.

(4) In exercise of its criminal jurisdiction, the Environmental Protection Tribunal shall have the same powers as are vested under the Code of Criminal Procedure, 1898 (Act V of 1898).

(5) In exercise of the appellate jurisdiction under section 27 the Environmental Protection Tribunal shall have the same powers and shall follow the same procedure as an appellate court in the Code of Civil Procedure, 1908 (Act V of 1908).

(6) In all matters with respect to which no procedure has been provided for in this Act, the Environmental Protection Tribunal shall follow the procedure laid down in the Code of Civil Procedure, 1908 (Act V of 1908).

(7) An Environmental Protection Tribunal may, on application filed by any officer duly authorised in this behalf by the Director General, issue bailable warrant for the arrest of any person against whom reasonable suspicion exists, of his having been involved in contravention punishable under sub-section (1) of section 22:

Provided that such warrant shall be applied for, issued and executed in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898):

Provided further that if the person arrested executes a bond with sufficient sureties in accordance with the endorsement on the warrant he shall be released from custody, failing which he shall be taken or sent without delay to the officer in-charge of the nearest jurisdiction police station.

(8) All proceedings before the Environmental Protection Tribunal shall be deemed to be judicial proceedings within the meaning of sections 193 and 228 of the Pakistan Penal Code (Act XLV of 1860), and the Environmental Protection Tribunal shall be deemed to be a court for the purpose of sections 480 and 482 of the Code of Criminal Procedure, 1898 (Act V of 1898).

(9) No court other than an Environmental Protection Tribunal shall have or exercise any jurisdiction with respect to any matter to which the jurisdiction of an Environmental Protection Tribunal extends under this Act and the rules and regulations.

(10) Where the Environmental Protection Tribunal is satisfied that a complaint made to it under sub-section (3) is false and vexatious to the knowledge of the complainant, it may, by an order, direct the complainant to pay to the person complained against such compensatory costs which may extend to one hundred thousand rupees.

Appeals to the Environmental Protection Tribunal.

27. (1) Any person aggrieved by any order or direction of the Agency under any provision of this Act or the rules or regulations may prefer an appeal with the Environmental Protection Tribunal within thirty days of the date of communication of the impugned order or direction to such person.

(2) An appeal to the Environmental Protection Tribunal shall be in such form, contain such particulars and be accompanied by such fees as prescribed.

Appeals from orders of the Environmental Protection Tribunal.

28. (1) Any person aggrieved by any final order or by any sentence of the Environmental Protection Tribunal passed under this Act may, within thirty days of communication of such order or sentence, prefer an appeal to the High Court.

(2) An appeal under sub-section (1) shall lie before the High Court of Sindh.

Jurisdiction of Judicial Magistrate.

29. (1) Notwithstanding anything contained in the Code of Criminal Procedure, 1898 (Act V of 1898), or any other law for the time being in force, but subject to the provisions of this Act, all contraventions punishable under sub-section (2) of section 22 shall exclusively be triable by the Court of Judicial Magistrate of First Class having of First Class having jurisdiction.

(2) A Judicial Magistrate shall be competent to impose any punishment specified in sub-sections (2) and (4) of section 22.

(3) A Judicial Magistrate shall not take cognizance of an offence triable under sub-section (1) except on a complaint in writing by—

(a) the Agency; and

(b) any aggrieved person.

Appeals from orders of the Judicial Magistrate.

30. Any person aggrieved by any final order or sentence passed by a Judicial Magistrate under section 28 may, within thirty days from the date of the communication of such order or sentence, appeal to the Court of the District and Sessions Judge defined as Green Court under this Act, whose decision thereon shall be final.

PART-X
PUBLIC PARTICIPATION

Public participation.

31.(1)The Agency shall cause relevant details of any proposed project regarding which an Environmental Impact Assessment has been received to be published, alongwith an invitation to the public to furnish their comments thereon within a specified period.

(2) In accordance with such procedure as may be prescribed, the Agency shall hold public hearings to receive additional comments and hear oral submissions.

(3) All comments received under sub-sections (1) and (2) shall be duly considered by the Agency while reviewing the environmental impact assessment or strategic impact assessment, and decision or action taken thereon shall be communicated to the persons who have furnished the said comments.

PART-XI
GENERAL

Power to make and amend schedule.

32. The Agency may, by notification in the official Gazette, make and amend the schedule.

Indemnity

33. No suit, prosecution or other legal proceedings shall lie against Government, the Council, the Agency, the Director General of the Agency, members, officers, employees, experts, advisors, committees or consultants of the Agency or Environmental Protection Tribunal or Court or any other person for anything which is done or intended to be done in good faith under this Act or rules or regulations.

Dues recoverable as arrears of land revenue.

34. Any dues recoverable by the Agency under this Act and rules or regulations shall be recoverable as arrears of land revenue.

Act to override other laws.

35. The provisions of this Act shall have effect notwithstanding anything inconsistent therewith contained in any other law for the time being in force.

Power to make rules.

36. The Sindh Environment Protection Agency may, by notification in the Official Gazette, make rules for carrying out the purposes not in consistence of this Act with the approval of Government.

Power to make regulations.

37. (1) For carrying out the purposes of this Act, the Agency may, by Notification in the Official Gazette and with the approval of Government, make regulations not inconsistent with the provisions of this Act or the rules.

(2) In particular and without prejudice to the generality of the foregoing power, such regulations may provide for —

(a) submission of periodical reports, data or information by any Government Agency, local authority or local council in respect of environmental matters;

(b) preparation of emergency contingency plans for coping with environmental hazards and pollution caused by accidents, natural disasters and calamities;

(c) appointment of officers, advisors, experts, consultants and employees **as per prescribed rules**;

(d) levy of fees, rates and charges in respect of services rendered, actions taken and schemes implemented;

(e) monitoring and measurement of discharges and emissions;

(f) categorization of projects to which, and the manner in which sections 17, 18 and 20 applies;

(g) laying down of guidelines for preparation of initial environmental examination, environmental impact assessment and strategic environmental assessment, and development of procedures of their filing, reviews and approval.

(h) laying down standard operating procedures for environmental sampling, examination of water, waste water, gaseous emissions, solid waste and noise;

(i) providing procedures for handling hazardous substances; and

(j) installation of devices in, use of fuels by, and maintenance and testing of motor vehicles for control of air and noise pollution.

BY ORDER OF THE SPEAKER
PROVINCIAL ASSEMBLY OF SINDH

G.M.UMAR FAROOQ
SECRETARY
PROVINCIAL ASSEMBLY OF SINDH

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ANNEXURE – II

Sindh EPA (Environmental Assessment) Regulations, 2021

GOVERNMENT OF SINDH
SINDH ENVIRONMENTAL PROTECTION AGENCY

Karachi dated the 03rd September, 2021

NOTIFICATION

NO.EPA/TECH/739/2021:- In exercise of the powers conferred by section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government, is pleased to make the following regulations, namely:-

1. Short title and commencement

(1) These regulations may be called the Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021.

(2) They shall come into force at once.

2. Definitions. -

(1) In these regulations, unless there is anything repugnant in the subject or context

(a) "Act" means the Sindh Environmental Protection Act, 2014 (VIII of 2014);

(b) "Agency" means the Sindh Environmental Protection Agency as defined under section 2(ii);

(c) "Director General" means the Director General of the Agency;

(d) Environmental Checklist means rapid environmental assessment or environmental screening through a prescribed checklist in respect of projects having least/minimal impacts on the environment.

(e) "Firm" means the Environmental Consulting Firm registered by the Agency.

(f) "Environmentally sensitive area" means a location, large or small, that has significant environmental values that contribute to maintaining biological diversity and integrity, have intrinsic or attributed scientific, historical or cultural heritage value, or are important in providing amenity, harmony or sense of community, ecosystem as declared by Agency.

(g) "Protected area" means any area which safeguards the earths precious bio-diversity, protected areas of natural beauty and conservation of cultural significance as declared by relevant authority;

(h) "Schedule" means the Schedules provided in these regulations;

(i) "Urban area" means an area within the limits of a town, municipality or city as determined by the Agency on the basis of population and environmental issues

(2) All other words and expressions used but not defined in these regulations shall have the same meaning as are assigned to them in the Act.

3. Projects requiring Environmental Checklist (EC)

A proponent of a project falling in any category listed in Schedule-I shall file environmental checklist with the Agency and the provisions of section 17 shall apply to such projects.

4. Projects requiring an Initial Environmental Examination (IEE)

A proponent of a project falling in any category listed in Schedule-II shall file an IEE with the Agency, and the provisions of section 17 shall apply to such projects.

5. Projects requiring an Environmental Impact Assessment (EIA)

A proponent of a project falling in any category listed in Schedule-III shall file an EIA with the Agency, and the provisions of section 17 shall apply to such projects.

6. Projects not requiring an Environmental Assessment

(1) A project not falling in any category listed in Schedules-I, II and III shall not be required to file an EC, IEE or EIA

(2) Notwithstanding anything contained in sub-regulation (1), the Agency may direct the proponent of a project, whether or not listed in Schedule I or II or III, to file an EC or IEE or EIA, for reasons to be recorded in such direction:

Provided that no such direction shall be issued without the recommendations in writing of the Advisory Committee constituted under regulations 21.

7. Preparation of environmental assessment report

(1) The Agency may issue guidelines for preparation of an EC or IEE or EIA reports including guidelines of general applicability, and sectoral guidelines indicating specific assessment requirements for planning, construction and operation of projects relating to particular sector.

(2) The Agency may issue guidelines for preparation scope of an Environmental Management Plan(EMP) or Environmental Audit(EA).

(3) Where guidelines have been issued under sub-regulation (1) & (2), an EC, IEE or EIA or EMP or EA shall be prepared, to the extent practicable, in accordance therewith and the proponent shall justify any departure therefrom.

8. Review Fees

The proponent shall pay, at the time of submission of an EC, IEE or EIA or EMP or BTS tower a non-refundable review fee to the Agency as prescribe in Schedule-IV.

9. Filing of report

(1) Two hard copies and two electronic copies for an EC or IEE or EIA report shall be filed with the Agency by the proponent. The Agency may require the proponent to submit additional copies, as and when required during the review process.

(2) Every EC, IEE and EIA shall be accompanied by -

(a) an application, in the form prescribed in Schedule-V;

(b) Copy of receipt showing payment of review fee as prescribed in Schedule-IV

10. Preliminary Scrutiny

(1) Any report filed by the proponent or applicant shall be returned, if found incomplete in terms of Regulation 9.

(2) Notwithstanding anything contained in sub-regulation (1) of regulation 12, the Agency may require the proponent to submit an additional information at any stage during the review process.

11. Public participation

(1) In the case in an EIA, the Agency shall issue a public notice to be published in widely circulated English or Urdu or Sindhi national newspaper and in a local newspaper of general circulation in the area affected by the project, mentioning the type of project, its exact location, the name and address of the proponent and the date, time and place of public hearing for inviting comments from primary stakeholders.

(2) The date fixed under sub-regulation (1) shall not be earlier than ten days from the date of publication of the notice.

(3) The Agency shall also ensure the circulation of the EIA, where necessary, to the concerned Government Agencies and solicit their comments thereon.

(4) All comments received by the Agency from the public or any Government Agency shall be duly considered before issuance of decision.

(5) The Agency may issue guidelines indicating the basic techniques and measures to be adopted to ensure effective public consultation, involvement and participation in EIA assessment.

12. Review process

(1) Notwithstanding anything contained in sub section (4) of Section 17, the Agency shall make every effort to conclude its review process of the EA, EMP or environmental checklist within fifteen days, of the IEE within thirty days, and of the EIA within sixty days after receiving of complete case.

(2) In reviewing an EIA, the Agency shall consult such Committee of Experts be constituted for the purpose by the Director General, and may also solicit views of concerned Advisory Committee, if any, constituted by the Agency.

(3) The Director General may, where considers it necessary, constitute a committee to inspect the site of the project and submit its report on such matters as may be specified.

(4) In reviewing the IEE, the Director General may constitute a committee of the officers from within the Agency, on case to case basis, in view of the jurisdiction and location of the project for the purpose to extend final recommendation about the approval or rejection of the IEE.

(5) The review of the IEE or EIA by the Agency shall be based on quantitative and qualitative assessment of the documents and data furnished by the proponent, comments from the public and Government Agencies received under regulation 12, and views of the committees mentioned in sub-regulations (2) and (3) above.

(6) EMP, EA, EC shall be reviewed as per guidelines issued by SEPA

13. Decision

(1) The documentary evidence in the form of videos (soft copies) of public hearing shall be submitted by the proponent within three days after conclusion of public hearing to the Agency.

(2) On completion of the review process, the decision of the Agency shall be communicated to the proponent in the form prescribed in Schedule-VI or in case of an IEE or EMP or environmental checklist or environmental audit in the form prescribed in Schedule-VII in case of an EIA.

14. Conditions of approval

(1) Every approval of an EC or IEE or EIA or EMP or EA shall, in addition to such conditions as may be imposed by the Agency, be subject to the condition that the project shall be designed, constructed or operated and mitigatory and other measures adopted, strictly in accordance with the EC or IEE or EIA or EMP or EA, unless any variations thereto have been specified in the approval by the Agency.

(2) Where the Agency accords its approval subject to certain conditions, the proponent shall submit an undertaking to the Agency, before commencing operation of the project, in the form prescribed in Schedule-VIII that the conditions of approval, and the requirements in the IEE or EIA relating to design and construction, adoption of mitigation and other measures have been duly complied with.

15. Validity period of Approval

(1) The approval accorded by the Agency under section 17 read with sub-regulation (2) of regulation 15 shall be valid, for commencement of construction, for a period of three years from the date of issue.

(2) If construction is commenced during the initial three years validity period, the

validity of the approval shall stand extended for a further period of three year.

(3) The proponent may apply to the Agency for extension in the validity periods mentioned in sub-regulations (1), (2), which may be granted by the Agency in its discretion for such period not exceeding three years at a time, if the conditions of the approval do not require significant change:

Provided that the Agency may require the proponent to submit a fresh IEE or EIA, if in its opinion changes in location, design, construction and operation of the project so warrant.

16. Entry and inspection

(1) For the purpose of verification of any matter relating to the review or to the conditions of approval of an EC or IEE or EIA or EMP or EA list prior to, before or during and after commencement of construction or operation of a project, duly authorized staff of the Agency shall be entitled to enter and inspect the project site, factory building and plant and equipment installed therein.

(2) The proponent shall ensure full cooperation of the project staff at site to facilitate the inspection, and shall provide such information as may be required by the Agency for this purpose and pursuant thereto.

17. Cancellation of approval

(1) Notwithstanding anything contained in these regulations, if, at any time, on the basis of information or report received or inspection carried out, the Agency is of the opinion that the conditions of an approval have not been complied with, or that the information supplied by a proponent in the approved EC or IEE or EIA or EMP or EA list is incorrect, it shall issue notice to the proponent for show cause within two weeks of receipt thereof as to why the approval should not be cancelled.

(2) In case no reply is received or if the reply is considered unsatisfactory, the Agency may, after giving the proponent an opportunity of being heard -

(i) require the proponent to take such measures and to comply with such conditions within such period as it may specify, failing which the approval shall stand cancelled; or

(ii) cancel the approval.

(3) On cancellation of the approval, the proponent shall cease construction or operation of the project forthwith.

(4) Any action taken under this regulation shall be without prejudice to any other action that may be taken against the proponent under the Act or rules or regulations or any other law for the time being in force.

18. Registers of EC or IEE and EIA projects

Separate Registers to be maintained by the Agency for EC or IEE and EIA projects shall be in the form prescribed in Schedule-IX.

19. Environmentally sensitive areas

(1) The Agency may designate an area to be an environmentally sensitive area,

(2) Notwithstanding anything contained in regulations 3 and 5, the proponent of a project situated in an environmentally sensitive area shall be required to file an EIA with the Agency.

20. Environmental assessment guidelines

(1) The Agency may from time to time issue guidelines to assist proponents and other persons involved in the preparation of environmental assessment.

(2) Where guidelines have been issued under sub-regulation (1), the projects shall be planned and prepared, to the extent practicable, in accordance therewith and any departure therefrom justified in the IEE/EIA pertaining to the project.

21. Environmental Assessment Advisory Committee. -

The agency may constitute one or more Committees for the purpose of rendering advice on implementation and enforcement of Section 17, which may include experts of relevant field, civil society, academia, environmental experts, representative of Administrative Department, legal expert and experts from natural resources.

22. Repeal and Savings.

(1) The Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2014, shall, on commencement of these regulations, stand repealed.

(2) All orders made, notification issued, actions taken under the repealed Regulations shall remain in force until amended, altered or repealed by the provisions of these regulations.

DIRECTOR GENERAL
SINDH ENVIRONMENTAL PROTECTION AGENCY

SCHEDULE-I

(See Regulation 3)

List of projects requiring Environmental Screening (through check list)

a. Subject to the compliance with concerned zoning laws:
   i. Construction of residential and commercial buildings having total covered area from 60,000 sq.feet to 100,000 sq.feet
   ii. Housing Schemes covering an area from 05 acres to 15 acres.
   iii. Ware Houses for Non-Hazardous substances having total area from 1000 sq.yards to 5,000 sq.yards
   iv. Warehouse for Fertilizers
   v. Marriage Halls/Banquet/Restaurants/Baking facilities having total area more than 500 sq.yards
   vi. Motor vehicle workshops/Service Stations having total area of more than 500 sq.yards.

b. Construction/Reconstruction/Rehabilitation of roads in urban area from 500 meters to 01 kilometres and in rural area from 500 meters to 05 kilometres.

c. Construction of Flyover, underpasses and bridges of length from 100 meters to 500 meters

d. On-farm dams and fish farms

e. Pulses mills

f. Flour Mills

g. Lining of existing minor canals and /or water courses.

h. Canal cleaning

i. Forest harvesting operations

j. Rain harvesting projects

k. Health care units of less than 50 beds

l. BTS Tower

m. Lime Kilns

n. Ice factories and cold storage.

o. Cotton oil mill

p. Construction of LPG, CNG, LNG filling station and petrol pumps

q. Carpet manufacturing units

r. Rain harvesting projects

s. Industrial Effluent Treatment Plant

t. Sanitary Landfill site up to 500 tons/day

Schedule-II

(See Regulation 4)

List of projects requiring an Initial Environmental Examination

A. Agriculture, Livestock and Fisheries

1. Poultry, livestock and fish farms
2. Warehousing for pesticides and pharmaceuticals
3. Projects involving packaging, formulation, cold storage and warehouse of agricultural, livestock and fish products.
4. Construction & Operation of Slaughter houses

B. Energy

1. Hydroelectric power generation up to 25 MW
2. Thermal power generation up to 100 MW
3. Coal fired power plants with capacity up to 50 MW
4. Transmission lines up to 132 KV, and grid stations
5. Waste-to-energy generation projects including bio-mass up to 25 MW
6. Construction of Coal Handling and storage facilities
7. Handling, Transportation & Storage of Biofuel Facility
8. Handling and storage of edible grains and seeds
9. All Renewable energy Projects (excluding Protected/Sensitive area under any law)

C. Oil and Gas projects:

1. Oil and gas 2D/3D Seismic survey and drilling activities (on and off shore)
2. Oil and gas extraction projects including exploration and production located outside the environmentally sensitive/protected areas
3. Oil & Gas transmission gathering, storage, separation & transportation system
4. Construction of CNG, LPG Petroleum and LNG bulk storage facility
5. Oil blending and recycling units

D. Manufacturing and processing

1. Ceramics and glass units
2. Food processing units
3. Pharmaceutical units.
4. Rice mills, ghee/oil mills, Cotton ginning
5. Man-made fibers and resin projects

6. Tanning and leather finishing projects
7. Manufacturing of apparel, textile garments units, including weaving, spinning, dyeing, bleaching and printing
8. Woodwork units manufacturing products
9. Steel re-rolling mills
10. Waste recycling plants
11. Battery manufacturing plant
12. Brick Kilns
13. Marble processing units
14. Stone Crushing units

E. Mining and mineral processing

1. Commercial extraction of sand, gravel, limestone, clay, Sulphur and other minerals not included in Schedule I.
2. Crushing, grinding and separation processes
3. Metal Smelting plant production capacity up to 20 tons/day

F. Transport

1. Construction of flyovers, underpasses and bridges having length more than 500 meters to 1000 meters in urban areas and more than 5km in rural areas
2. Bus terminals/ railway station/ metro stops and construction & operation of transport related terminals
3. Rehabilitation or rebuilding or reconstruction of existing roads more than one kilometers in urban areas and more than 5 km from rural areas

G. Water management, dams, irrigation and flood protection

1. Dams and reservoirs with storage volume of less than 25 million cubic meters of surface area less than 4 square kilometers
2. Irrigation systems and drainage system with the area of less than 15,000 hactors
3. Flood protection bunds

H. Water supply and filtration

Water supply schemes and filtration plants

I. Waste disposal and wastewater treatment

1. Solid and Non-hazardous waste with annual capacity up to 10,000 tonnes (excluding municipal landfill sites and commercial facilities) including Garbage Transfer station/composting plant

2. Wastewater treatment for sewerage treatment facility less than 100 mgd
3. Hospital waste disposal facilities including incineration units owned by Hospitals for own use excluding commercial facility.

J. Urban development

1. Housing schemes more than 15 acres to 50 acres
2. Residential, Commercial multistory High rise construction projects having covered area more than 100,000 sq.feet to 500,000 sq.feet.
3. Laboratories
4. Hospitals, health care unit of more than 50 beds
5. Construction of Educational and Academic institutions.

K. Other projects

Any other project for which filing of an IEE is required by the Agency under sub-regulation (2) of Regulation 6.

SCHEDULE III

(See Regulation 5)

List of projects requiring an EIA

A. Energy

1. Hydroelectric power generation more than 50 MW
2. Thermal power generation more than 100 MW
3. Coal power projects more than 50 MW
4. Transmission lines above 132 KVA and distribution projects.
5. Nuclear power plants
6. Wind, Solar or renewable energy projects if falls under any environmental sensitive and protected area.

B. Oil and Gas projects

1. Oil Petroleum refineries.
2. LPG and LNG Terminals Projects
3. Coal Handling Terminals Projects

C. Manufacturing and processing

1. Cement plants
2. Chemical manufacturing industries
3. Fertilizer plants
4. Steel Mills
5. Sugar Mills and Distilleries
6. Establishment of Industrial estates & Export processing zones
7. Petrochemicals complex
8. Synthetic resins, plastics and man-made fibers, paper and paperboard, paper pulping, plastic products, printing and publishing, paints and dyes.

D. 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. Metal Smelting plant production capacity more than 20 tons/day

E. Transport

1. Airports
2. Construction of highway, motor ways, major roads (Intercity roads) more than one km and above

3. Ports and harbor development
4. Mass transit projects
5. Railway works
6. Construction of Flyover, underpass and bridges having total length more than one km.

F. Water management, dams, irrigation and flood protection

1. Dams and reservoirs with storage volume of 25 million cubic meters and above having surface area of 4 square kilometers and above
2. Irrigation and drainage projects serving more than 15,000 hectares and above

G. Water supply and filtration

Public water supply schemes and **filtration** plants.

H. Waste Disposal and treatment

1. Facilities for handling, storage or disposal of hazardous or toxic wastes or radioactive waste (including landfill sites, incineration units, etc.)
2. Solid waste municipal landfill sites.
3. Combine Effluent Treatment Plant
4. Domestic wastewater treatment plant more than 100mgd

I. Urban development and tourism

1. Housing schemes above 50 acres
2. Residential, Commercial High rise buildings subject to compliance of building bylaws of relevant organizations more than 500,000 sq.feet
3. All Projects located in High Density Zones notified by Government and relevant land controlling organization, irrespective of their size.
4. Commercialization of major corridors/roads in urban centers
5. Large Scale public facilities
6. Large-scale tourism development projects

J. Environmentally Sensitive Areas

All projects situated in environmentally sensitive areas being identified by the Agency.

K. Other projects

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

Schedule-IV

(See Regulation 8)

Project Cost (in million)	Review Fee
Up to 20	**Rs.50,000**
Above 20 up to 100	**Rs. 100,000**
Above 100 up to 200	**Rs. 200,000**
Above 200 up to 500	**Rs. 400,000**
Above 500	**Rs. 600,000**
Review fee for Environmental Checklist or EMP shall be Rs. 40,000/=	
Review fee for BTS Tower shall be 20,000/=	

*

Note:

The fee shall be payable into the "Sindh Sustainable Development Fund" account Details are as under:

A/C Title: Sindh Sustainable Development Fund

Account Number: 03084572626100

Bank: Sindh Bank

Branch Code: 0308-Korangi Industrial Area

SCHEDULE V

[See Regulation 9(2)(a)]

Application Form

1.	Name and address of Proponent		Phone: Email:	
2.	CNIC No. of proponent			
3.	Brief description of project			
4.	Location of project			
5.	Cost of the Project			
6.	Objectives of project			
7.	IEE/EIA attached?	IEE/EIA:	Yes/No	
8.	Have alternative sites/options been considered/ reported in IEE/EIA?		Yes/No	
9.	Title document of the project			
10.	Existing land use		Land requirement	
11.	Is basic site data available, or has it been measured?	(only tick yes if the data is reported in the IEE/EIA)	Available	Measured
		Meterology (including rainfall)	Yes/No	Yes/No
		Ambient air quality	Yes/No	Yes/No
			Yes/No	Yes/No
			Yes/No	Yes/No
12.	Have estimates of the following been reported, especially Quantitative Analysis?	Water balance	Estimated	Reported
		Solid waste disposal	Yes/No	Yes/No
		Liquid waste	Yes/No	Yes/No
			Yes/No	Yes/No
13.	Source of power		Power requirement	
14.	Labour force (number)	Construction: Operation:		
15.	Environmental Consulting Firm			

Verification. I do solemnly affirm and declare that the information given above and contained in the attached EC/IEE/EIA is true and correct to the best of my knowledge and belief.

Date

Signature, name _____
of proponent (with official stamp/seal)

SCHEDULE VI
[See Regulation 13(2)]

Decision on IEE/Environmental Check List

1. Name and address of proponent _____

_____

2. Description of project

3. Location of project

4. Date of filing of IEE

5. After careful review of the IEE, the Agency has decided –

(a) to accord its approval, subject to the following conditions:

_____

_____

or (b) that the proponent should submit an EIA of the project, for the following reasons –

_____

Dated _____

Tracking no.___

Director-General
Sindh Environmental Protection Agency
(with official stamp/seal)

SCHEDULE VII

[See Regulation 13(2)]

Decision on EIA

1. Name and address of proponent _____

2. Description of project _____

3. Location of project _____

4. Date of filing of EIA _____

5. After careful review of the EIA, and all comments thereon, the Federation Agency has decided –

   (a) to accord its approval, subject to the following conditions:

   _____

   _____

   or (b) that the proponent should submit an EIA with the following modifications-

   _____

   _____

   or (c) to reject the project, being contrary to environmental objectives, for the following reasons:

   _____

   Dated _____

Tracking no.___

Director-General
Sindh Environmental Protection Agency
(with official stamp/seal)

SCHEDULE VIII

[See Regulation 14(2)]

Undertaking

I, (full name and address) as proponent for (name, description and location of project) do hereby solemnly affirm and declare that the conditions of approval and the requirements in the IEE or EIA relating to design and construction, adoption of mitigation and other measures and other relevant matters have been duly complied with in the design and construction of the project.

Signature, name and designation of proponent
(with official stamp/seal)

Witnesses(full names and addresses)

_____

_____

SCHEDULE IX

(*See* Regulation 18)

Form of Registers for EC, IEE and EIA projects

S. No.	Description	Relevant Provisions
1	2	3
1.	Tracking number	
2.	Category type (as per Schedules I or II)	
3.	Name of proponent	
4.	Name and designation of contact person	
5.	Name of consultant	
6.	Description of project	
7.	Location of project	
8.	Date of submission of IEE/EIA	
9.	Date of public hearing / technical presentation	
10.	Date of committee of experts for schedule-II projects	
11.	Approval granted (Yes/No)	
12.	Date of approval granted or refused	

ANNEXURE – III

Sindh Environmental Quality Standards (SEQS)

EXTRAORDINARY Registered No. M324

The Sindh Government Gazette

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PART-I

GOVERNMENT OF SINDH
SINDH ENVIRONMENT PROTECTION AGENCY

NOTIFICATION

NO.EPA/TECH/739/2014:- In exercise of the powers conferred under clause (g) of sub-section (1) of section of 6 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of the Sindh Environmental Protection Council, is pleased to establish the following standards:-

1. (1) These Standards may be called the Sindh Environmental Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Airs, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards, 2015.

(2) These Standards shall come into force at once.

2. In these Standards, unless there is anything repugnant in the subject or context –

(a) "Government" means the Government of Sindh;

(b) "Standards" means the Sindh Environmental Quality Standards.

SINDH ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND LIQUID INDUSTRIAL EFFLUENTS (mg/l, UNLESS OTHERWISE DEFINED)

S. No.	Parameter	Standards		
		Into Inland Waters	Into Sewage Treatment (5)	Into Sea (5)
1	2	3	4	5
1.	Temperature 40^0C or Temperature Increase *	$\leq 3^oC$	$\leq 3^oC$	$\leq 3^oC$
2.	pH value (H^+) .	6-9	6-9	6-9
3.	Biochemical Oxygen Demand (BOD)5 at 20^0C (1)	80	250	80**
4.	Chemical Oxygen Demand(COD) (1)	150	400	400
5.	Total Suspended Solids (TSS)	200	400	200
6.	Total Dissolved Solids (TDS)	3500	3500	3500
7.	Oil and Grease	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.3	0.3
9.	Chloride (as Cl^-)	1000	1000	SC***
10.	Fluoride (as F^-)	10	10	10
11.	Cyanide (as CN^-) total .	1.0	1.0	1.0
12.	An-ionic detergents (as MBAS)(2)	20	20	20
13.	Sulphate (SO_4^{2-})	600	1000	SC***
14.	Sulphide (S^{2-})	1.0	1.0	1.0
15.	Ammonia (NH_3)	40	40	40
16.	Pesticides (3)	0.15	0.15	0.15
17.	Cadmium (4) ..	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent (4) ..	1.0	1.0	1.0
19.	Cooper (4)	1.0	1.0	1.0
20.	Lead (4)	0.5	0.5	0.5
21.	Mercury (4)	0.01	0.01	0.01
22.	Selenium (4)	0.5	0.5	0.5
23.	Nickel (4) ..	1.0	1.0	1.0
24.	Silver (4)	1.0	1.0	1.0
25.	Total toxic metals	2.0	2.0	2.0
26.	Zinc	5.0	5.0	5.0
27.	Arsenic (4)	1.0	1.0	1.0
28.	Barium (4)	1.5	1.5	1.5
29.	Iron	8.0	8.0	8.0
30.	Manganese	1.5	1.5	1.5
31.	Boron (4)	6.0	6.0	6.0
32.	Chlorine	1.0	1.0	1.0

Explanations:

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Sindh Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.
2. Methylene Blue Active Substances; assuming surfactant as biodegradable.
3. Pesticides include herbicides, fungicides, and insecticides.
4. Subject to total toxic metals discharge should not exceed level given at S. N. 25.
5. Applicable only when and where sewage treatment is operational and BOD5=80mg/l is achieved by the sewage treatment system.
6. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.

* The effluent should not result in temperature increase of more than 3^0C at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the point of discharge.

** The value for industry is 200 mg/l

*** Discharge concentration at or below sea concentration (SC).

Note: 1. Dilution of liquid effluents to bring them to the STANDARDS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.

2. The concentration of pollutants in water being used will be subtracted from the effluent for calculating the STANDARDS limits".

"SINDH ENVIRONMENTAL QUALITY STANDARDS FOR INDUSTRIAL GASEOUS EMISSION (mg/Nm^3, UNLESS OTHERWISE DEFINED)."

S. No.	Parameter	Source of Emission	Standards
1	2	3	4
1.	Smoke	Smoke opacity not to exceed	40% or 2 Ringleman Scale or equivalent smoke number
2.	Particulate matter	(a) Boilers and Furnaces	
	(1)	(i) Oil fired	300
		(ii) Coal fired	500
		(iii) Cement Kilns	300

		(b) Grinding, crushing, Clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas.	500
3.	Hydrogen Chloride	Any	400
4.	Chlorine	Any	150
5.	Hydrogen Fluoride	Any	150
6.	Hydrogen Sulphide	Any	10
7.	Sulphur Oxides (2)(3)	Sulfuric acid/ Sulphonic acid plants	
		Other Plants except power Plants operating on oil and coal	1700
8.	Carbon Monoxide	Any	800
9.	Lead	Any	50
10.	Mercury	Any	10
11.	Cadmium	Any	20
12.	Arsenic	Any	20
13.	Copper	Any	50
14.	Antimony	Any	20
15.	Zinc	Any	200
16.	Oxides of Nitrogen	Nitric acid Manufacturing unit.	3000
	(3)	Other plants except power plants operating on oil or coal:	
		Gas fired	400
		Oil fired	600
		Coal fired	1200

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 oil. Higher content of Sulphur will case standards to be pro-rated.
3. In respect of emissions of Sulphur dioxide and Nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to Standards specified above, comply with the following standards:-

A. **Sulphur Dioxide**

Sulphur Dioxide Background levels Micro-gram per cubic meter (ug/m^3) Standards.

Background Air Quality (SO_2 Basis)	Annual Average	Max. 24-hours Interval	Criterion I Max. SO_2 Emission (Tons per Day Per Plant)	Criterion II Max. ground level increment to ambient (One year Average)
Unpolluted	<50	<200	500	50
Moderately Polluted*				
Low	50	200	500	50
High	100	400	100	10
Very Polluted**	>100	>400	100	10

* For intermediate values between 50 and 100 ug/m^3 linear interpolations should be used.
** No projects with Sulphur dioxide emissions will be recommended.

B. Nitrogen Oxide

Ambient air concentrations of Nitrogen oxides, expressed as NO_X should not be exceed the following:-

Annual Arithmetic Mean 100ug/m^3 (0.05 ppm)

Emission level for stationary source discharge before missing with the atmosphere should be maintained as follows:-

For fuel fired steam generators as Nanogram (10^0-gram) per joule of heat input:

Liquid fossil fuel	130
Solid fossil fuel..	300
Lignite fossil fuel	260

Note:- Dilution of gaseous emissions to bring them to the STANDARDS limiting value is not permissible through excess air mixing blowing before emitting into the environment.

Sindh Environmental Quality Standards for Motor Vehicle Exhaust and Noise

(i) **For in-use Vehicles**

S. No.	Parameter	Standards (maximum permissible limit)	Measuring Method	Applicability
1	2	3	4	5
1.	Smoke	40% or on the Ringleman Scale during engine acceleration mode	To be compared with Ringleman Chart at a distance of 6 meters or more.	Immediate effect
2	Carbon Monoxide	6 %	Under idling conditions: Non-dispersive infrared detection through gas analyzer.	
3.	Noise	85 db (A)	Sound-meter at 7.5 meter from the source.	

For new Vehicles

EMISSION STANDARDS FOR DIESEL VEHICLES

(a) For passenger Cars and Light Commercial Vehicles (g/Km)

Type of Vehicle	Category/Class	Tiers	CO	HC+ NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8
Passenger Cars.	M 1: with reference mass (RW).	Pak-II, IDI	1.0	0.7	0.08		All imported and local manufactured
	up to 2500 kg. Cars with RW over 2500 kg. to meet NI Category standards	Pak-II DI	1.0	0.9	0.10	NEDC (ECE 15+ EUDCL.)	Diesel vehicles with effect from 01-07-2012
Light Commercial Vehicles	NI-I (RW<1250 Kg)	Pak-II IDI	1.0	0.70	0.08		
		Pak-II DI	1.0	0.90	0.10		
	NI-II(1250kg< RW < 1700 Kg)	Pak-II IDI	1.25	1.0	0.12		
		Pak-II DI	1.25	1.3	0.14		
	NI-III(RW< 1700 Kg)	Pak-II IDI	1.50	1.2	0.17		
		Pak-II DI	1.50	1.6	0.20		

Parameter Standards (maximum permissible limit) Measuring method

Noise	85 db (A)	Sound-meter at 7.5 meters from the source

(b) For Heavy Duty Diesel Engines and Large Goods Vehicles (g/Kwh)

Type of Vehicle	Catogry/ Class	Tiers	CO	HC	NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8	9
Heavy Duty Diesel Engines	Turks and Buses	Pak-II	4.0	1.1	7.0	0.15	ECE-R-49	All Imported and local manufactured diesel vehicles with the effect 1-7-2012
Large goods Vehicles	N2(2000 and up	Pak-II	4.0	7.0	1.10	0.15	EDC	

Parameter Standards (maximum permissible limit) Measuring method

Noise 85 db (A) Sound-meter at 7.5 meters from the Source

Emission Standards for Petrol Vehicles (g/km)

Type of Vehicle	Category/ Class	Tier	Co	HC+ NOx	Measuring Method	Applicability
1	2	3	4	5	6	7
Passenger Cars.	M 1: with reference mass (RW): upto 2500 kg. Cars with RW over 2500 kg. to meet N1 Category standards	Pak-II	2.20	0.5	NEDC (ECE 15+ EUDCL)	All imported and new models * locally manufactured petrol vehicles with effect from 1st July, 2009**

Light Commercial Vehicles	NI-I (RW<1250 kg) NI-NI-II (1250kg> kg RW < 1700 Kg)	Pak-II	2.20	0.5	
		Pak-II	4.0	0.65	
	NI-III(RW> 1700 kg)	Pak-II	5.0	0.08	
Motor Rickshaws & Motor Cycles	2,4 strokes < 150 cc	Pak-II	5.5	1.5	ECER 40
	2,4 strokes > 150cc	Pak-II	5.5	1.3	

Parameter	Standards (maximum permissible limit)	Measuring method
Noise source	85 db (A)	Sound-meter at 7.5 meters from the

Explanations:

DI:	Direct Injection.
IDI:	Indirect Injection.
EUDCL:	Extra Urban Driving Cycle.
NEDC:	New European Driving Cycle.
ECE:	Urban Driving Cycle.
M:	Vehicles designed and constructed for the carriage of passenger and Comprising no more than eight seats in addition to the driver's seat.
N:	Motor vehicles with at least four wheels designed and constructed for the carriage of goods.
*	New model means both model and engine type change.
**	The existing models of petrol driven vehicles locally manufactured will immediately switch over to Pak-II emission standards but no late than 30th June, 2012.

SINDH ENVIRONMENTAL QUALITY STANDARDS FOR AMBIENT AIR

Pollutants	Time-weight average	Concentration in Ambient Air	Method of measurement
Sulphur Dioxide(SO2)	Annual Average* 24 hours**	80 µg/m³ 120 µg/m³	Ultraviolet Fluorescence method
Oxides of Nitrogen as (NO)	Annual Average* 24 hours**	40 µg/m³ 40 µg/m³	Gas Phase Chemiluminescence
Oxides of Nitrogen as (NO2)	Annual Average* 24 hours**	40 µg/m³ 80 µg/m³	Gas Phase Chemiluminescence
O³	1 hour	130 µg/m³	Non dispersive UV absorption method
Suspended Particulate Matters(SPM)	Annual Average* 24 hours**	360 µg/m³ 500 µg/m³	High Volume Sampling (Average flow rate not less than 1.1 in 3/minutes)
Respirable Particulate Matter PM10	Annual Average* 24 hours**	120 µg/m³ 150 µg/m³	ß Ray absorption method
Respirable Particulate Matter PM2.5	Annual Average* 24 hours**	40 µg/m³*** 75 µg/m³	ß Ray absorption method
Lead Pb	Annual Average* 24 hours**	1 µg/m³ 1.5 µg/m³	ASS Method after sampling using EPM 2000 or equivalent filter paper
Carbon Monoxide(CO)	8 hours** 1 hours**	5 mg/m³ 10 mg/m³	Non Dispersive Infra Red(NDIR) method

*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly and at uniform interval.

** 24 hourly/8 hourly values should be met 98% in a year, 2% of the time. It may exceed but not on two consecutive days.

***Annual Average limit of 40μ/m³ or background annual average concentration plus allowable allowance of 9μg/m³, whichever is lower.

Sindh Standards for Drinking Water Quality

Properties / Parameters	Standard Values for Sindh	WHO Standards	Remarks
Bacterial			
All water intended for drinking (e.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Most Asian countries also follow WHO standards
Physical			
Colour	≤ 15 TCU	≤ 15 TCU	
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable	
Odour	Non	Non	

	objectionable/Acceptable	objectionable/Accep table
Turbidity	⟨ 5 NTU	⟨ 5 NTU
Total hardness as $CaCO_3$	< 500 mg/l	---
TDS	⟨ 1000	⟨ 1000
pH	6.5 – 8.5	6.5 – 8.5
Chemical		
Essential Inorganic	***mg/Litre***	***mg/Litre***
Aluminium (Al) mg/l	≤ 0.2	0.2

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Antimony (Sb)	≤ 0.005 (P)	0.02	
Arsenic (As)	≤ 0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium(Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl)	< 250	250	
Chromium (Cr)	≤ 0.05	0.05	
Copper (Cu)	2	2	
Toxic Inorganic	***mg/Liter***	***mg/Litre***	
Cyanide (CN)	≤ 0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤ 1.5	1.5	
Lead (Pb)	≤ 0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤ 0.001	0.001	
Nickel (Ni)	≤ 0.02	0.02	

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Nitrate (NO_3)	≤ 0.50	50	
Nitrite (NO_2)	≤ 3 (P)	3	
Selenium (SE)	0.01 (P)	0.01	
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	---	
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Organic			
Pesticides mg/L		PSQCA No. 4639-2004. Page No. 4 Table No. 3 Serial No. 20-58 may be consulted.***	Annex II
Phenolic compounds (as Phenols) mg/L		≤ 0.002	
Polynuclear aromatic hydrocarbons (as PAH g/L)		0.01 (By GC/MS method)	
Radioactive			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

*** PSQCA: Pakistan Standards Quality Control Authority

Proviso:

The existing drinking water treatment infrastructure is not adequate to comply with WHO guidelines. The Arsenic concentrations in some parts of Sindh have been found high then Revised WHO guidelines. It will take some time to control arsenic through treatment process. Lead concentration in the proposed standards is higher than WHO Guidelines. As the piping system for supply of drinking water in urban centers are generally old and will take significant resources and time to get them replaced. In the recent past, Lead was completely phased out from petroleum

products to cut down Lead entering into environment. These steps will enable to achieve WHO guidelines for Arsenic, Lead, Cadmium and Zinc. However, for bottled water, WHO limits for Arsenic, Lead, Cadmium and Zinc will be applicable and PSQCA Standards for all the remaining parameters.

Sindh Environmental Quality Standards for Noise

S. No.	Category of Area / Zone	Effective from 1st Jan, 2015		Effective from 1st January, 2015	
		Limit in dB(A) Leq *			
		Day Time	Night Time	Day Time	Night Time
1.	Residential Area (A)	65	50	55	45
2.	Commercial Area (B)	70	60	65	55
3.	Industrial Area (C)	80	75	75	65
4.	Silence Zone (D)	55	45	50	45

Note: 1. Day time hours: 6:00 a.m to 10:00 p.m

2. Night time hours: 10:00 p.m to 6:00 a.m

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

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

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

3. **Repeal and Savings.**

(1) The provisions of the Statutory Notification dated 10th August, 2000 and 18th October, 2010, issued by the Ministry of Environment, Government of Pakistan, to the extent of the Province of Sindh are hereby repealed.

(2) All actions taken, proceedings initiated shall be deemed to have been taken and initiated validly under the the provisions of these Rules.

DIRECTOR GENERAL
SINDH ENVIRONMENTAL PROTECTION AGENCY

Karachi: Printed at the Sindh Government Press
28-1-2016

ANNEXURE – IV

Environmental Monitoring Reports

Quality TESTING SERVICES

EPA Certified Lab
EPA/LAB/Certificate/QTS-11/2013

QMS/III/018 WA	
Revision : 03	Date 14.01.2021

Lab Report Ref. No.: QTS/SPP/22/5474-A

Reporting Date: 12/12/2022

Project Name: ESMP 175 MW Solar Power Plant Deh Halkani & Band Murad.

SAMPLE DESCRIPTION

Sample ID: Drinking water 01 (Deh Halkani & Band Murad)
Sample Type: Grab Sample
Sample Collected/Submitted by: QTS Representative
Sampling Date: 03/12/2022
Sample Receipt at QTS - Date: 03/12/2022

ANALYTICAL TEST REPORT

S. NO.	PARAMETERS	STANDARDS	STANDARD	LDL	UNITS	RESULTS	TEST METHOD
		SSDWQ - LIMITS	WHO				
1	pH value	6.5 – 8.5	6.5 – 8.5	0.01	SU	7.31	USEPA 150.1
2	Odour	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
3	Taste	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
4	Color	≤ 15	≤ 15	1.0	TCU	0.46	APHA-2020 B/C
5	Turbidity	< 5	<5	0.01	NTU	0.33	APHA-2130 B
6	Total Dissolved Solids (TDS)	< 1000	NS	1.0	mg/L	925	Hach 8160
7	Total Hardness as $CaCO_3$	< 500	180	0.1	mg/L	310	EDTA Titration.Hach-8213
8	Fluoride (as F^-)	≤ 1.5	≤ 1.5	0.01	mg/L	0.5	USEPA 340.1
9	Chloride (as Cl^-)	< 250	< 250	0.1	mg/L	280*	Hach 8206
10	Nitrate (NO_3)	≤ 50	≤ 50	0.01	mg/L	0.37	Hach -8039
11	Nitrite (NO_2)	≤ 3	≤ 3	0.001	mg/L	0.031	Hach - 8153
12	Cyanide (as CN-) total	≤ 0.05	< 0.7	0.001	mg/L	BDL	Hach 8027
13	Phenolic Compound as (Phenols)	-	-	0.001	mg/L	BDL	USEPA-420.1
14	Aluminum (Al)	≤ 0.2	≤ 0.2	0.001	mg/L	BDL	APHA-3111 D
15	Antimony (Sb)	≤ 0.005	0.02	0.001	mg/L	BDL	APHA-3111 B
16	Arsenic	≤ 0.05	≤ 0.01	0.01	mg/L	BDL	APHA-3120 B
17	Cadmium	0.01	0.003	0.001	mg/L	BDL	ASTM D-3557
18	Chromium Total	≤ 0.05	≤ 0.05	0.01	mg/L	BDL	ASTM D-1687
19	Copper	2	2	0.01	mg/L	0.021	Hach 8506
20	Lead	≤ 0.05	≤ 0.01	0.001	mg/L	BDL	ASTM D-3559
21	Mercury	≤ 0.001	≤ 0.001	0.001	mg/L	BDL	ASTM D-3223
22	Selenium	0.01	0.04	0.001	mg/L	BDL	ASTM D-3859
23	Nickel	≤ 0.02	< 0.02	0.01	mg/L	BDL	ASTM D-1886
24	Boron	0.3	0.3	0.01	mg/L	BDL	ASTM D-3082
25	Zinc	5.0	3.0	0.01	mg/L	0.043	USEPA 3500 Zn B
26	Manganese	≤ 0.5	≤ 0.5	0.01	mg/L	0.03	Hach 8034
27	Barium	0.7	0.7	0.01	mg/L	BDL	Hach 8014
	MICROBIOLOGICAL ANALYSIS REPORT						
28	Total Coliform	0 cfu/100mL	0	0	Cfu	>250*	APHA-SM9221B
29	Fecal Coliform	0 cfu/100mL	0	0	Cfu	>100*	APHA-SM9221F
30	Escherichia Coli(E-Coli)	0 cfu/100mL	0	0	cfu	>80*	APHA-SM9221F

SSDWQ=Sindh Standard for Drinking Water Quality
USEPA=United State Environmental Protection Agency method
Hach USA, method
BDL=Below Detection Limit
NS= Not Specified

Term & Condition:

- This report is not valid for any negotiations.
- Report is valid for current batch(sample).
- The remaining portion of the sample will be discarded after 07 days unless otherwise instructed.
- This report is intended only for your guidance & not for legal purpose or for advertisement.

Comments:

*Tested parameters are not within the SSDWQ and WHO Standards.

Sample Analyzed by: Hareem Zehra	**Signature of Laboratory In charge:** **Name : Ali Raza**

Quality Testing Services Karachi Q.T.S

Office No.505, Anum Estate Building, Opposite Duty Free Shop, Main Shahrah-e-Faisal, Karachi.
Tel. No. 92-21-34311466, 92-21-34382860, 92-21-34321532, Fax. No. 92-21-34311467

Email: info@qts.com.pk

Quality TESTING SERVICES

EPA Certified Lab
EPA/LAB/Certificate/QTS-11/2013

QMS/III/018 WA	
Revision : 03	Date 14.01.2021

Lab Report Ref. No. : QTS/SPP/22/5474-B

Reporting Date: 12/12/2022

Project Name: ESMP 175 MW Solar Power Plant Deh Halkani & Band Murad.

SAMPLE DESCRIPTION

Sample ID: Drinking water 02(Deh Halkani & Band Murad)
Sample Type: Grab Sample
Sample Collected/Submitted by: QTS Representative
Sampling Date: 03/12/2022
Sample Receipt at QTS - Date: 03/12/2022

ANALYTICAL TEST REPORT

S. NO.	PARAMETERS	STANDARDS SSDWQ - LIMITS	STANDARD WHO	LDL	UNITS	RESULTS	TEST METHOD
1	pH value	6.5 – 8.5	6.5 – 8.5	0.01	SU	7.60	USEPA 150.1
2	Odour	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
3	Taste	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable	-	Physical	Acceptable	Physical
4	Color	≤ 15	≤ 15	1.0	TCU	0.41	APHA-2020 B/C
5	Turbidity	< 5	<5	0.01	NTU	0.31	APHA-2130 B
6	Total Dissolved Solids (TDS)	< 1000	NS	1.0	mg/L	902	Hach 8160
7	Total Hardness as $CaCO_3$	< 500	180	0.1	mg/L	299	EDTA Titration.Hach-8213
8	Fluoride (as F^-)	≤ 1.5	≤ 1.5	0.01	mg/L	0.42	USEPA 340.1
9	Chloride (as Cl^-)	< 250	< 250	0.1	mg/L	253*	Hach 8206
10	Nitrate (NO_3)	≤ 50	≤ 50	0.01	mg/L	0.34	Hach -8039
11	Nitrite (NO_2)	≤ 3	≤ 3	0.001	mg/L	0.027	Hach - 8153
12	Cyanide (as CN-) total	≤ 0.05	< 0.7	0.001	mg/L	BDL	Hach 8027
13	Phenolic Compound as (Phenols)	-	-	0.001	mg/L	BDL	USEPA-420.1
14	Aluminum (Al)	≤ 0.2	≤ 0.2	0.001	mg/L	BDL	APHA-3111 D
15	Antimony (Sb)	≤ 0.005	0.02	0.001	mg/L	BDL	APHA-3111 B
16	Arsenic	≤ 0.05	≤ 0.01	0.01	mg/L	BDL	APHA-3120 B
17	Cadmium	0.01	0.003	0.001	mg/L	BDL	ASTM D-3557
18	Chromium Total	≤ 0.05	≤ 0.05	0.01	mg/L	BDL	ASTM D-1687
19	Copper	2	2	0.01	mg/L	0.032	Hach 8506
20	Lead	≤ 0.05	≤ 0.01	0.001	mg/L	BDL	ASTM D-3559
21	Mercury	≤ 0.001	≤ 0.001	0.001	mg/L	BDL	ASTM D-3223
22	Selenium	0.01	0.04	0.001	mg/L	BDL	ASTM D-3859
23	Nickel	≤ 0.02	< 0.02	0.01	mg/L	BDL	ASTM D-1886
24	Boron	0.3	0.3	0.01	mg/L	BDL	ASTM D-3082
25	Zinc	5.0	3.0	0.01	mg/L	0.041	USEPA 3500 Zn B
26	Manganese	≤ 0.5	≤ 0.5	0.01	mg/L	0.02	Hach 8034
27	Barium	0.7	0.7	0.01	mg/L	BDL	Hach 8014
	MICROBIOLOGICAL ANALYSIS REPORT						
28	Total Coliform	0 cfu/100mL	0	0	Cfu	>200*	APHA-SM9221B
29	Fecal Coliform	0 cfu/100mL	0	0	Cfu	>90*	APHA-SM9221F
30	Escherichia Coli(E-Coli)	0 cfu/100mL	0	0	cfu	>80*	APHA-SM9221F

SSDWQ=Sindh Standard for Drinking Water Quality
USEPA=United State Environmental Protection Agency method
Hach USA, method
BDL=Below Detection Limit
NS= Not Specified

Term & Condition:

- This report is not valid for any negotiations.
- Report is valid for current batch(sample).
- The remaining portion of the sample will be discarded after 07 days unless otherwise instructed.
- This report is intended only for your guidance & not for legal purpose or for advertisement.

Comments:

*Tested parameters are not within the SSDWQ and WHO Standards.

Sample Analyzed by: Hareem Zehra	**Signature of Laboratory In charge:** **Name : Ali Raza**

Quality Testing Services Karachi Q.T.S

Office No.505, Anum Estate Building, Opposite Duty Free Shop, Main Shahrah-e-Faisal, Karachi.
Tel. No. 92-21-34311466, 92-21-34382860, 92-21-34321532, Fax. No. 92-21-34311467

Email: info@qts.com.pk

Quality TESTING SERVICES

EPA Certified Lab
EPA/LAB/Certificate/QTS-11/2013

QMS/III/018 WA	
Revision : 03	Date 14.01.2021

Ambient Air Quality Test Report

Project Name:	ESMP 175 MW Solar Power Plant Deh Halkani & Band Murad.	Test Report No:	QTS/SPP/22/5475-A
		Sample Duration:	24hr's
Sample Description:	Ambient Air Quality Test	Location: A	25°01'58.50"N 66°58'59.99"E

PARAMETERS								
Date	Time	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SPM (µg/m³)	Lead (µg/m3)
02.12.2022	10:00	14.5	12.6	16.2	103	24	309	ND
	11:00	13.3	10.8	20.3	109	22	328	
	12:00	18.5	06.0	25.6	116	29	345	
	13:00	21.8	08.2	21.9	130	30	350	
	14:00	19.2	14.4	30.0	132	35	365	
	15:00	20.3	11.6	33.5	129	29	342	
	16:00	20.9	09.2	37.1	122	25	322	
	17:00	15.0	18.2	29.4	121	19	304	
	18:00	14.5	16.3	25.5	120	19	296	
	19:00	16.9	13.5	21.5	115	20	295	
	20:00	13.2	14.8	23.2	103	22	275	
	21:00	10.6	16.4	14.8	96	19	264	
	22:00	10.3	19.2	11.5	92	16	250	
	23:00	09.4	14.0	16.2	91	15	238	
03.12.2022	00:00	16.4	12.4	18.4	84	14	224	
	01:00	18.3	16.3	15.3	81	14	211	
	02:00	20.9	13.5	14.6	75	16	218	
	03:00	17.2	10.3	14.3	78	13	220	
	04:00	12.3	14.3	16.6	69	17	223	
	05:00	11.6	14.6	17.3	63	12	238	
	06:00	13.5	15.9	19.4	74	16	242	
	07:00	14.9	19.3	20.3	88	19	251	
	08:00	14.0	15.2	14.6	93	20	279	
	09:00	16.9	11.4	17.5	102	22	294	
MIN		9.4	6	11.5	63	12	211	
MAX		21.8	19.3	37.1	132	35	365	
AVG		15.6	13.6	20.9	99.2	20.5	279.1	
SEQS		40	80	120	150	75	500	1.5

Quality Testing Services Karachi Q.T.S

Office No.505, Anum Estate Building, Opposite Duty Free Shop, Main Shahrah-e-Faisal, Karachi.
Tel. No. 92-21-34311466, 92-21-34382860, 92-21-34321532, Fax. No. 92-21-34311467

Email: info@qts.com.pk

Ambient Air Quality Test Report

Project Name:	**ESMP 175 MW Solar Power Plant** Deh Halkani & Band Murad.	**Test Report No:**	**QTS/SPP/22/5475-A**
		Sample Duration:	**24hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: A**	**25°01'58.50"N 66°58'59.99"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m3	08 Hours	0.09	5.0	NA	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m3	08 Hours	15.6	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO2)	µg/m3	08 Hours	13.6	80.0	200	
Sulphur Dioxide (SO2)	µg/m3	08 Hours	20.9	120.0	20	Ultraviolet Fluorescence Method
Ozone (O3)	µg/m3	01 Hour	16.2	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM10)	µg/m3	08 Hours	99.2	150.0	50	β Ray Absorption Method
Particular Matter (PM2.5)	µg/m3	08 Hours	20.5	75.0	25	
Total Suspended Particles (TSP)	µg/m3	08 Hours	279.1	500.0	NA	
Lead	µg/m3	08 Hours	ND	1.5	NA	ASS Method

*SEQS= Sindh Environmental Quality Standards.
*IFC= International Finance Corporation
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
,mg/m3= Milligrams per Cubic Meter
ppm = Parts per million
ND= Not Detected
N/A=Not Available

Remarks:
The average concentration calculated for the 08 hours are well within guideline values set by SEQS

Sample Analyzed By: Sajid Ali	**Signature of Laboratory Incharge:**_____ **Name : Ali Raza**

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

Project Name:	ESMP 175 MW Solar Power Plant Deh Halkani & Band Murad.	Test Report No:	QTS/SPP/22/5475-B
		Sample Duration:	24hr's
Sample Description:	Ambient Air Quality Test	Location: B	25°01'58.50"N 66°58'59.99"E

PARAMETERS								
Date	Time	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SPM (µg/m³)	Lead (µg/m3)
03.12.2022	10:00	16.5	20.6	26.2	93	32	249	ND
	11:00	12.3	15.8	30.3	94	39	248	
	12:00	12.5	16.0	35.6	102	37	255	
	13:00	12.8	18.2	31.9	112	31	250	
	14:00	10.2	24.4	30.0	118	29	255	
	15:00	10.3	28.6	30.5	120	20	262	
	16:00	10.9	29.2	37.1	135	21	271	
	17:00	14.0	28.2	36.4	131	18	274	
	18:00	12.5	22.3	29.5	110	16	266	
	19:00	10.9	23.5	22.5	105	20	255	
	20:00	13.2	24.8	23.2	103	18	245	
	21:00	11.6	19.4	24.8	100	19	244	
	22:00	10.3	16.2	29.5	92	20	240	
	23:00	08.4	14.0	26.2	90	27	218	
04.12.2022	00:00	10.4	17.4	28.4	81	20	204	
	01:00	11.3	20.3	24.3	79	19	191	
	02:00	12.9	16.5	18.6	75	16	188	
	03:00	17.2	15.3	15.3	68	14	190	
	04:00	12.3	21.3	19.6	69	18	193	
	05:00	18.6	24.6	14.3	76	25	198	
	06:00	20.5	16.9	18.4	80	23	201	
	07:00	14.9	19.3	20.3	88	29	211	
	08:00	12.0	25.2	19.6	98	24	219	
	09:00	13.9	23.3	22.5	95	29	224	
MIN		8.4	14	14.3	68	14	188	
MAX		20.5	29.2	37.1	135	39	274	
AVG		13.0	20.9	25.6	96.8	23.7	231.2	
SEQS		40	80	120	150	75	500	1.5

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

Project Name:	**ESMP 175 MW Solar Power Plant** Deh Halkani & Band Murad.	**Test Report No:**	**QTS/SPP/22/5475-B**
		Sample Duration:	**24hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: B**	**25°01'58.50"N 66°58'59.99"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m3	08 Hours	0.24	5.0	NA	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m3	08 Hours	13.0	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO2)	µg/m3	08 Hours	20.9	80.0	200	
Sulphur Dioxide (SO2)	µg/m3	08 Hours	25.6	120.0	20	Ultraviolet Fluorescence Method
Ozone (O3)	µg/m3	01 Hour	16.2	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM10)	µg/m3	08 Hours	96.8	150.0	50	β Ray Absorption Method
Particular Matter (PM2.5)	µg/m3	08 Hours	23.7	75.0	25	
Total Suspended Particles (TSP)	µg/m3	08 Hours	231	500.0	NA	
Lead	µg/m3	08 Hours	ND	1.5	NA	ASS Method

*SEQS= Sindh Environmental Quality Standards.
*IFC= International Finance Corporation
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
,mg/m3= Milligrams per Cubic Meter
ppm = Parts per million
ND= Not Detected

Remarks:
The average concentration calculated for the 08 hours are well within guideline values set by SEQS

Sample Analyzed By: Sajid Ali	**Signature of Laboratory Incharge:**_____ **Name : Ali Raza**

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

Project Name:	**ESMP 175 MW Solar Power Plant** Deh Halkani & Band Murad.	**Test Report No:**	**QTS/SPP/22/5475-C**
		Sample Duration:	**24hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: C**	**25°01'50.27"N 66°59'57.39"E**

PARAMETERS								
Date	**Time**	**NO (µg/m³)**	**NO_2 (µg/m³)**	**SO_2 (µg/m³)**	**PM 10 (µg/m³)**	**PM 2.5 (µg/m³)**	**SPM (µg/m³)**	**Lead (µg/m3)**
05.12.2022	10:00	26.5	16.2	36.4	122	22	345	ND
	11:00	22.8	19.4	40.6	124	19	338	
	12:00	22.5	28.0	31.2	132	22	315	
	13:00	19.8	28.9	19.9	136	21	320	
	14:00	20.2	34.1	20.4	138	18	355	
	15:00	18.4	38.0	28.0	120	24	312	
	16:00	14.9	31.4	27.4	115	31	291	
	17:00	15.0	27.0	30.6	112	26	284	
	18:00	22.5	19.0	39.5	104	26	278	
	19:00	20.9	13.5	42.0	95	30	261	
	20:00	23.2	14.8	26.2	103	27	255	
	21:00	21.6	09.4	21.8	80	22	249	
	22:00	16.3	11.9	19.4	82	17	230	
	23:00	12.6	10.7	16.9	70	15	227	
06.12.2022	00:00	13.0	15.4	22.4	61	14	216	
	01:00	12.8	22.0	34.8	69	18	201	
	02:00	16.0	26.5	28.6	74	22	196	
	03:00	22.8	21.3	19.3	78	24	192	
	04:00	22.4	11.4	21.0	60	19	198	
	05:00	16.6	14.6	24.6	71	15	208	
	06:00	14.5	19.8	20.4	84	13	216	
	07:00	16.9	22.0	21.4	91	20	241	
	08:00	19.0	20.4	26.6	108	21	269	
	09:00	23.4	18.9	32.0	105	26	294	
MIN		12.6	9.4	16.9	60	13	192	
MAX		26.5	38	42	138	31	355	
AVG		18.9	20.8	27.3	97.2	21.3	263	
SEQS		40	80	120	150	75	500	1.5

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

Project Name:	**ESMP 175 MW Solar Power Plant** Deh Halkani & Band Murad.	**Test Report No:**	**QTS/SPP/22/5475-C**
		Sample Duration:	**24hr's**
Sample Description:	**Ambient Air Quality Test**	**Location: C**	**25°01'50.27"N 66°59'57.39"E**

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	IFC Limits	Methodology
Carbon Monoxide (CO)	mg/m3	08 Hours	0.36	5.0	NA	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m3	08 Hours	18.9	40.0	NA	Chemiluminescence
Nitrogen Dioxide (NO2)	µg/m3	08 Hours	20.8	80.0	200	
Sulphur Dioxide (SO2)	µg/m3	08 Hours	27.3	120.0	20	Ultraviolet Fluorescence Method
Ozone (O3)	µg/m3	01 Hour	18.4	130.0	100	Non Dispersive UV Absorption Method
Particulate Matter (PM10)	µg/m3	08 Hours	97.2	150.0	50	β Ray Absorption Method
Particular Matter (PM2.5)	µg/m3	08 Hours	21.3	75.0	25	
Total Suspended Particles (TSP)	µg/m3	08 Hours	263.0	500.0	NA	
Lead	µg/m3	08 Hours	ND	1.5	NA	ASS Method

*SEQS= Sindh Environmental Quality Standards.
*IFC= International Finance Corporation
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
,mg/m3= Milligrams per Cubic Meter
ppm = Parts per million
ND= Not Detected

Remarks:
The average concentration calculated for the 08 hours are well within guideline values set by SEQS

Sample Analyzed By: Sajid Ali	**Signature of Laboratory Incharge:**_____ **Name : Ali Raza**

Quality Testing Services Karachi Q.T.S

Lab Report Ref. No. : EMC/QTS/SPP/22/ 5476 Reporting Date: 12/12/2022

Project Name: ESMP 175 MW Solar Power Plant Deh Halkani & Band Murad.

SAMPLE DESCRIPTION

Sample ID: Noise Level Test
Sample Description: Ambient Noise
No. of samples: 05
Sample Collected/Submitted by: QTS representative
Sampling Date: 03/12/2022
Sample Receipt at QTS - Date: 03/12/2022

NOISE LEVEL TEST REPORT

S.NO.	LOCATION/SOURCE	Noise Level Readings				
		Minimum	Maximum	Average	SEQS	WHO
1	Point -1 25°02'02.07"N 66°59'40.41"E	52.1	55.9	54.0	Limits: *65dB(A)	Limits: *70dB(A)
2	Point -2 25°01'37.52"N 66°58'48.15"E	50.6	56.2	53.4		
3	Point -3 25°01'27.32"N 67°00'07.89"E	53.0	57.0	55.0		
4	Point -4 25°01'23.08"N 66°59'31.27"E	51.6	56.8	54.2		
5	Point -5 25°01'56.62"N 66°58'54.05"E	52.0	57.4	54.7		

SEQS *= Sindh Environmental Quality Standards (Outside Noise Level)*
dB (A) Leq=Time weighted average of the level of sound in decibel on scale which is relatable to human hearing.

Term & Condition:

- This report is not valid for any negotiations
- Report is valid for current batch(sample)
- This report is intended only for your guidance & not for legal purpose or for advertisement.

Comments:
The Noise Level from the sources is within acceptable level as describe in SEQS.

Sample Analyzed by: Sajid Ali	**Signature of Laboratory In charge:** _____ **Name : Ali Raza**

Quality Testing Services Karachi Q.T.S