NATIONAL MANAGEMENT & CONSULTANCY SERVICES

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA)

MANGROVE CREEKSIDE URBAN DEVELOPMENT

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EMC Pakistan Private Limited

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ABBREVIATIONS & ACRONYMS

BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental & Social Management Plan
EPA	Environmental Protection Agency
EPCC	Engineering, Procurement and Construction Contractor(s)
GOS	Government of Sindh
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IMC	Independent Management Consultant
NOC	No Objection Certificate
PGA	Peak Ground Acceleration
PMD	Pakistan Meteorological Department
PS	Performance Standard
SEPA	Sindh Environmental Protection Agency
SEQS	Sindh Environmental Quality Standards
TDS	Total dissolved solids
TPH	Total Petroleum Hydrocarbon
TSS	Total Suspended Solids
WHO	World Health Organization

1 INTRODUCTION

EMC Pakistan (Private) Limited has been commissioned by National Management & Consultancy Services to conduct the Environmental & Social Impact Assessment (ESIA) study for the development of the "Mangrove Creekside Urban Development" project proposed within Korangi Creek Cantonment, Karachi. Nestled between Korangi Creek industrial park to the North and dense mangrove vegetation on the west, the proposed project will oversee the development of buildings over 18 different plots of land, situated over an area of 40 acres (Figure 1.1). Overall, once completed, the development will house:

- Residential quarters (apartments and green view communities),
- A technology zone (offices, commercial zones, cafes & restaurants),
- A hospitality area (hotel/ service apartments overlooking the mangroves),
- A communal area (a park, community spaces, play areas, and a mosque),
- A boardwalk (a boardwalk alongside the Creekside mangroves).

To address the potential environmental and social impacts of this project, this Environmental and Social Impact Assessment (ESIA) has been prepared in accordance with International Best Practices, and the guidelines of the Sindh Environmental Protection Agency (SEPA) for their scrutiny and approval.

1.1 Project Proponent[1]

National Management & Consultancy Services (NMCS) is special purpose vehicle (spv) that has been established for the development of the Creekside Mangrove Urban Development project, where this company falls under the umbrella of TPL Properties.

TPL Properties was established in 2007 and became a PSX-listed company in 2016. Its first project and flagship office development, Centrepoint, was completed in 2013 and subsequently acquired by a leading bank for their head office in 2021. Overtime, TPL Properties has grown to establish itself as a leading institutional Real Estate investor, developer and manager in Pakistan.

The company has also established a REIT management subsidiary which is in the process of launching its first REIT Fund, which will then take over three self-developed projects. This will establish TPL Properties as the only institutional Real Estate company in Pakistan listed on the stock market (PSX) with a portfolio of assets across Residential, Commercial, Retail, and Logistics Warehousing. Furthermore, a subsidiary of the company, TPL Property Management continues to provide facility management services.

TPL Properties are focused on sustainable developments and are ensuring LEED standard developments across their portfolio, where they partner with a number of reputed international and domestic design and engineering firms to deliver the highest level of quality and set new benchmarks in Real Estate in Pakistan

Environmental & Social Governance (ESG)

"TPL Properties incorporates sustainability in all its processes - which includes energy-efficient methods that minimize harmful environmental impact. We do this by integrating ESG considerations into all our management processes and ownership practices in the belief that these factors will have an impact on financial performance". The company's ESG objectives are highlighted below:

[1] https://tplproperty.com/

Environmental

- Evaluate and implement low-cost measures, capital improvements, and new technologies with the intent to improve energy efficiency.
- Evaluate and disclose environmental risk factors during every investment's due diligence and decision-making process.
- Reuse or restore old buildings through adaptive reuse.

Social

- Provide tools and resources to educate and engage our property management teams on ESG and sustainability issues.
- Promote the health and well-being of residents at each of our developments by providing services and amenities such as fitness centers, public parks, swimming pools, hospitals, schools, and green spaces.
- Encourage our employees to play an active role in the growth and development of the surrounding communities in which they live and work through volunteering and charitable contributions.
- Support gender diversity and inclusion by providing in-house trainings, corporate communication and creating a work environment that optimizes the full potential of our employees.
- Encourage our third-party property management teams to host community / resident events to enhance a sense of belonging and inspire residents to gainfully impact the community in which they live. Additionally, each property is encouraged to host plantation drives and community meetups.

Governance

- Appointed a female director on the company's Board as per SECP guidelines.
- The board has adopted the code of corporate governance practices and is monitoring the effectiveness of such practices.
- The business promotes corporate social responsibility initiatives such as philanthropic activities, donations, contributions to charities, and other matters of social welfare.
- Established adequate systems and controls for identification and redressal of grievances arising from unethical practices.
- Engagement of qualified and reputable service providers, vendors, and independent auditors.
- Implementation of emerging ESG practices through the direction of the company's ESG/CSR team.
- Disclose our ESG strategy and performance to investors through a structured reporting framework.
- Ensuring that our employees adhere to the highest standards of honest and ethical conduct through each employee's acknowledgment and confirmation of compliance with the company's Code of Conduct.

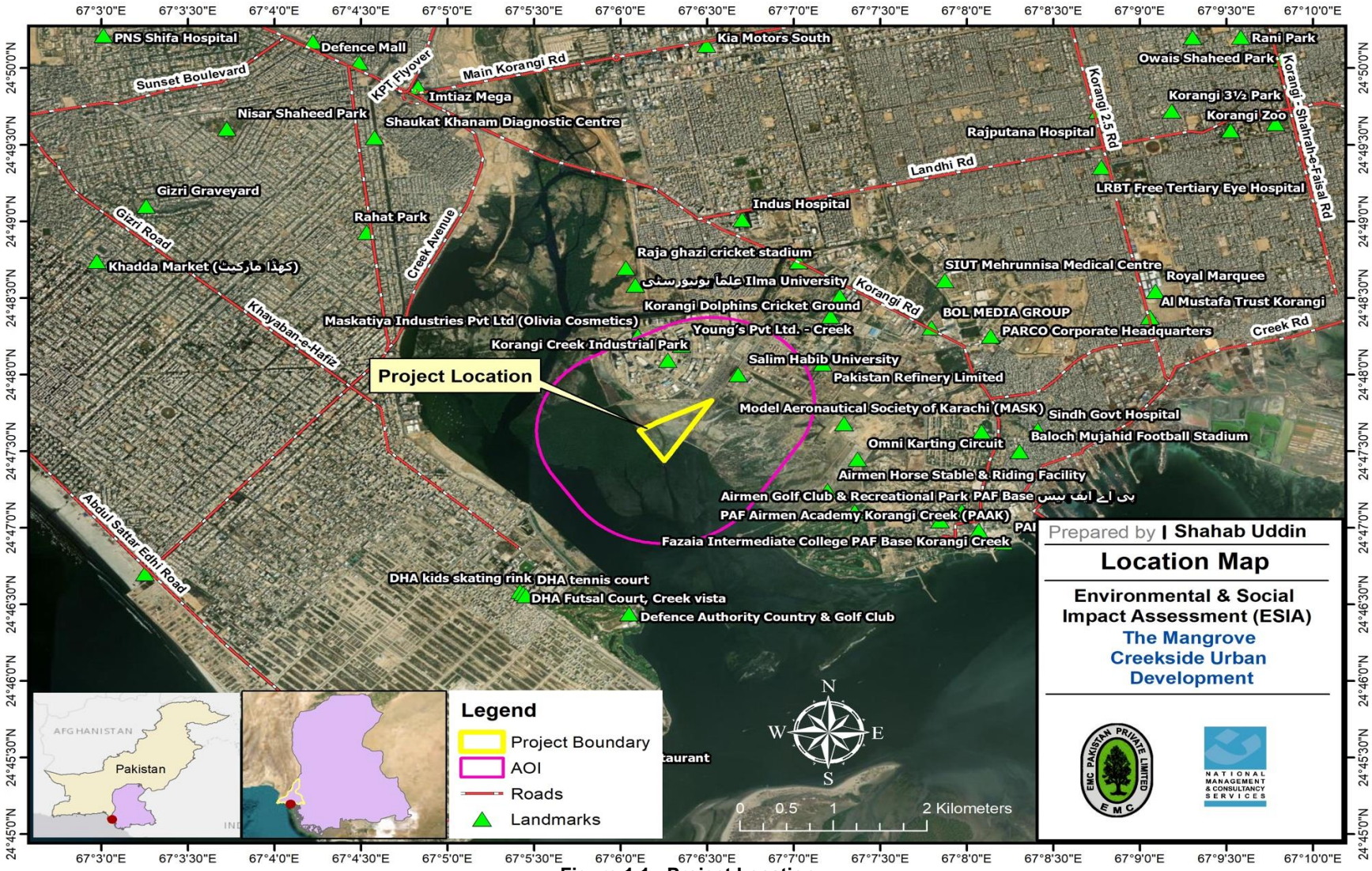


Figure 1.1 - Project Location

1.2 Need for the Project

Karachi is among the five mega cities of South Asia performing a vital function with regard to investment, trade, growth, and innovation while simultaneously bearing the cost of this function. Coupling this with the population burst, and the associated demand for multiple lifestyle accessories, there is a huge and growing demand for housing units, commercial entities and technology zones in the city. This project has been identified as a potential area to aid in bridging the gap between demand and supply by providing modern infrastructure and public transportation links, sustained by employment generators in the form of industrial areas supported by various residential and retail formats.

1.3 Need for ESIA

This Environmental and Social Impact Assessment (ESIA) for the proposed development has been carried out in compliance with the mandatory requirement of Section 17 of Sindh Environmental Protection Act (SEPA), 2014 which requires that:

"No Proponent of a project shall commence construction or operation unless it has filed with the Agency an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) and has obtained from Agency approval in respect thereof. SEPA shall review the IEE & EIA and accord approval subject to such terms and conditions as it may prescribe or require."

Subsequently, the Sindh EPA (Review of Environmental Assessment Regulations) 2021 also provides the necessary details pertaining to the preparation, submission, and review of different environmental assessment, including ESIA reports, along with categorization of projects into different kinds of assessments that would be required. The categorization of the proposed project falls under the following category in the regulation:

Schedule III – Projects Requiring an ESIA
Category J – Urban Development
Sub-Category (2) – Residential, Commercial High-rise buildings subject to compliance of building bylaws of relevant organizations more than 500,000 square feet

Furthermore, alongside the compliance of the Sindh EPA, and in line with NMCS's mission to ascribe to the highest of standards, the IFC's Performance Standards, 2012, have also been used during this environmental and social evaluation conducted.

1.4 Objectives of Environmental Assessment

The prime objective of the ESIA study is to identify and assess the anticipated impacts and risks of the proposed project, and to accordingly recommend adequate mitigation measures to prevent/ minimize the identified negative impacts on the surrounding physical, biological, and social environment. This is done through adopting changes and practices, which ameliorate the environmental and social performance of a project during its different stages (pre-construction, construction, development, and operation).

The objectives outlined for this study are given below:

- To identify and describe elements of community and environment likely to be affected by the proposed developments and / or likely to cause adverse impacts to the project, including natural and man – made environment;
- To identify any potential losses or damage to flora, fauna and natural habitats;

- Develop a baseline of its current environmental scenario as well as socioeconomic conditions;
- Identify potential impacts that may arise;
- Determine social aspects and environmental resources which are particularly sensitive to impacts and categorize impacts on the basis of their severity;
- Evaluate impacts due to construction and operational activities of the project with the relevant environmental regulations of Pakistan
- Evaluation of impacts severity / degree and providing necessary mitigation measures;
- Provide recommendations / suggestions for the environmental monitoring and management of social and physical environment in the surroundings of project area; and
- Ensure that all the impacts of the project have been taken care and all the relevant stakeholders are aware of the impacts.

1.5 Methodology for Environmental & Social Assessment

This environmental impact assessment was conducted in the following manner:

1.5.1 Literature Review

Prior to mobilization, a desktop study was conducted through collection and review of guidelines, data, and reports related to the project, that included (a) review of relevant Environmental Legislations and IFC's Performance Standards on Environmental and Social Sustainability 2012; (b) Google Earth Satellite Imagery; (c) socio-economic Data of Census 2017; (d) relevant design data provided by the client and the design consultant, and (e) reference of similar project ESIA documents.

1.5.2 Review of Environmental Laws and Institutional Requirements

The project needs to comply with all the applicable environmental and social policies, laws, and guidelines, acts, and legislations of the Government of Pakistan (GoP) and GoS. Moreover, the IFC's Performance Standards on Environmental and Social Sustainability 2012 related to the proposed project have also been discussed in detail in chapter 3 of this ESIA.

1.5.3 Delineation of Area of Influence (AOI)

The area of influence of a project encompasses the primary project site and related facilities such as the contractor camps, temporary material stacking areas, vehicle parking areas, and access roads, where project impacts are perceived to take place. The environmental and social risks and impacts were analyzed for all relevant stages of the project cycle, including the pre-construction, construction, and operational phases of the project.

The area of influence for the proposed site is delineated in Table 1.2 below and is also pictorially depicted in the following pages.

Table 1.2 - Area of Influence

S. No.	Project Site	Area of Influence (m)
1	40-acre area of project site and its vicinity	1000 meters

The AOI of the project is depicted in Figure 1.1 also.

1.5.4 Analysis of Alternatives

It is a mandatory requirement for the ESIA study to analyze each potential alternative available that could have been developed to meet the objectives and recommend the most environmentally, socially, and economically feasible option.

To select the most viable location for the proposed project, keeping in view the environmental, economic, and social constraints, the analysis of different alternatives was carried out amongst three different location options. Moreover, the no-project option (NPO) was also discussed with reference to the increasing energy demand with increasing populations. This exercise confirmed the justification for the need for the project.

1.5.5 Baseline Data Collection

Following the selection of the most feasible alternative, along with the mapping of the AOI, detailed environmental and social surveys were conducted within the AOI for environmental parameters on which any adverse or positive impacts ere envisaged by the implementation of the proposed project. Prior to the start of field activities, comprehensive checklists, proformas, and maps were developed covering the following main parameters:

Physical Environment

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

- Land Resources (including land use pattern, soil composition, contamination of soil and soil erosion, etc.)
- Water resources (including available surface and groundwater resources and natural streams, hydrology, spring water, water supply, water contamination, etc.)
- Climate data (including temperature, rainfall, humidity, wind speed, and direction, etc.)
- Ambient air quality and noise level monitoring data; and

Environmental Monitoring, Sampling, Testing & Modelling

Environmental Monitoring has the key role to assess the status of the existing environment that changes spatially and temporally. However, the goals, sample collection strategies, and methods of analysis used in monitoring must be well defined in advance to obtain robust results. In the preparation of a sampling plan, goals, strategies, and methods must be considered in conjunction with an understanding of the target environment, including the physical, chemical, and biological variables and processes involved. Environmental Monitoring has been conducted for the following parameters:

- Ambient Air Quality Monitoring (08-24 hours)
- Noise Measurements (24 hours)
- Sampling & Analysis of Drinking Water, Municipal wastewater, and groundwater

Ecological Environment

Information collected through primary (field surveys) and secondary data sources for the establishment of the ecological baseline included the following main parameters:

- Flora (trees, shrubs, herbs, grasses, and overall vegetation including valuable or rare trees and their loss due to implementation of the project, etc.)
- Fauna/ Wildlife (mammals, reptiles, amphibians, and avifauna)

- Agriculture and livestock
- Protected Areas, Natural Parks, Game Reserves, Wildlife Sanctuaries or any other ecologically important areas (surveys confirmed that no such areas were found in the AOI of the project sites)
- Migratory birds' corridors (survey confirmed that no migratory birds' corridors are found in and around the AOI)
- Endangered species (both flora and fauna)

Socio-Economic Environment

Despite being located along a highway where there is a sparse residential footprint, there are numerous up and coming developments in the area.

To understand the existing socio-economic conditions in the area of the masses, socio-economic surveys were conducted amongst residents and people found in the area.

1.5.6 Stakeholder Consultations

Consultations with the various stakeholders were carried out to document the concerns of the local community and other stakeholders, and to identify issues that may require additional assessment in order to address these concerns. The objectives of the consultations were as follows:

- To inform the stakeholders, communities and project affected persons about the project
- To gather feedback from primary and secondary stakeholders of the project
- To identify relevant potential issues, including the socioeconomic impact of the project, and corresponding mitigation measures

During the stakeholder consultation process, the following key considerations were focused on:

- Identification of sensitive receptors in the area
- Concerns of the residents about the project

1.5.7 Impact Assessment & Mitigation Measures

A logical and systemic approach was adopted for impact identification and assessment. The process began during the screening and continued through scoped which identified the key issues and classified them into different categories. The tools, which were used for impact assessment, are:

- Checklists to identify the impacts during field investigations/ surveys;
- Matrices for Qualitative assessment of the identified impacts; and
- Overlays for the quantification of significant impacts of land use-based aspect on images from Google Earth and field verification.

The assessment of potential environmental and social impacts in terms of their nature, extent, location, timing, and duration were carried out. The severity of the assessed impact was determined considering the magnitude and likelihood, along with the sensitivity of the receptor. The impacts were correlated to the project location, design, construction, and operational stages. Based on the impacts prediction and as a result of public/ stakeholder consultations, the ESIA team screened the adverse environmental and social impacts for inclusion in the mitigation measures and ESMP. Public consultations (which provided feedback of the impacts from the stakeholder's viewpoint) were used to screen out the insignificant impacts. Matrices and overlays were used for the evaluation of temporal and spatial impacts respectively.

The Consultants proposed pragmatic, economically feasible, and socially acceptable mitigation measures for the significant adverse environmental and social impacts. These measures were based on exploring the ways to achieve the project objectives causing least disturbance to the existing environment by alternative ways, proposing changes in the project design, through improved monitoring and management practices (storage of construction materials, labor camps, waste disposal, disposal of construction debris etc.).

1.5.8 Environmental & Social Management Plan (ESMP)

An ESMP has also been prepared to ensure the adequacy and effectiveness of the proposed measures by clearly identifying the roles and responsibilities of the agencies responsible for implementation, monitoring, and auditing of ESMP activities, existing and suggested framework, necessary approvals, training needs and the required further studies. The ESMP also includes an organizational setup, a monitoring mechanism, monitoring plan, where environmental monitoring, ecological and social component/ social mitigation measures were also introduced as part of the ESMP. Environmental monitoring, evaluation, auditing, and reporting mechanisms were also proposed as part of the ESMP.

1.6 Report Organization

This report contains nine chapters. The contents of chapters are described as follows:

1. **Chapter 1 – "Introduction"** describes introduction, location of project, objective and purpose of the ESIA report;
2. **Chapter 2 – ""Project Description"** furnishes an overall description of the project, including its background, features and key components and Project Alternatives;
3. **Chapter 3 – "Environment Legislative Requirements and Framework"** elucidates the current legal framework including national and IFC's Performance Standards on Environmental and Social Sustainability 2012 requirements which are applicable to the proposed project in the context of environment and sustainable development;
4. **Chapter 4 – "Description of the Environment / Baseline Data"** comprises a detailed narrative of the existing (baseline) conditions of the project area, with respect to its physical, biological and socio-economic environment;
5. **Chapter 5 – "Information on Disclosure, Consultation, and Participation"** provides a summary of consultative sessions with the local community as well as with other stakeholders, including local politicians, local government officials, policymakers, and NGOs, for their opinions and suggestions on the project and provides details of grievance redress mechanisms;
6. **Chapter 6 – "Anticipated Environmental Impacts and Mitigation Measures"** elaborates the likely impacts of the project on the physical, biological and socio-economic environment during the construction and operation stages and lays down the proposed measures to mitigate the adverse impacts of the project;
7. **Chapter 6 – "Cumulative Impact Assessment"** provides the result of the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones;
8. **Chapter 8 – "Environmental and Social Management Plan"** provides the mechanism to be adopted for the implementation of measures along with monitoring to be conducted during all stages of the project; and
9. **Chapter 9 – "Conclusion"** provides a summary of impacts related to the proposed project and gives recommendations.

2 PROJECT DESCRIPTION

2.1 The Project

NMCS has proposed the project "The Mangrove Creekside Urban Development", planned over an area of 40 acres having mixed used features with sustainability focused development comprising residential area, commercial and retail spaces and technology zone.

2.2 Project Location

The project located in Korangi Creek Cantonment, Karachi at the extreme southern end along Gizri Creek. The project site (a 40-acre plot) sits between the national industrial park to the north and a dense area of mangroves to the west. The larger portion of the site has access to views of the mangroves and coastline.

Apart from industrially zoned land surrounding the site, a university also lies to the north and is within walking distance of the site. The location of the site is shown in Figure 2.1.

2.3 Project Details

The project involves the creation of a boulevard at the center of the development. The technology zone and commercial areas create an energetic bustling core at the center of the development while the residential buildings surround the site will terminate at the mangrove boardwalk. Following are the components of the project:

Table 2.1 - Project Components

#	Project Components	Facilities
1	Technology Zone	Flexible to host corporation & start ups
2	Residential Quarter	Healthy mix and inclusive housing
3	Community Facilities	Mosque
4	Mangrove Hotel / Serviced Apartments	Hospitality anchor on the boardwalk
5	Mangrove Boardwalk	Mix of exclusive apartments / F&B & Retail
6	Utility Plots	Substation
7	Green Links	Community Green Spaces at the center of the development

3D renderings of the project are shown below in Figures 2.2 and 1.3 respectively:

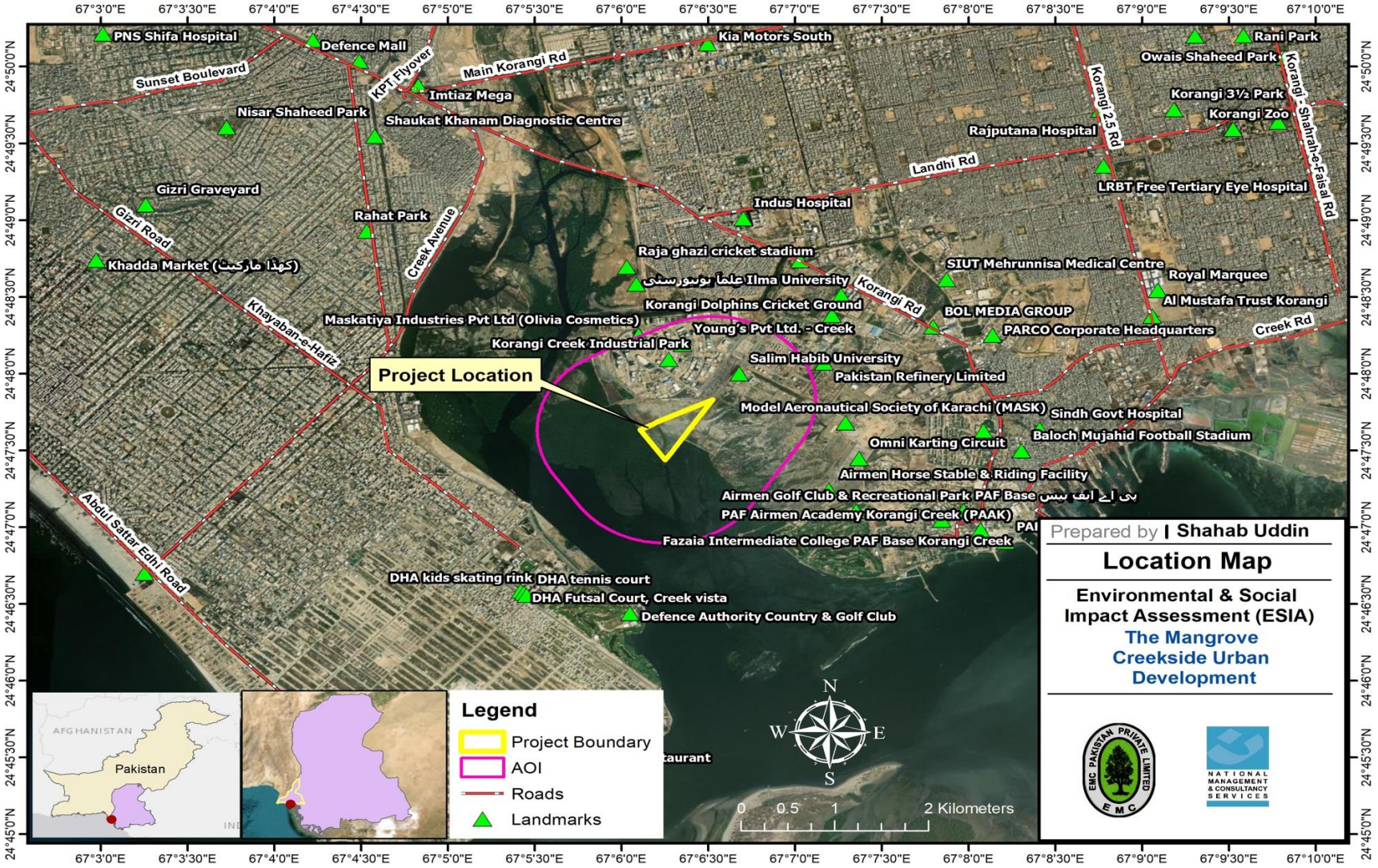


Figure 2.1 - Location Map of Project Site

Figure 2.2 - 3D Rendering of Project (Top View)

Figure 2.3 - 3D Rendering of Project (Front View)

Table 2.2 - Schedule of Area

Plot Area				40 acres or 193,600 Sq. Yd or 17,424,00 Sq. Ft.				
Schedule of Plots								
Type	Plot Designation	Floors	Plot Size	Plot Size (Sq. Ft)	Total Plots	Area In Soft	Area In (Sq. Yd)	Percentages
Com-Res	C 1	G+2+22	As Per Plan	9l815.3	1	91,815.30	10,201.70	-
Com-Res	C2	G+2+22	370 'x 320'	118.4	2	236,800	26,311.10	
Com-Res	C3	G+2+22	As Per Plan	111,531.60	1	111,531.60	12,392.40	
Flats	C4	G+2+22	180' x 265'	47,700	10	477,000	53,000	
Flats	C5	G+2+22	As Per Plan	53,190.90	1	53,190.90	5910.1	
Office Tower	C6	G+4+22	As Per Plan	75102.2	1	75102.2	8344.69	
Total					16	1,045,440	116,160	60%
Public Use	PB					137,021.40	15,224.60	7.86%
Green						141,987.60	15,776.40	8.14%
Roads						417,951	46,439	24%
Grand Total						1,742,400	193,600	100%

2.4 International Standards Applied

NMCS is committed to leading the way in sustainable urban development by undertaking a series of innovative urban buildings project. As part of this dedication to environmental responsibility, the project is aiming for EDGE (Excellence in Design for Greater Efficiencies) certification from the IFC. EDGE is a globally recognized green building certification that focuses on improving the efficiency of buildings in terms of energy, water, and materials, helping us ensure that projects not only meet but exceed sustainability standards. In line with this commitment, NMCS is also planning to produce a significant portion of our electricity through biogas methane, harnessed from local organic waste using specialized bowsers. This renewable energy source will significantly reduce reliance on non-renewable energy, further aligning projects with eco-friendly practices. Additionally, during the construction phase, the project will integrate several sustainable practices, including the use of locally sourced and recycled materials, low-impact construction techniques, and water-efficient systems. These efforts will minimize waste and reduce the environmental footprint of our project. The focus is on creating spaces that are not only energy-efficient but also resilient, adaptable, and in harmony with the natural environment, ensuring a lasting positive impact on both the urban landscape and the community.

2.5 Construction & Commissioning

2.5.1 Construction Schedule

The construction & commissioning phase will consist of following major activities:

- Construction of campsite including facilities and mobilization of contractors
- Construction of foundations and auxiliary structures (piling, civil works etc.)
- Internal and External finishing
- Mechanical, electrical and other works

- Demobilization and site restoration

2.5.2 Pre-Construction/Design Phase

This essential phase provides the basis for the construction program, the methodology to be adopted and the technologies to be involved. The project site has been assessed in terms of its geology, seismicity and seismo-tectonics. A detailed geo-technical investigation has been conducted and load bearing capacity of the soil has been established. The pre-construction activities will involve earthworks & excavations. In order to obtain geotechnical information for the design of foundation, it was considered essential to carry out subsoil investigation at the project site.

2.5.3 Construction Activities

The sequence of construction will be as follows:

- Construction of earth retaining structure (secant pile wall, contiguous pile etc.)
- Drilling and installation of dewatering wells
- Excavation of plot upto groundwater level
- Dewatering
- Excavation upto Raft bottom level
- Construction of raft foundation followed by construction of substructure.

Standard and environmentally compatible construction materials (cement, sand, steel reinforcement, bricks etc.) & techniques/construction practices will be employed besides adopting Standard Operating Procedures (SOPs) set-out in the Environmental Management Plan.

1. **Construction Office & Camp**

The construction contractor will develop his own camp & offices for construction purposes within the project site. Development of campsite will include the following activities:

- Leveling and compaction of the area for office and campsite
- Provision of drainage works in and around the campsite
- Laying and compaction of the gravel topping in the office and campsite
- Construction of fuel storage tank area and water tank
- Provision of fence, access and emergency gates
- Construction of septic tanks
- Installation of membrane liner for fuel storage
- Installation of security guard cabins
- Installation of sewerage pipeline with manholes for the septic system & connecting it with Sewer line
- Provision of signage for each activity center

2. **Foundations**

Excavation for the foundations work will be made in accordance with recommendation of Geotechnical investigation. Excavated material will be disposed of off-site via trucks and sent to approve sites. The excavated soil will be sent to road construction contractors for appropriate utilization.

3. **Building Shell and Core Construction**

Construction of the exterior enclosure or "shell'' of the building include construction of the building's framework (installation of beams and columns), floor decks, facade (exterior walls and cladding), and roof construction. These activities require the use of tower cranes, compressors, personnel and material hoists, front-end loaders, concrete pumps, on-site bending jigs and a variety of hand-held tools, in addition to the delivery trucks bringing construction materials to the site. At the same time, infrastructure connections are built. These include lines for water, sewer, storm water, electricity & telecommunications.

4. **Interior Construction and Finishing**

This stage includes the construction of interior walls, installation of lighting fixtures and interior finishes (flooring, painting, etc.), as well as mechanical & electrical works such as the:

- Installation of elevators
- Internal and external pipe works
- Fire protection & Life safety systems
- Car Park Ventilation
- Electrical Distribution
- Emergency Lighting installations
- Lightning Protection

5. **Civil Works**

Civil works involves excavation, piling, formwork, reinforcement, concreting, masonry, plastering, painting, tinsmiths, and also waterproofing work with gas-flame sticking, construction of light separating walls, hung ceilings, flooring, lining and facing.

6. **Construction Equipment & Machinery**

Conventional machinery and equipment will be used for construction activities. The equipment and machinery may include dozers, excavators, loaders, mobile crane, lorry, dump trucks, back hoe, bar bending machine, water bowsers, material hoist, passenger hoist, concrete placement booms & power generators.

7. **Construction Material and other Supplies**

Main construction material to be used during the construction phase will include ready mix concrete that will be sourced through reputable companies. Additionally, paints, glass, wood, tiles, aluminum, PVC/GI pipes, concrete/cement pipes, electric cables, etc. will be used during the different phases of construction. The materials will be transported by trucks to the project site, where they will be stored until moved to different locations as and when required. Materials including paving stone, crush, gravel and sand will be brought from commercial quarries located in the Sindh Province.

8. **Site Restoration**

On the completion of the construction phase, the entire site will be built-up thus no site restoration to original condition is required. External sites are not being used.

2.6 Geotechnical Investigation

A significant area of the site is covered with a soft sand layer. This makes the movement of trucks a problem, and the area needs to be plowed by a tractor to make the land suitable for the movement of machinery.

The ten boreholes were drilled using the rotary wash boring method. Clay and sand were encountered up to the maximum explored depth of 30m. Tricone and clay bits were used to drill the 4-inch borehole.

The subsurface deposits up to the explored depth consist of the following units:

- Silty fine to medium grained sand
- Silty Clay

Following sub-sections describe the strength characteristics of these geological units along with the groundwater conditions at the site.

1. **Silty Fine Sand**

These soil deposits are found from a depth of 0-18 meters below the existing ground level at the locations of the boreholes, except boreholes 5, 6, 7 and 9. The sand deposits vary from medium dense to very dense state of compactness. Direct shear tests conducted on the remolded samples indicate high shearing resistance varying from 25 degrees to 38 degrees.

2. **Silty Clay**

The silty clay layer is encountered at two different depth horizons in all the boreholes. In BH 1 hard silty clay was found from 25-30 m below the existing ground level. In boreholes 5, 6, 7 and 9 silty clays have been encountered from existing ground level to about 3m below existing ground level. The clay encountered in the boreholes can be classified as soft to stiff, based on the SPT data. The clay can be classified in the “CLML” group of Unified Classification System.

3. **Groundwater Encountered**

Groundwater was encountered in all the boreholes drilled at the site. The depth of water table in the boreholes was determined to be around 1.6m below present ground level. The groundwater encountered at very shallow depth indicates presence of perched water table in the sediment layers.

2.7 Utilities

2.7.1 Water Supply

2.7.1.1 Potable Water Consumption Rates

Residential potable water demand is calculated based on:

- Building type and the estimated number of people in that building multiplied by the average daily rate of water consumption.
- Allowance of 20% of total domestic and non-domestic consumption for leakage.

The demand for both residential domestic and non-domestic use is presented in the table below:

Table 2.3 - Potable Water Unit Demands

Category	Base Daily Demand (L/C/D)
Residential	160
Commercial	47
Government institutions	47
Educational	47

Toilet fixture	200

2.7.1.2 Water Demand

Within this report is an outline summary of the water demand as presented in table below:

Table 2.4 - Water Demand Scenario

Water Demand	Unit (m3/day)	Remark
Average Daily demand (ADD)	3,069.12	
Firefighting Demand (1 Fires = 2 hydrants, max. 120 min in a day)	455 +455	The total demand is 455 per day, however we have to consider this volume for both tanks.
Average Daily Demand + Fire Demand	6586.96	
Daily Maximum Demand (PDD)	8,515.44	
Peak Hour Demand (PDD)	12,773.16	
Peak Hour Demand + Fire Demand	13683.16	

2.7.1.3 Water Source

The potable water distribution network design assumes supply will be provided partially by KW&SB and an RO system will be needed to treat the municipal water prior to use (if required), and the remaining demand will be supplied by bowsers and bore-wells. The design will be developed in later stage once the characteristics of bore-wells are acquired.

2.7.1.4 Storage Tank Capacity

Each building will be provided with a separate tank, pump station and RO plant, water from borewell and municipality line will be connected to the RO plant and treated then supplied to the storage tank and pumped to the building for usage. The storage tank will cater to supply potable and firefighting water.

2.7.1.5 Booster Pump Station

The design of the booster shall respect a normal working for firefighting and potable water and cover all needed duty points (flow & head), this will be through fixing the number of pumps and providing VFDs to each pump to maintain and explore all the model variables.

Booster pump stations shall cover the cumulative flow demand.

2.7.1.6 Design Criteria and Parameters

Velocity Flow in Pipes Distribution mains 0.5 to 2 m/sec. rising mains 0.3 to 2 m/sec but for long rising mains, life cycle cost analysis will be done to ensure most economical size of pipe.

- Current Masterplan and Land Use
- The network is to be as per adoptable standards.
- Population estimates based on Preliminary master plan report
- Peak factor of 1.5.
- Potable water lines are preferred to be above sewerage, storm and irrigation water pipelines
- Fire demand of 500 (2x250) gpm per hydrant is assumed and two simultaneous fires can occur at a time.

- Main pipes shall have a minimum cover of 1000 from finished level to Crown of pipe and service pipes shall have a minimum cover of 600 to 750mm depending on the situation.
- There shall be a minimum vertical clearance of 300mm between services
- uPVC Pipe ducts shall be provided at road crossings.
- Thrust blocks will be provided.

2.7.1.7 Velocity

The following standards shall be adopted for the velocity of pipes:

- Distribution mains 0.5 to 2 m/sec.
- Rising mains 0.3 to 2 m/sec but for long rising mains, life cycle cost analysis will be done to ensure most economical size of pipe.

2.7.1.8 Distribution Pipes

As per the Water and Sanitation Agencies & PHED Punjab manual, the minimum size of the tertiary water pipe shall be taken as 3 inches, the pipe material to be used shall conform the standard given in the table below.

Table 2.5 - Pipe Material

Material	Standard
uPVC Class C Pipes	BS: 3505:1986
PE Class C Pipes	DIN 8074/8075
GRP Class C Pipes	ASTM D-3517

2.7.1.9 Sluice Valves

Sluice valves will be located at main control points for balancing and regulating the flows. The sluice valves shall be Cast Iron Flanged or non-rising stem.

2.7.1.10 Non-Return Valves

The non-return valve shall meet the following minimum standards:

- Outside the delivery main of the Borewells
- In the rising main after every 1000 meters

2.7.1.11 Air Release Valves

The Air relief valve shall meet the following minimum standards:

- At the summits,
- After 2000-meter intervals in straight reaches to facilities escape of trapped air
- The material of the air relief valve shall be Cast Iron

2.7.1.12 Washout Valve

Washout to be located at the lowest points to wash out all kinds of debris.

2.7.1.13 Pressure

Operating pressure for potable water.

Keeping in view the trends of multi-storey building construction in urban residential areas, at least 6 meters (0.6 bars) minimum terminal pressure and maximum terminal pressure of 65 m (6.5 bars), PRV will be added to water connections to reduce pressure.

- For rural residential areas, the existing standard of terminal pressure is 12 meters.
- Minimum pressure for firefighting: 6.9 bars as per NFPA.

2.7.1.14 Fire Hydrants and Hydrant Spacing

Fire hydrants should be installed in water distribution network, no fire hydrants to be installed on transmission network. According to the Building Code of Pakistan – Fire Safety Provisions 2016, spacing between fire hydrants is as per the below.
Detached One- and Two-Family Dwellings: Fire hydrants shall be provided for detached one- and two-family dwellings in accordance with both of the following:

The maximum distance to a fire hydrant from the closest point on the building shall not exceed 600 ft (183 m). The maximum distance between fire hydrants shall not exceed 800 ft (244 m).

Buildings Other than Detached One- and Two-Family Dwellings: Fire hydrants shall be provided for buildings other than detached one- and two-family dwellings in accordance with both of the following:

The maximum distance to a fire hydrant from the closest point on the building shall not exceed 400 ft (122 m). The maximum distance between fire hydrants shall not exceed 500 ft (152 m).

2.7.1.15 Network Design Analysis

The Water CAD Software V8i by Bentley was used in the design and analysis of the proposed combined Potable Water and Fire Fighting Network. The software has the capability of analyzing complex networks combining the piping networks, devices and a reservoir system.

Peak Daily Demand plus firefighting event is also considered in the hydraulic modelling

A complete and comprehensive network hydraulic analysis result table will be provided at the Schematic stage.

2.7.2 Foul Sewerage

The foul sewer management plan consists of two main components. The building gravity sewer system which collects the building's generated flow in collection tank/chamber and the Sewage Treatment Plant (STP) where the generated flow is collected and treated.

The gravity sewer flows are generated from Apartment, Retail and Commercial units. Each building project is served with a dedicated sewage collection chamber. The chambers are provided to serve the purpose of collection and sedimentation tank for sewage and then it is pumped to STP for treatment and further usage in irrigation or for disposal.

2.7.3 Design Methodology

The foul sewer network design includes different components. Inspection chambers, manholes, lateral and main pipes. The design of the components is based on several factors, the main criteria for pipe sizing is the design peak flow. The Inspection chambers and manhole types and sizes are based on Water and Sanitation Agencies & PHED Punjab design criteria manual.

The sizes of the various design components are based on the demands which have been based upon information provided in the below sections.

2.7.3.1 Design Criteria and Parameters

- Infiltration is 10% of the total sewage demand this is as an assumption.
- Peak flow shall be determined as mentioned in equation below.
- The gradient of the sewer pipes shall be sufficient to maintain the minimum self-cleansing velocity of 0.60 m/sec to ensure sewer cleaning. At the head of the sewerage system, the low velocity based on minimum self-cleansing may not be achieved. In such cases the minimum pipe gradient for the sewer shall be calculated based on hydraulic design approach of minimum tractive force
- Pipe size should not generally decrease downstream.
- Sewer should be designed to convey peak flows without surcharge.
- To allow for ventilation of the system, maximum design depth of flow should not exceed 50% pipe diameter for diameter up to 500 mm and 75% of pipe diameter for pipe diameter greater than 500 mm.
- At manholes, all pipes should be laid such that their soffits are at the same level. Pipes in manholes should not be laid with the invert level, as this can promote deposits of solids in minor branches leading to odor problems and blockages.
- Maximum distance between manholes to manhole shall be 70m.
- Maximum velocity of sewer flow shall be 3 m/s to avoid erosion.
- Lateral sewers are generally 200mm diameter.
- Where depth of cover is less than 1000m they shall be concrete encased.

2.7.3.2 Design Peak Flow

Peaking flows are the cumulative results of combinations of factors such as diurnal and seasonal flow variations of flow components and characteristics responses of inflow and base flows to the storm events. Peak flows can be determined by multiplying the average dry weather flow (DWF) by the peaking factor (PF).

The maximum design flow is determined using Average Daily Flow (ADF) and the Harmon Peaking Factor (HPF):

$$M = 1 + 14/(4 + P0.5)$$

Where,
M = the Harmon Peaking Factor
p = population (in thousands)
The maximum design flow shall be the average daily flow times the peaking factor M.
The peak domestic sewage flow is calculated as:

$$Q(d) = Pq\,M/86.4 + IA$$

Where:
Q (d) = Peak domestic sewage flow (including extraneous flow) in liters per second.
P = Design Population in thousands
q = Average daily per capita domestic flow in liters/capita/day
M = Peaking Factor (as derived from the Harmon Formula)
ℓ = Unit of peak extraneous flow in liters/hectare/second
A = Area in hectares

2.7.3.3 Foul Sewer Estimate

The following foul sewer rates were adopted in the design of the network and are shown in the table below. Infiltration was considered to be 10% of the total sewage demand.

Table 2.6 - Sewage Unit Demand

Category	Sewerage flow (inclusive of 10% infiltration) lpcd
Residential	135
Commercial	40
Government institutions	40
Educational	40
Toilet fixture	170

Using the above flow equivalents, the total sewage flow estimate for the project site is as depicted in the below Table.

Table 2.7 - Sewage Flow Estimation

Sum of Foul Sewer – Total Average Flow (m3/day)	Sum of Total Design Maximum Flow - (m3/day)	Sum of Total Design Peak Flow - (m3/day)
2,380	2,558	4,940

2.7.3.4 Plot Connection

Each Plot will be provided with an external Inspection Chamber (IC) on the lateral sewer, this IC will be inside plot boundary premises away from the ROW.

2.7.3.5 Earth Cover

A 1.0m earth cover should be provided above crown of the sewer. However, in case of sewer laid under road crossings, sand will be filled to provide cover instead of earth.

2.7.3.6 Velocity at Design Flow

The velocity shall be as per the below table.

Table 2.8 - Sewage Velocities

Design Condition	Velocity
Desirable Minimum	2.0 ft/sec
In Difficult Situation	2.50 ft/sec
Max in Hilly Areas	7ft/sec

2.7.3.7 Pipe Materials and Manning Factor

The pipe materials and manning factor considered for the project development is shown in below table:

Table 2.9 - Sewage Material & Mannings Coefficient

Sewer Material	Manning Coefficient
RCC	-
New Line	0.013
Old Line	0.015
uPVC	0.009
PE	0.008-0.011
HDPE	0.012-0.024

2.7.3.8 Sewerage Treatment Plant Sizing

The approximatively size of the STP shall be according to the estimated population anticipated to habilitate the Project.

2.7.3.9 Network Design Analysis

The Sewer Gems Software by Bentley is used in the concept design and analysis of the proposed sewage network. The software has the capability of analyzing complex networks combining the piping networks, devices and a pumping system.
Sewage water networks is analyzed to determine its capability to sustain design flow, pressures and velocity given in the design standards and parameters. Hydraulic analysis of the network was done to determine the adequacy of the proposed sizes during worst flow condition.

2.8 Irrigation Network

2.8.1 Design Methodology

The TSE network is designed as a pressurized network, TSE output from the STPs shall be of an acceptable quality and will not require further treatment.

The network design includes storage tanks, pumps, and underground piping distribution network. The size of the various design components will be based on the demands which have been based upon information provided in the Concept Design Stage. Each building will provide enough TSE in order to irrigate the landscapes in the vicinity around.

2.8.2 TSE Source

TSE water generated from the On-Site Sewage Treatment Plant.

2.8.2.1 Assumptions

The following assumptions have been made to produce this Concept Design Report. Any changes to these assumptions may impact the design.

- 10 hours of Irrigation supply has been considered.
- Landscape area estimate based on the STP generation.

2.8.2.2 Distribution Philosophy

For the landscape areas, the philosophy of the system is that the treated sewage effluent will be distributed to all the plots within the site through main distribution lines and secondary and tertiary lines. Total flow throughout the system shall be monitored at the main TSE pumping station to ensure that maximum daily allowances are not exceeded.

2.8.2.3 Storage and Pumping Station Facilities

One underground TSE storage tank will be located in each building, It will be sized to provide one (1) day of storage based on the STP generation. The water level will be controlled by a check valve on the inlet pipeline. The tank will be designed to take inflow from tertiary treated STP water.

The following will be considered in the design of TSE pumping systems:

- Pumping stations shall be designed to ensure a safe working environment for operation and maintenance staff.
- The design shall include features to maximize performance whilst minimizing operation cost.
- Provisions shall be made to facilitate removing pumps, motors, and other mechanical and electrical equipment for maintenance and replacement.
- Pump operation shall be automatically controlled using a level sensing system to facilitate sequential pump operation.
- The design should include efficiency features, with all flanged pipework to include the following:
- Proper anchorage and robust pipework support
- Drainage facilities for emptying pumps and pipework
- Flexible and dismantling couplings
- Good access facilities to all equipment, with adequate working space.
- Adequate ventilation needs to be provided to all areas that have to be accessed.
- Provision of adequate lighting and electrical power points for portable lights and tools.

Table 2.10 - Storage & Pumping Station Facilities

Avg. daily irrigation demand (m3/day)	Dimension of Tank (M x M x M)	Area of Tank (m2)	Free Board	Pump Station Flow (l/s)	Pump station dimension (M x M)
2,142	22 x 22 x 5	484	0.5	59.50	12 x 8

2.8.2.4 Design Criteria

- Reservoirs shall be sized for a minimum of 1 day of the STP generation.
- Reservoirs shall be operated by telemetry with all key valves actuated.
- Treated effluent storage reservoirs shall be of reinforced concrete construction.

2.8.2.5 Configuration

The reservoirs shall have the following configuration:

- Underground construction or above ground tank.
- Rectangular, square, or circular depending on the plan area of the allocated site
- Roof supported on columns to suit structural design.

2.8.2.6 Network Design Analysis

The Water GEMS Software V8i by Bentley is used in the design and analysis of the proposed Treated Sewage Effluent Network. The software has the capability of analyzing complex networks combining the piping networks, devices, and a reservoir system.

Daily Demand supplied in 15 hours (worst case scenario PF=24/10 =2.4) event is considered in the hydraulic modelling.

2.8.3 Storm Water Drainage

The Storm Water network will be designed as a gravity network collecting storm discharge from the site. The surface runoff from the plot is considered to flow into the road carriageway and to the storm water gullies.

2.8.3.1 Design Methodology

The network design includes channels, gravity pipes, storm water manhole and outfall. The proposed storm water collection network aims to drain the surface run-off from roads, roof drains of buildings, structures and hard and soft landscape within the project boundaries and discharge it to the proposed channels or gullies and manholes and ultimately drain it to the proposed main storm water network. This network finally drains into the sea through outfalls.

2.8.3.2 Karachi IDF curve

The design Return Period for this project will be considered 1:10 years.

The below figure shows the IDF curve for Karachi.

Return Period, Tr Year	PT (mm/day)	Rainfall Intensity (I) at various Durations (mm/hr)										
		5 min	15 min	20 min	30 min	60 min	120 min	180 min	360 min	720 min	1080 min	1440 min
5	90.40	83.45	72.32	67.80	60.27	45.20	30.13	22.60	12.91	6.95	4.76	3.62
10	127.57	118.13	102.38	95.98	85.31	63.99	42.66	31.99	18.28	9.84	6.74	5.12
25	181.81	167.82	145.45	136.36	121.21	90.90	60.60	45.45	25.97	13.99	9.57	7.27
50	226.34	208.93	181.07	169.75	150.89	113.17	75.45	56.58	32.33	17.41	11.91	9.05
100	274.41	253.30	219.53	205.80	182.94	137.20	91.47	68.60	39.20	21.11	14.44	10.98
500	400.23	369.44	320.18	300.17	266.82	200.11	133.41	100.06	57.18	30.79	21.06	16.01

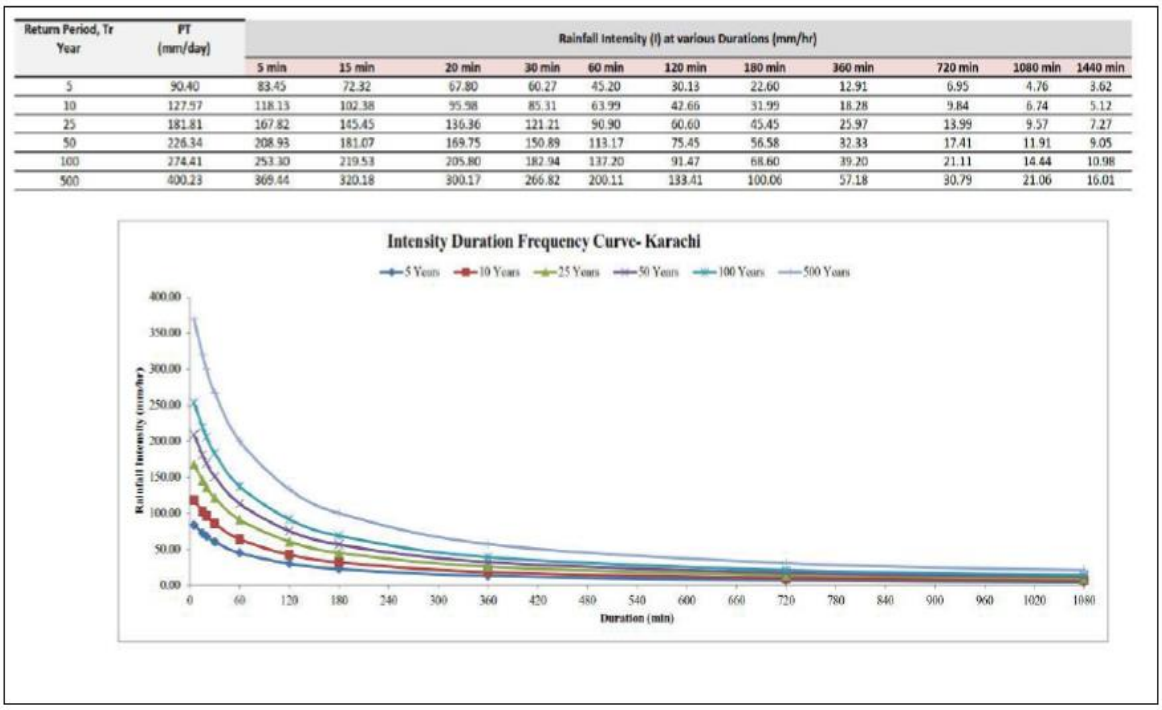


Figure 2.4 - Karachi IDF Curve

2.8.3.3 Design Criteria and Parameters

The following design criteria shall be adopted during the detailed design:

- Pipe size should not generally decrease downstream
- Storm network is designed to convey peak flows generated by 1 in 10 years' rainfall event without surcharging.
- Maximum distance between MH's shall 70m.
- At manholes, all pipes should be laid such that their soffits are at the same level.
- Minimum pipe diameter for the main storm water network is 300mm and for house connection and inlet pipes it is 150mm.
- The minimum velocity considered for self-cleansing shall be 0.8 m/s with a maximum velocity of 3.0 m/sec.
- Minimum vertical clearance between utilities shall be 300mm
- Pipes shall be installed in accordance with the utility cross sections and standards, specifications and best practices.
- Minimum cover depth of pipe is 1.0 minimum

2.8.3.4 Catchment Areas

The drainage catchment areas are defined as any areas that are naturally or artificially draining into any of the proposed collection systems, where they will be channeled through the network to the proposed outfall to sea. Based on the land use of the site, the catchment area is divided into various type and each type has its specific run off coefficient. Run-off coefficients are used to describe the amount of run-off which can be expected from areas of a given characteristic.

Specifically, these coefficients vary based on surface treatment or land use (i.e., paving, grass, sand, etc.), slope and soil type.

Table 2.11 - Runoff Coefficient Table

Type of Drainage Area	Runoff Coefficient, C*
Business	
Downtown Areas	0.70 – 0.95
Neighborhood area	0.50 – 0.70
Residential	
Single – Family areas	0.30 – 0.50
Multi-units, detached	0.40 – 0.60
Multi-units, attached	0.60 – 0.75
Suburban	0.25 – 0.40
Apartment dwelling areas	0.50 – 0.70
Lawns	
Sandy soil, flat, <2%	0.05 – 0.10
Sandy soil, Average, 2 - 7%	0.10 – 0.15
Sandy soil, Steep, <7%	0.15 – 0.20
Heavy soil, flat, <2%	0.13 – 0.17
Heavy soil, Average, 2 - 7%	0.18 – 0.22
Heavy soil, Steep, <7%	0.25 – 0.35
Street	
Asphaltic	0.70 – 0.95
Concrete	0.80 – 0.95

2.8.3.5 Pipe Materials and Manning Coefficient

The pipe materials and manning coefficient considered for the project development is shown in below table.

Table 2.12 - Pipe Material & Manning's Coefficient

Sewer Material	Manning Coefficient
RCC	
New Line	0.013
Old Line	0.015
uPVC	0.009
PE	0.008-0.011
HDPE	0.012-0.024

2.8.3.6 Rational Method

There are several methods for estimating flood peaks, storm durations and runoff volumes. One of the simplest, the Rational Method, is an empirical formula that expresses a relationship between rainfall intensity, catchment area and runoff, as follows

$$Q = C I A$$

Where;
Q = Peak discharge (l/s)

C = Average of the runoff coefficients assigned to different contributing areas
I = Rainfall intensity for the selected frequency and time of concentration (l/s/ha)
A = Catchment area (ha)

Discharge, as computed by the Rational Method, assumes that the discharge has the same frequency as the selected rainfall intensity. Because of the assumption that rainfall is of equal intensity over the entire watershed, and because its frequency is not truly related to flood frequency this method is to be used only for estimating runoff from areas of 130 ha or less.

The total area of development is less than 130 hectares, so rational method can be used to arrive to the flood peaks, storm duration and runoff volumes.

2.8.3.7 Road gullies

The spacing of road gullies is determined by longitudinal and cross slopes of the road, efficiency of the gullies and the road width. A maximum allowable depth of ponding at the kerb is limited to 5 cm, provided the width of water spread over the road does not exceed half traffic lane width or shoulder width.

The spacing is calculated with due consideration to high and low points, super elevation and junctions.

The water spread is the width of flow on the deck. One approach is to set it equal to the shoulder width keeping the gutter flow entirely off the travelled way. Another approach may be to let the flow on the deck move out to the expected track of the outside tires, which is about 1 m into the lane. Still another approach is to sacrifice an entire lane of an infrequently travelled road.

As we move ahead in the design the gully spacing will be finalized in consultation with the concerned authority.

2.8.4 Electrical Network

2.8.4.1 Dry Utility - Electrical

For the Project, the primary requirements upon the analysis of all collected data and based on the design standard, the project Diversified load is 100MVA.

This Design consist of the following:

- Power Assumption table.
- Load Calculation table.
- Building transformer rooms.
- Street lighting network.
- Telecommunication Network.
- Infrastructure ELV Network.

2.8.4.2 Design Criteria

Table 2.13 - Design Parameters

Parameters	Description
Maximum sun radiation temperature in summer	44°C
Maximum outdoor ambient temperature in summer	36°C
Minimum temperature in winter	12°C
Maximum average ambient temperature in summer	27°C
Relative Humidity	100%(Max) at 30°C

Plant /Machine room ambient operating temperature	45°C
Continuous operating ambient temperature of cables and equipment	35°C
Power Factor	0.95

2.8.4.3 Design Methodology

Table 2.14 - Electrical Load Assumptions

Load & Design Assumptions						
Type of Building	Lighting	Power	A/C	Water Heater	Appliances	Conn Load
	W/M2	W/M2	W/M2	W/M2	W/M2	W/M2
Residential	10	25	50	20	25	130
Office	40	50	80	20	10	200
Commercial	30	30	70	30	40	200
Mousques	20	5	40	30	5	100
Hotel	40	30	80	30	80	260
Food and Bevarge	30	10	80	40	70	230
closed Parking	15	15	15	5	10	60
Utilities	20	30	40	10	20	120
Open areas	10	5			10	25
Roads	10	5				15

Load calculations:

The Electrical load calculations is based on GFA received for each plot areas, the load assumptions considered are shown in the below Table.

The electrical design calculation includes the assumption watt/m2 to obtain the connected load, demand load and diversify load.

Grid Station and LV Distribution:

An electrical grid station is an important unit in the transmission of electricity throughout the country. A grid station is the electrical link between the power plants and other grids, and then transmits that electricity to long distances. Usually, the network varies from 132KV to 11KV.

Whereas the LV distribution with the independent plot will be done through MV substations, which are connected from one side to the grid network and the other side, to the LV networks for individual incomers. The LV system operates on the voltage levels that are directly utilized without any further reduction, example 240/415V.

11 KV Substation and distribution substations:

The load will be confirmed during the detail design stage. Subsequently further coordination with the Authority has to be established for our tie-in with their main Networks and approval of the Design electrical distribution network

2.8.4.4 LV Network

The Low-voltage network or secondary network is a part of electric power distribution which carries electric energy from distribution transformers to electricity meters of end customers, street lighting feeder pillars etc. LV Cabling will be realized by underground power cables inside the LV corridor or trench. Anything below 400KVA will be fed from the LV distribution network and above will require its own secondary substation.

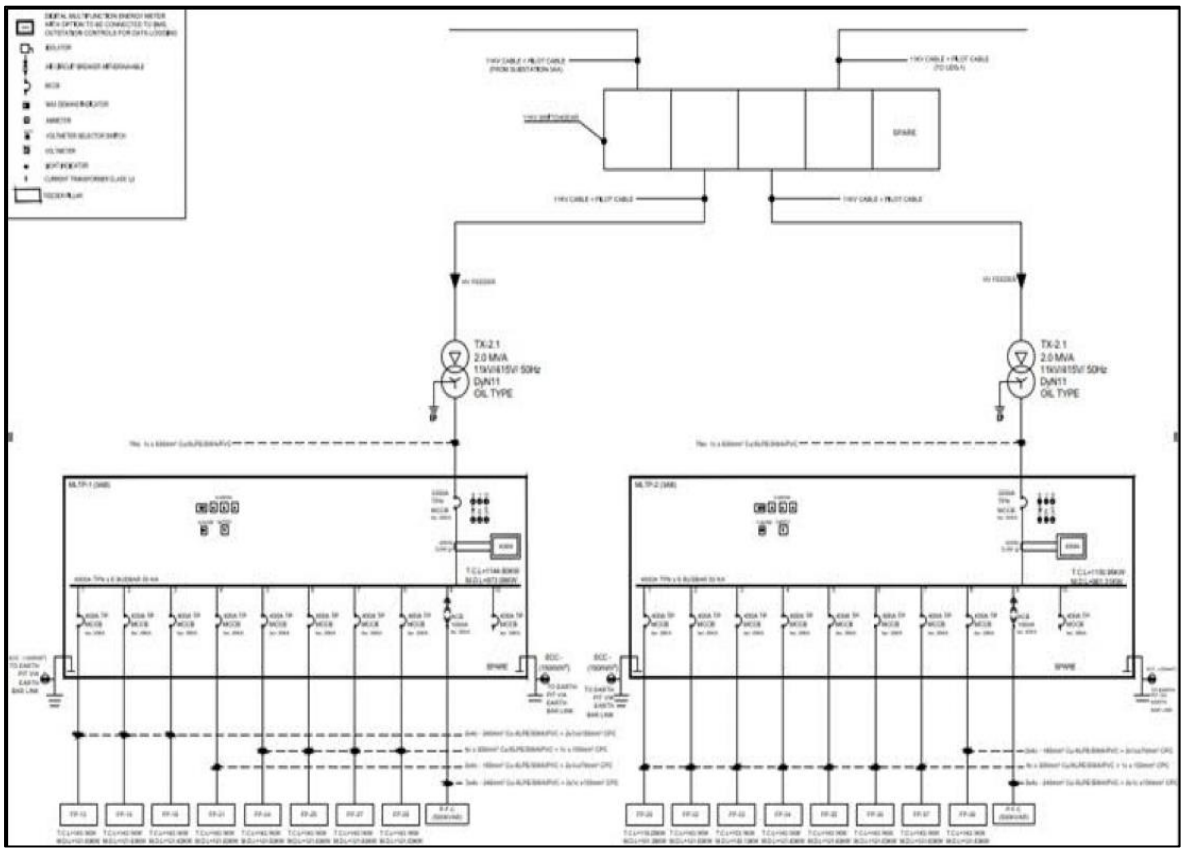


Figure 2.5 - Proposed LV Distribution SLD

2.8.4.5 Road Crossing Ducts

When electrical underground service crosses under a road, as per regulation ducts pipes should be used for protecting the cables crossing the road.

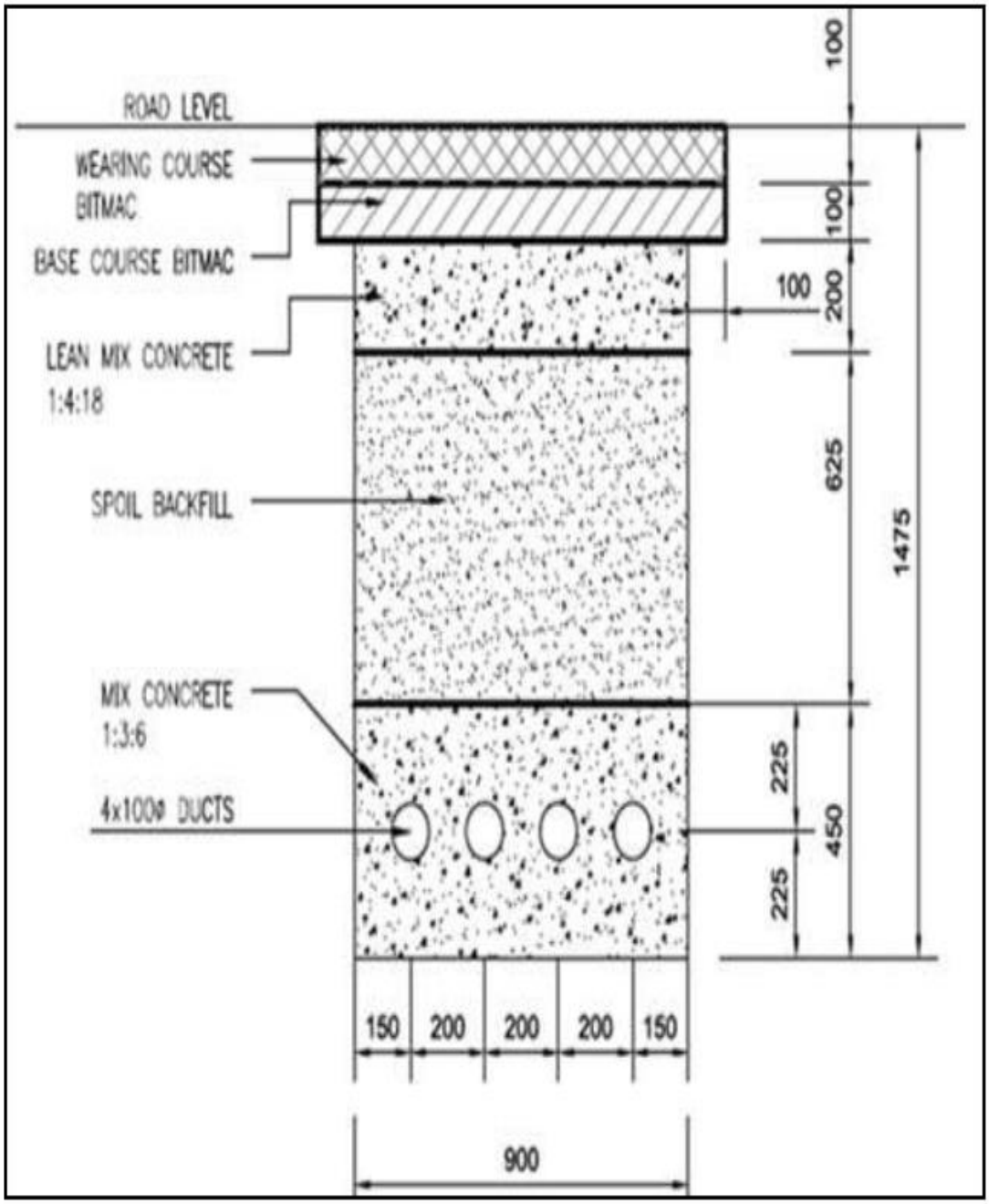


Figure 2.6 - Typical Cable Trench Details

2.8.4.6 Street lighting

This design is based on the road widths. The proposed lighting System will be LED lighting.

Street Lighting Basic Assumptions		
Average Luminance Level	Lav (CD/m2)	≥0.75
Overall Luminance Uniformity Ratio	Uo (Lmin/Lav)	≥0.4
Longitudinal Luminance Uniformity Ratio	U1 (Lmin/Lmax)	≥0.6
Average Illumination	Eav	20 Lux
Threshold Increment	Ti	≤15
Lighting of Surroundings	EIR	≥30
LED light c/w Light Pole	50-94W LED	Philips; Thorn, Luma, Sapphire, Teceo, Ruud or GEC, 10M Height and 25-30M spacing
LED light c/w Light Pole	95-160W LED	Philips, Thorn, Luma, Sapphire, Teceo, Ruud or GEC 12M Height and 35-40M spacing

FEEDER PILLAR NO. : FP-SL2	1 NO. 200A TP MCCB 1 NO. 200A TP ELECTROMAGNETIC CONTACTOR
F.P. TYPE : TYPE - E	CONTROLLED BY ASTRONOMICAL TIME SWITCH & PHOTOCELL, 40 LUX ON, 80 LUX OFF 12 NOS. 32A, SP MCCB

CKT. NOS.	OUTGOING MCCB	CABLE SIZE SQ. MM.	LIGHTING UNIT		WATTAGE		
			UNIT NOS.	QTY. & TYPE	R	Y	B
1	32A, SP	(2x16mm+1x10mm) CU/PVC/PVC	1/1/2,2/1/2,3/1/2, 4/1/2,5/1/2,6/1/2, 7/1/2	5 NOS OF LIGHT LP3T 2X166 W 1 NO. OF LIGHT LP6 1X115 W 1 NO. OF LIGHT LP2 1X100 W	1875		
2	"	(2x16mm+1x10mm) CU/PVC/PVC	14/2/2,15/2/2,16/2/2, 17/2/2,18/2/2	5 NOS OF LIGHT LP2 1X100 W		500	
3	"	(2x16mm+1x10mm) CU/PVC/PVC	8/3/2,9/3/2,10/3/2, 11/3/2,12/3/2,13/3/2	5 NOS OF LIGHT LP3T 2X166 W 1 NO. OF LIGHT LP2 1X100 W			1760
4	"	(2x16mm+1x10mm) CU/PVC/PVC	150/4/2,151/4/2,152/4/2, 153/4/2,154/4/2	5 NOS. OF LIGHT LP4 1X114 W	570		
5	"	(2x16mm+1x10mm) CU/PVC/PVC	19/5/2,20/5/2,21/5/2, 22/5/2,23/5/2,24/5/2, 25/5/2	7 NOS OF LIGHT LP3T 2X166 W		2324	
6	"	(2x16mm+1x10mm) CU/PVC/PVC	155/6/2,156/6/2,157/6/2, 158/6/2,159/6/2	5 NOS. OF LIGHT LP3T 2X166 W			1660
7	"	(2x16mm+1x10mm) CU/PVC/PVC	145/7/2,146/7/2,147/7/2, 148/7/2,149/7/2	5 NOS OF LIGHT LP4 1X114 W	570		
8	"						
9	"						
10	"						
11	"						
12	"						
TOTAL WATTAGE PER PHASE					3015	2824	3420
TOTAL WATTAGE IN KW.					9.259		

Figure 2.7 - Typical Load Schedule for Feeder Piller

2.8.4.7 Basis of Design

The basic assumptions for illumination levels of the street lighting are clearly shown and identified in the following table. This is based on the latest Standard EN 13201-2015 adapted to LED Fittings The power supply for the light poles will be via street lighting feeder pillars from the general substations. In accordance with current understanding of the Street Lighting requirements are as provided in Table below for the placing of streetlights:

Electrical Street Lighting Calculations Assumptions:

Table 2.15 - Street Lighting Spacing

Row width (m)	Pole Height (m)	Spacing (m)	Lamp Wattage	Location	Offset
30	8	25	≤ 150	Median	Center of median
20	6	20	≤ 100	Footpath	500mm from plot boundary
12.5	6	20	≤ 50	Footpath	500mm from plot boundary

2.8.4.8 Street Lighting Electric Cables

- All cables from Feeder Pillar must be 4Cx16mm2 XLPE/SWA/PVC cables and the circuit cabling is to be that light pole phasing is alternated as Red/ Yellow/Blue and then repeated. Poles adjacent to each other's must not have similar phases to ensure illumination continuity if 1 phase is lost.
- Electric Flexible Cables, 300/500 Volt Grade the flexible cables specified here are required for the installation inside the steel street lighting poles (between the control gear and the lamps) where the temperature and humid conditions are extreme and severe.
- The flexible cords shall be PVC insulated PVC sheathed, 300/500 volts, circular, 3-core, with 1.5 mm2 copper conductors and shall comply with Table 6 of BS 6500:1984, except that the insulation and sheathing shall be to Type 4 of BS 6746:1916.
- Cables shall be installed within dedicated corridors in accordance with local requirements.

2.8.4.9 Poles

LED Street Light Poles, Current offers steel and aluminum light pole and bracket mounting solutions that complement a wide variety of outdoor area lighting and roadway lighting fixtures. Choose from tapered and non-tapered pole designs and heights of up to 30 feet (9 meters).

Figure 2.8 - Ligthing Poles

2.8.4.10 Feeder Pillars

Feeder pillars shall be in accordance with the authority requirements and shall consist of several outgoing single-phase circuits. Design intent, all street lighting feeder pillars shall be supplied by nearest general substation, wherever possible.

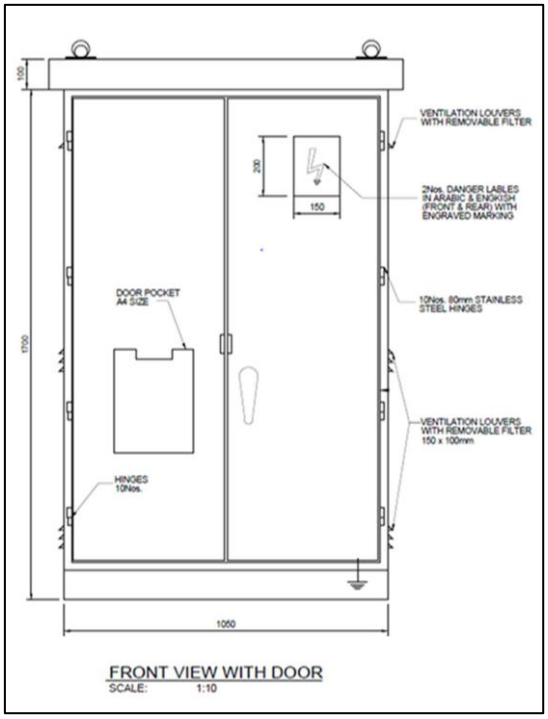


Figure 2.9 - Feeder Pillar

2.8.4.11 Conclusions

In this design, we made provision inside corridor for feeder cables of street lighting. There is also a possibility of using standard poles for the entire project for uniformity. That must be confirmed to proceed in our next stage of design.

2.8.5 Telecommunication

As per direction of the PTA (Pakistan Telecommunications Authority) an open communications network is to be established for the project development that would allow third parties to lease communication network and allow for greater competition between communication providers and benefiting the end user. The telecommunications containment will be designed to local authorities' standards.

2.8.5.1 Design Methodology

This preliminary design is related to the infrastructure works related to telecommunications. The telecommunication works are divided into:

- Telephone network. (Manholes, hand-holes, telephone booth locations and uPVC ducts)
- Internet network. (Manholes, hand-holes and uPVC ducts)
- Cable television network. (Manholes, hand-holes and uPVC ducts)
- GSM Mobile phone towers as applicable.
- The network is designed so that the latest telecommunication services and fiber optic cables can be laid and drawn inside these ducts to reach the various plots of the projected area.

2.8.5.2 Assumptions

Assumptions for number of telephone lines and internet points of each construction type are mentioned in the below Table. This is based on the previous approved assumption method that was adopted by the main developer.

Table 2.16 - Telecommunication Services Calculation Assumptions

Plot Usage	Tel Line	Mobile Phone
Residential Villa	0.5/100 m2	1.2/100 m2
Commercial Villa	0.8/100 m2	2.0/100 m2
Investment Buildings	2.0/100 m2	3.0/100 m2
Commercial Retail	0.8/100 m2	3.0/100 m2
Masjid	4	3.0/100 m2
Substation	1	3.0/100 m2
Infra Buildings	2--5	1.0/100 m2
Main Distribution Frame	1000 lines	
Sub-Main Distribution Cabinets	100 lines	
Telecom GSM/CMDA Towers		1500 call/Tower
	50% of users calling at the same time	

2.8.5.3 Design Criteria and Parameters

Based on the assumptions above, number of plots, usages of each plot and lifestyle in Pakistan as well as the area and populations, the quantity of the various land lines and mobile phones can be calculated.

2.8.5.4 Trench and Backfill

This work shall consist of constructing trenches for the accommodation of the telecommunication network ducts and backfilling. The contractor shall include the furnishings of the backfill material and disposing of surplus materials. The trench shall be excavated in a manner to prevent cave-ins and to a depth of not less than 750-1100mm. Excavated material shall be deposited at a sufficient distance so that the excavated material cannot fall back into the trench. The width of the trench shall be at least 800mm. The uPVC ducts shall be in the bottom of the trench or covered with backfill material as directed by the Engineer. Note that the method and type of equipment to be used during construction, in the compaction of the backfill material shall be approved by the Engineer before any work is started.

2.8.5.5 Manholes and uPVC ducts

At every 50m and/or at locations were shown on the drawing, the developer must construct telecommunication manholes and lay the telecommunication uPVC ducts as per the local Pakistan standards and regulations. All the main run ducts must be connected to these manholes for cables continuations and/or branch cables looping. At the preliminary design stage, specified locations shall be shown on the proposed drawings, from every manhole, 4 Nos''. of 100mm uPVC pipes must be laid to be connected in the future for each plot telecommunication networks. The ends of these uPVC ducts must be plugged and sealed till the time of usage. This is to prevent entry of water and/or debris inside of the pipe.

2.8.5.6 Plot Terminal Box

Anticipated locations of these sub-distribution cabinets will be decided at the next design stage. Then, every plot will have a common telecommunication terminal/distribution/box/cabinet to cater for the incoming lines in the house. Location of such terminal box will be decided at the next design stage based on the building internal design

2.8.5.7 Road Crossing Ducts

Road crossing ducts will be provided at intersections as well as areas that require a telecommunication corridor on one side of the road.

2.8.6 GSM Towers

The usual practice in Karachi is that the GSM facilities can be installed at the rooftops of certain towers and as required by the local telecommunication providers.

If the strategy of utilizing certain buildings to host the telecom antennas and facility, then a plot of 30X 30m will be required at certain location that can be agreed upon in the development stages of the design.

2.8.6.1 Coordination with the Services Providers

Considering more than one telecom provider will be involved in providing services to Project, the telecom ducts will be designed in a way to cater all providers.

Coordination between the various service providers needs to be conducted to ensure the best service for the consumers in terms of land lines, house internet and mobile network will be considered for the building part.

2.8.6.2 Construction

If at the time of actual execution of the network civil works, the developer requires additional ducts, then these ducts must be within the same right of way as mentioned in the overall services network drawing. Where the pipes cross the roads, then the concrete encasement of these ducts must be adapted for protection of breaking and/or settlements.

Protection concrete tiles at 400mm below finish floor level along all over the run of the uPVC ducts must be installed with clear label on the concrete tile that say Telecom Services.

Prior to execution of the works, the developer or the sub-developer must prepare the required shop drawings and obtain approval from local authority.

2.8.6.3 Infrastructure ELV Network

The outside plant infrastructure ELV Network is designed to meet the requirements of the premises that maybe considered to be used in the future without any possible interruption to the roads and landscape.

The ELV comprises of a combination of ducts and hand holes that are provided with space to accommodate any future fiber optic splice closure (FOSC) and copper splice closure (CSC). The UPVC ducts will be used in the future for the following services CCTV, Security and any possible ELV networks in the future.

2.8.6.4 CCTV/Security/FA

Part of the ELV system the CCTV outdoor camera for the infrastructure is proposed to be installed with the streetlight pole to avoid many additional poles in the development. For the intent of sustainable city project, self-powered solar camera will be more suitable, however the design include corridor provision in case physical connections to the security Cameras are needed.

Figure 2.10 - Outdoor PTZ Camera

A 0.5m corridor all around the various roads of the project shall be obtained for the ELV networks in all road types. The ELV network will also link the various building Fire Alarm to a common center at the same location where the CCTV and security system main panels and monitors will be gathered and allocated.

4 nos. of 110mmUPV ducts with small hand holes will be provided all along the project and will be connected to the various buildings to ensure that all the buildings can be monitored from one location.

2.8.7 Gas Network

The Project will make use of Natural Gas. This will minimize the usage of electrical stoves and ovens and reduces the energy consumption.

Backup system of SNG/LPG may also be considered to be added to the individual building design as tanks with needed pumps, manifolds and PRV and other required mechanical and monitoring equipment to ensure safe and continuous operation of the network for all the various plots.

The sizes of the tanks will be finalized in the design stages and development of the design.

Tanks and related pumps will be located in area where it is safe and secure in coordination with the local authority and Civil Defence. Estimated area is anticipated to be 10mx15m.

2.9 Solid Waste Management

The collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful is necessary to keep the environmental and hygiene conditions of surrounding healthy. To ensure this, solid waste management is designed to cope with daily solid waste requirement in the Project.

2.9.1 Design Basis

As per the data extracted from Solid Waste Management report for Karachi, issued by IUCN, UNO HABITAT & UNESCAP in 2019, the average waste generated by residential units in High income areas is 0.84kg/capita/day per household, on average 1.795 Kg/Cap/day from commercial/office buildings and 11.7kg/cap/day per shop/market store.

Table 2.17 - Waste Generation in Residential Units

S. No.	Residential Class	Waste Generation (kg)/c/d		
		Average	Low	High
1	Low income	0.19	0.087	0.59
2	Middle income	0.29	0.11	0.68
3	High income	0.84	0.14	2.33

Similarly, the waste generated by commercial units is depicted in table below:

Table 2.18 - Waste Generation in Commercial Units

S. No.	Commercial Group	Waste Production kg/d

		Average	Low	High
1	Travel agency	0.48	0.06	1.2
2	Grocery store 1	3.78	1.08	9.12
3	Grocery store 2	1.35	0.87	2.2
4	Bank 1	2.43	0.15	4.3
5	Bank 2	3.57	0.50	6.3
6	Mobile shop	0.8	0.45	1.32
7	Educational institution	0.71	0.05	1.1
8	Office	0.99	0.1	1.67
9	Restaurant	2.69	0.74	7.83
10	Mart	1.16	0.43	2.16
Average of all groups		1.795		

Among the generated waste, 45% is estimated to be organic and remaining to be inorganic.

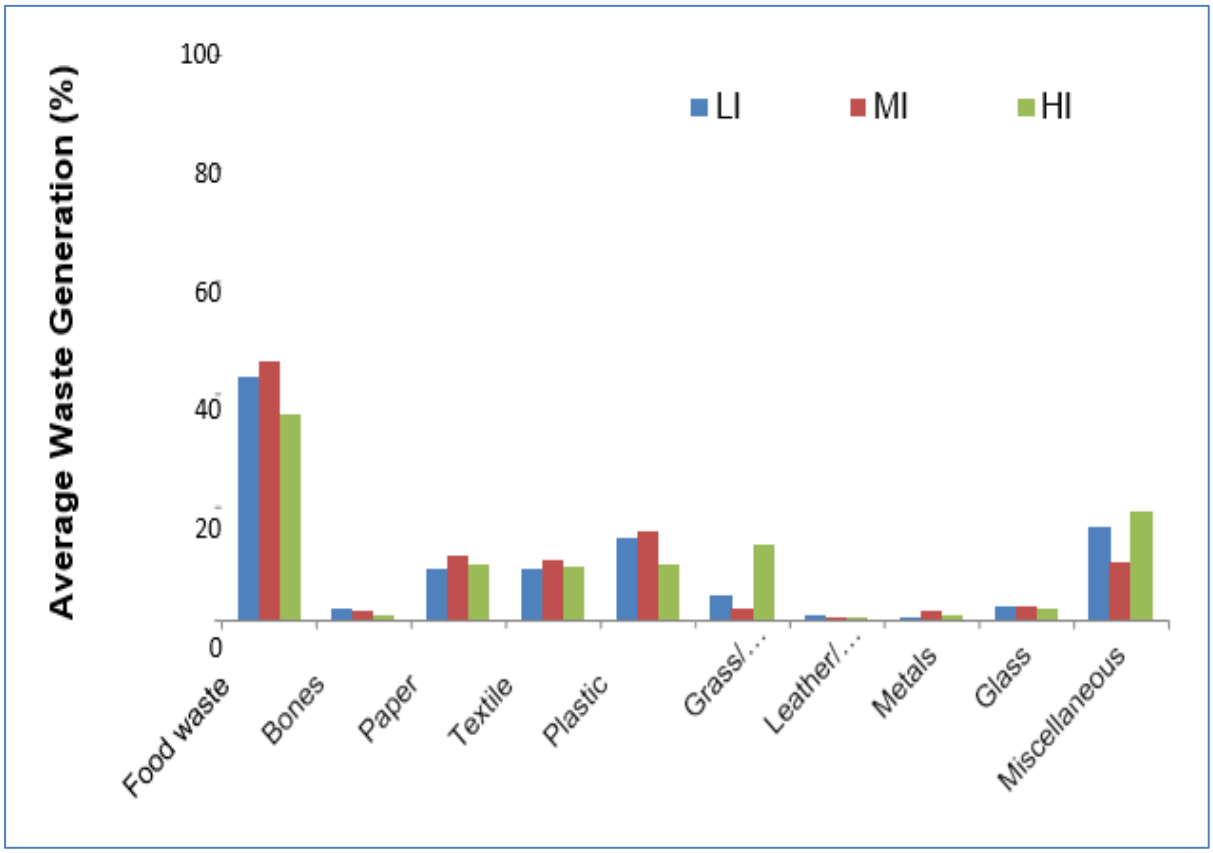


Figure 2.11 - Average Waste Generation

2.9.2 Design Methodology

To ensure the smooth disposal of solid waste each building floor will be provided with garbage refuse disposal chutes which shall be sized in order to transport the waste bags smoothly to disposal outlet.

The chute shall deliver the waste bags to disposal outlets and dispose off the solid waste bags in large garbage bins located at the base level of each building. After filling of garbage bin at specified weight or level, another garbage bin is placed beneath disposal point and the filled garbage bin shall be checked for garbage segregation. The garbage segregation shall be done in order to specify, organic, inorganic and recyclable waste. Each specified waste shall be placed in designated garbage bins for organic, inorganic and recyclable waste. From these bins, the waste shall be collected by Solid waste management team and shall be transported to relevant landfills for further process.

A specific room for disposal of large items including cardboard, appliances etc. shall be provided at base level of each building.

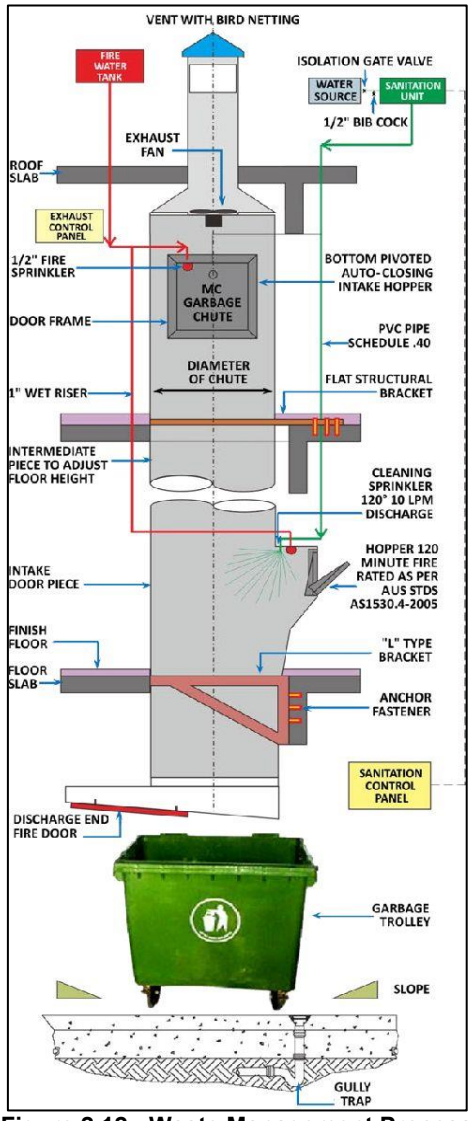


Figure 2.12 - Waste Management Process

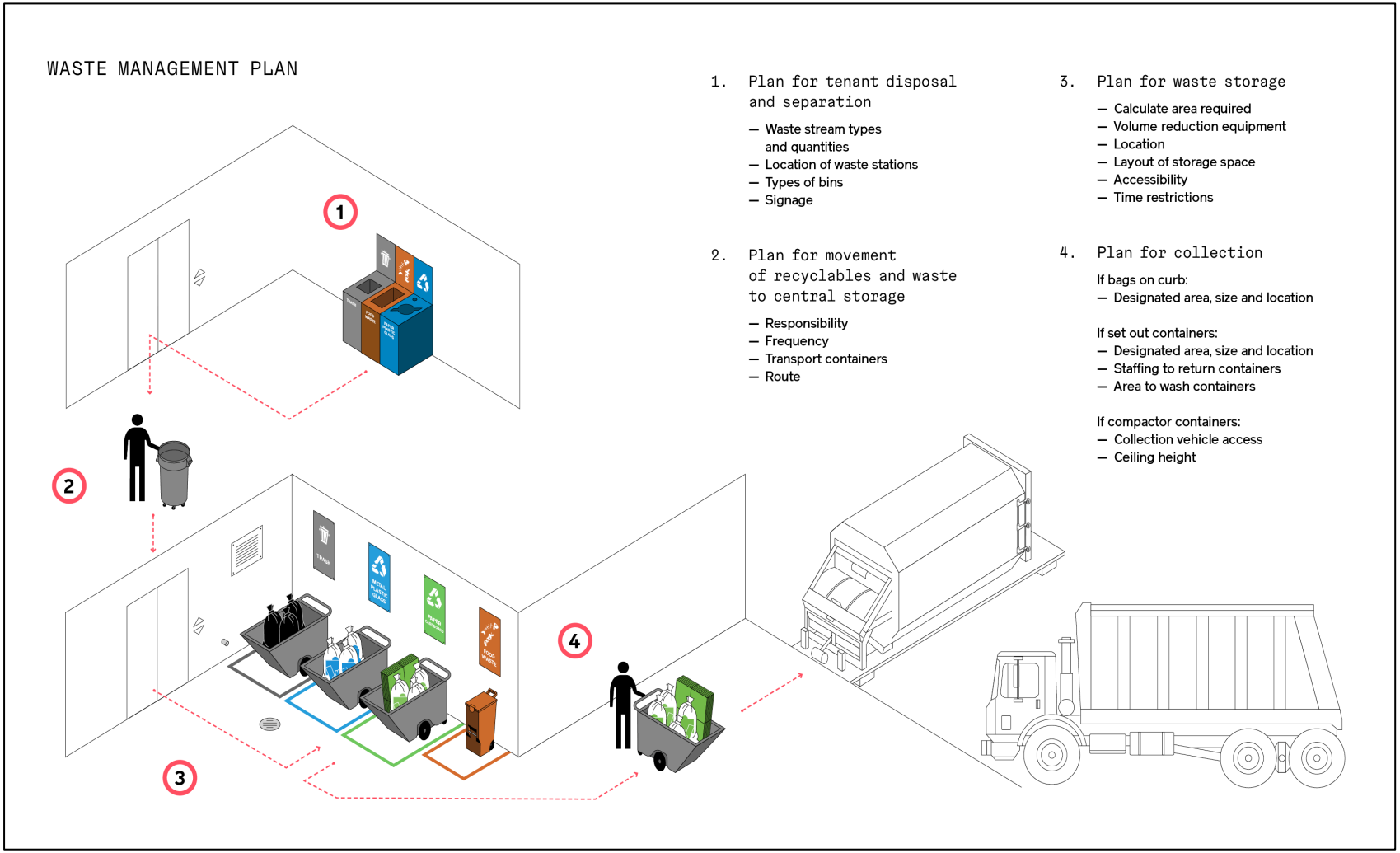


Figure 2.13 - Waste Management Plan

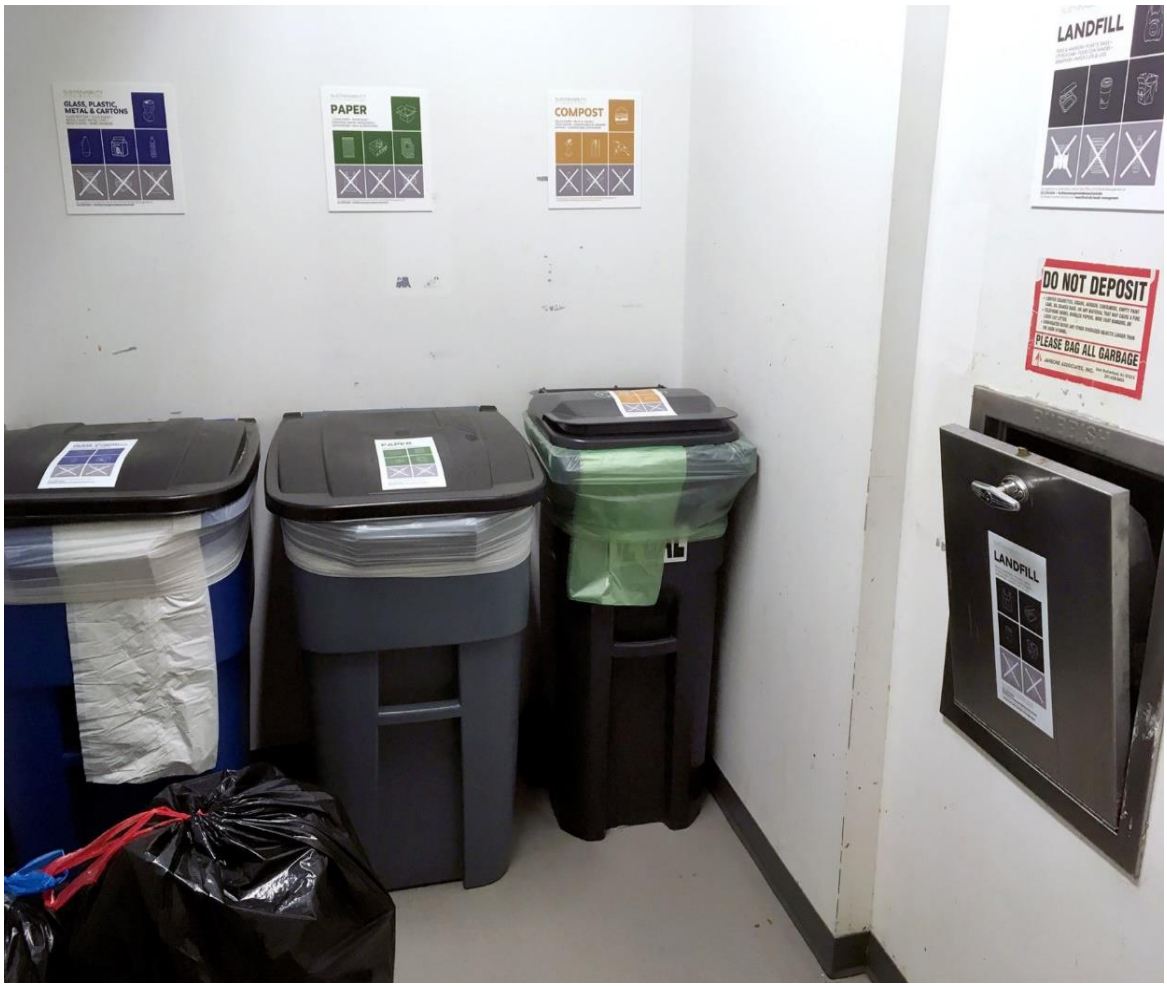


Figure 2.14 - Design for co-location of organics and all waste streams in waste rooms

2.9.3 Design Parameters

Following parameter shall be followed while performing detail design as per building population requirement.

- The material of chute, hopper and garbage drum shall be rust free, usage of SS 430, Galvanized Iron to be consider for chute pipe and hopper, while the garbage drum can be M.S.
- Proper exhaust system must be incorporated to remove foul smell and gases generated from waste in garbage chute. Automated ventilation fan should be installed, CFM will be calculated as per floors and no of chute doors.
- Inspection and cleaning point will be incorporated in chutes.
- Sound insulation to be provided if chutes pass next to habitable room.
- Material of chute should be non-combustible and wall must be moisture proof.
- Chute system to comply with NFPA and national building codes.

3 RELEVANT LEGISLATIVE REQUIREMENTS & FRAMEWORK

This section provides detailed review of policies, legislation, and guidelines that have relevance to the proposed development. The Project needs to comply with all the applicable environmental policies, laws, guidelines, acts and legislations of Government of Pakistan, the provincial government, international treaties ratified by Pakistan, and IFC Performance Standards.

3.1 Summary of Relevant Strategies, Policies, Acts and Legislation

A summary of the major relevant strategies, policies, acts, and legislation from the environmental perspective are briefly discussed in the tables below:

3.2 National Environmental Policies and Laws

3.2.1 National Conservation Strategy, 1992

The National Conservation Strategy (NCS) is the primary policy document of the Government of Pakistan (GoP) on national environmental issues. The policy was approved by the Federal Cabinet in March 1992. The Strategy also attained recognition by the international donor agencies, principally the World Bank. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage and recommends immediate attention to these core areas in order to preserve the country's environment.

A mid-term review of the achievements of the NCS in 2000 concluded that achievements under the NCS have been primarily awareness raising and institutional building rather than actual improvement to environment and natural resources and that the NCS was not designed and is not adequately focused as a national sustainable strategy (GoP, November 2000). The need therefore arose for a more focused National Environmental Action Plan (NEAP) required to bring about actual improvements in the state of the national environment with greater emphasis on poverty reduction and economic development in addition to environmental sustainability.

The National Environmental Action Plan was approved by the Pakistan Environmental Protection Council under the chairmanship of the President/ Chief Executive of Pakistan in February 2001. NEAP also constitutes the national environmental agenda and its core objective is to initiate actions that safeguard public health, promote sustainable livelihoods, and enhance the quality of life of the people of Pakistan.

The Government of Pakistan and United Nations Development Program (UNDP) have jointly initiated an umbrella support program called the National Environmental Action Plan-Support Program signed in October 2001 and implemented in 2002. The development objective supported by NEAP-SP is environmental sustainability and poverty reduction in the context of economic growth. The objective of new policy has total 171 guidelines on sectoral and cross sectoral issues. The objectives of new policy include assurance of sustainable development and safeguard of natural wealth of country. The following are the approved Sectoral Guidelines:

- Water Supply and Management.
- Air Quality and Noise.
- Waste Management.
- Forestry.

- Biodiversity and Protected Areas.
- Climate Change and Ozone Depletion.
- Energy Efficiency and Renewable.
- Agriculture and Livestock.
- Multilateral Environmental Agreements.

3.2.2 National Biodiversity Strategy and Action Plan, 2017 – 2030

Pakistan was among 150 countries that signed the Convention on Biological Diversity (CBD) at the 1992 Rio Earth Summit, and ratified it in 1994. A Biodiversity Action Plan (BAP) of Pakistan was approved by the Pakistan Environment Protection Council in 2000 as a principal instrument for implementing the Convention at the national level (CBD, Article 6) and mainstream the protection of biodiversity in policies and planning of the country.

The monitoring will not only measure progress towards the achievement of NBSAPs and national targets, but also help in identification of implementation issues, and in adaptive management for its effective implementation. Subject to availability of funds, an independent mid-term evaluation shall be commissioned in 2020, to review the implementation of NBSAP and make recommendations for achieving national targets by 2030 in an effective and timely manner. Final evaluation of NBSAP will be undertaken in 2030. The monitoring and evaluation reports will be presented to the National Steering Committee and Provincial Coordination Committees for their help in overcoming the obstacles in successful achievement of the targets.[2]

3.2.3 National Environmental Policy, 2005

The National Environmental Policy provides an overreaching framework for addressing the environmental issues facing Pakistan, particularly pollution of fresh water bodies and coastal waters, air pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, and loss of biodiversity, desertification, natural disasters and climatic change.

It also gives direction for addressing the cross-sectional issues as well as the underlying causes of environmental degradation and meeting international obligations.
The National Environmental Policy, 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 for their environmental resources.

The National Environmental Policy aims to protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development.

3.2.4 Pakistan Climate Change Act, 2016

The Prime Minister established Pakistan Climate Change Council which coordinates and supervises the enforcement of the provisions of the Act, monitor implementation of the international agreements relating to climate change, approve and monitor implementation of comprehensive adaptation and mitigation policies, strategies, plans, programs, projects and other measures formulated by the authority to meet Pakistan's international obligations, monitor the implementation of National Adaptation Plan and its constituent provincial and local adaptation action plans,

[2] https://www.cbd.int/doc/world/pk/pk-nbsap-v2-en.pdf

approves guidelines for the protection and conservation of renewable and nonrenewable resources, species, habitats and biodiversity adversely affected or threatened by climate change.

3.2.5 National Action Plan for COVID-19 Pakistan

Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at https://www.nih.org.pk/wp-content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf. The Government of Pakistan has launched the real-time data portal for COVID-19 http://covid.gov.pk/. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf.
Ensure that works undertaken as part of the project, comply with COVID guidelines to curtail its transmission.

3.3 National & Provincial Laws and Regulations

Prior to the 18th Amendment to the Constitution of Pakistan in 2010, the legislative powers were distributed between the federal and provincial governments through two 'lists' attached to the Constitution as Schedules. The ‘Federal list’ covered the subjects over which the federal government had exclusive legislative power, while the 'Concurrent List' contained subjects regarding which both the federal and provincial governments could enact laws. The subject of 'environmental pollution and ecology' was included in the Concurrent List and hence allowed both the national and provincial governments to enact laws on the subject. However, as a result of the 18th Amendment this subject is now in the exclusive domain of the provincial government. As a result, the Ministry of Environment at the federal level has been abolished. Its functions related to the national environmental management have been transferred to the provinces and the respective provincial environmental ministries and agencies. The international obligations in the context of environment will be managed by the ministry of climate change.

As a result, the Pakistan Environmental Protection Act, 1997 is no longer applicable to provinces and provinces have enacted their own environmental protection acts at provincial level.

3.3.1 Sindh Environmental Protection Act, 2014

In March, 2014, the Government of Sindh passed the Sindh Environmental Protection Act (Annex I) having 37 sections. The applicable sections of this act to this project are:

Section 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.

Section 11(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.

Section 11(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.

Section 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.

Section 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- Handling of hazardous substances. (a) under a license 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.

Section 14: No person shall undertake any action which adversely affects environment or which lead to pollute or impairment of or damage to biodiversity, ecosystem, aesthetics or any damage to environment etc.

Section 15: This section deals with regulation of motor vehicles banning emission of air or noise pollutants being emitted from them in excess of allowable standards.

Section 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.

This report of the proposed Project will be submitted to the Sindh Environmental Protection Agency (EPA) for approval and only after the issuance of NOC will the construction activity be commenced.
Section 21: Where agency is satisfied that the discharge or emission has occurred in violation of any provision of this act or rules etc. then it may, after giving an opportunity to person responsible, by order direct such person to take such measures within specified period. The agency under this section has been empowered to immediately stop, prevent or minimize emission, disposal etc. for remedying adverse environmental effects.

Section 22: The person who fails to comply with section 11, 17, 18 and 21 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. And, where a person convicted under sub-sections 1 & 2 had been previously convicted for any contravention of this Act, the Environmental Protection Tribunal (EPT) may, in addition to punishment, award imprisonment for a term that may extend up to three years, or order confiscation or closure of facility etc.

Section 23: Where any violation of this Act has been committed by any of employee of any corporate body, then, that employee shall be considered to be guilty of environmental pollution.

3.3.2 Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021

Sindh EPA Environmental Assessment Regulations, 2021 categorize projects into three separate schedules depending on whether a project requires an Environmental Checklist (Schedule-I) or an IEE (Schedule-II) or ESIA (Schedule III). The Regulations also require that all projects located in environmentally sensitive areas need submission of an ESIA.
On the basis of the nature and scope of project, it has been accordingly categorized as per the following:

Schedule-III
Category J: Urban Development
Subcategory 2: Residential, Commercial High-rise buildings subject to compliance of building bylaws of relevant organizations more than 500,000 sq. feet

This Environmental and Social Impact Assessment (ESIA) report presents the evaluation of environmental impacts of the construction and operation of the proposed development.

3.3.3 Sindh Prohibition of Child Employment Act, 2017

Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines or any other hazardous employment. In accordance with this Article, the Prohibition of Child Employment Act (PCEA) 2017 disallows the child labor in Sindh. The PCEA defines a child as a person who has not completed his/her fourteenth years of age, and an adolescent means a person who has completed fourteenth year of age but has not completed eighteenth years of his age. No child shall be employed or permitted to work in any establishment including construction but an adolescent can be employed or permitted to work under strict guidelines provided in the PCEA and rules. An adolescent shall not be employed in any hazardous work included in the schedule to the PCEA.

3.3.4 Self-Monitoring and Reporting by Industry Rules, 2014

These rules classify the industrial units for monitoring and reporting their liquid effluent and gaseous emissions into three and two categories respectively. According to each category they define the priority parameters to be monitored and reported to SEPA according to a specific frequency based on working conditions. This monitoring and reporting is in addition to the monitoring conditions as required by the conditions of approval of ESIA. The sampling for testing must be carried out according to Environmental Samples Rules, 2014 and be sent to SEPA certified environmental testing laboratories.

3.3.5 Archaeological Relics

After the Eighteenth amendment in the constitution the subject of “Ancient and historical monuments, archaeological sites and remains” the entry No.37 of the concurrent legislative list has also devolved to provincial legislations. There are two laws that are directly relevant for archaeological relics. The first is The Antiquities Act, 1975, which ensures the protection of Pakistan’s cultural resources. The Act defines “antiquities” as ancient products of human activity, historical sites or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the GoP to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the Project proponents are obligated to ensure that no activity is undertaken within 61 m (200 ft.) of a protected antiquity, and to report to the GoP’s Department of Archaeology any archaeological discovery made during the course of the project. The second is The Sindh Cultural Heritage (Preservation) Act, 1994, which is the provincial law for the protection of cultural assets. Its objectives are similar to those of the Antiquity Act. Heritage Foundation has catalogued 600 historic buildings declared heritage sites under the Sindh Cultural Heritage (Preservation) Act, 1994.

3.3.6 Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020

The Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020 aims to enhance protection for wildlife. Its passing marked the repealing of a weaker law, hardly providing any protection to wild animals, for the first time since 1972.
The new legislation has wider coverage, protecting even those wild animals that enter Sindh via trans-boundary migration or as a result of human activity.

3.3.7 Pakistan Penal Code, 1860 (PPC)

Chapter XIV of the PPC deals with the offences affecting the public health, safety, convenience, decency and morals. Person may be guilty of public nuisance if his act or omission causes common injury, danger or annoyance to the public or results in spread of infection of disease dangerous to life. The chapter also deals with environmental pollution.

3.3.8 Sindh Solid Waste Management Board Act, 2014

A board established under the Act for management of collection and disposal of all solid waste, to arrange for effective delivery of sanitation services, and to deal with other relevant matters. Under the Act, the board shall have the right over the solid waste related issues, assets, funds and liabilities of the Councils and shall possess sole rights on all kinds of solid waste within the limits of all Councils.

The Supreme Court of Pakistan in recent judgment passed on 16.03.2017 in C.P. No.38 of 2016 (Shahab Usto vs GoS & Ors) has shown serious reservation with regard to the continuation of the Board. The Court has observed in Para No.49 that if this Board is allowed to exist, it would be a permanent liability of the Sindh Government. Sindh Government has filed a review application in the Supreme Court but order dated 16.03.2017 has not been suspended yet; therefore, it is still in field. In the circumstances, the Act has not been reviewed in detail.

3.3.9 Sindh Resettlement & Rehabilitation (R & R) Policy 2023

In sum, the R&R Policy sets out the principles and standards to be applied in resettlement and rehabilitation of people affected by displacement (physical and/or economic), such as due to development projects, non-development projects/to free public land, RoWs, and natural disasters or climate related events, in Sindh. The proposed measures are in harmony with existing laws, acting as additions to the LAA (1894) and other relevant laws. The LAA (1894) will continue to apply in full force to all the situations envisaged in the law.

3.3.10 The Sindh Wildlife Protection, Preservation, Conservation and Management Rules, 2022

In exercise of the power conferred by section 83 of the Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020 the Government of Sindh has promulgated these rules.

3.3.11 Sindh Strategy for Sustainable Development, 2007

The Sindh Strategy for Sustainable Development (SSSD) proposed a ten-year sustainable development agenda for Sindh. The main focus of SSSD is to promote the sustainable use of natural resources. It targets to reduce poverty and enhance social development through the participation of the people of Sindh.

SSSD recommends for the sustainable development and environmentally complying operations of industries: incentive mechanisms for reducing pollution; awareness raising of industrialists and stakeholders; promote cleaner production; enforce pollution charges as per SEPA 2014; prepare baseline of all industrial estates and sites to establish the pollution levels, waste disposal practices,

air emissions, generation of hazardous waste for the preparation of environmental management plans for complying SEPA 2014; preparation of ESIAs for all industrial development and infrastructure projects.

3.3.12 Disaster Management Act, 2010

This Act was enacted to provide for the establishment of a National Disaster Management System for Pakistan. Sindh Disaster Management Authority enforces the Act. The Act defines 'disaster' as a catastrophe or a calamity in an affected area, arising from natural or man-made causes or by accident which results in a substantial loss of life or human suffering or damage to, and destruction of, property. Disaster management includes preparedness and response. The Act provides establishment of disaster management authorities at national, provincial and district levels. The authorities require preparing and implementing disaster management plan for their area.

3.3.13 Sindh Drinking Water Policy, 2017

Public Health Engineering & Rural Development Department, Government of Sindh, with the approval of Chief Minister Sindh issue the drinking water policy on 3rd May 2017.

Principles: The main principles of Sindh Drinking Water Policy, adopted from the National Drinking Water policy 2009, and aligned with the Sustainable Development Goals, are as follows:

- Access to safely managed drinking water is a fundamental right of every citizen and that it is the responsibility of the Government to ensure its provision to all citizens,
- Water allocation for drinking purpose shall be given priority over other uses,
- In order to ensure equitable access, special attention shall be given to removing the existing disparities in coverage of safe drinking water and for addressing the needs of the poor and the vulnerable on priority basis.
- Recognizing that inadequate and unsafe water supply and sanitation are a major cause of diarrhea and nutritional deficiency in children, which as a consequence contribute towards child mortality. Safely managed drinking water supply and sanitation shall be integrated in health, nutrition and school health programs.
- Access shall be increased to high quality nutrition-sensitive services, including access to water, sanitation facilities, and hygiene.
- Key hygiene actions (safe drinking water, hand washing with soap, safe disposal of excreta, food hygiene) shall be integrated as essential components in all nutrition programs.
- Realizing the fact that access and availability of safe drinking water affects all aspects of life of a citizen, a multi sectoral approach, involving different departments of the government, shall be adopted to address the issues related to safe drinking water.
- Being cognizant of the fact that women are the main providers of domestic water supply and maintainers of hygienic household environment, their participations in planning, implementation, monitoring and operation & maintenance of water supply systems shall be ensured, and WASH shall be integrated in maternal and neonatal health programs.
- Responsibilities and resources shall be delegated to local authorities to enable them to discharge their assigned functions with regard to provision of safe water supply.
- A supportive policy framework shall be developed that encourages alternate options through private provision, public private partnerships, the role of NGOs and community organizations
- The execution of component-sharing model for government programs and projects shall be promoted to ensure financial sustainability and community and private sector involvement in development and O&M.
- Low-cost technologies in water and sanitation, that are easy and cost-effective to maintain shall be developed and used.

Goals and Objectives:

Overall Goal: The goal of the Sindh Drinking Water Policy is to improve the quality of life of people of Sindh by reducing morbidity and mortality caused by water-borne diseases through provision of safely managed and potable drinking water to the entire population that is located on premises, available when needed, and free from contamination, affordable and of sufficient quantity, and in a way, that is efficient, equitable and sustainable.

Objectives:

- Introduce legislative measures and regulations to create an enabling framework for safely managed drinking water supply, regulation of water usage, extraction, treatment, transportation and distribution.
- Ensure that all drinking water resources and supply systems are protected with community involvement.
- Develop district level drinking water availability plans for urban and rural areas to ensure improved planning for equitable access.
- Enhance the coverage of safely managed drinking water supply in the province to achieve the Sustainable Development Goals (SDGs) targets of universal access.
- Develop criteria for installation of new drinking water supply schemes and ensure that all new schemes are safely managed, rationalized and constructed through need based criteria so that all areas and communities are served.
- Develop standardized service delivery models for both urban and rural drinking water supply schemes to improve efficiency, cost-effectiveness, monitoring & sustainability.
- Develop mechanisms for reuse, recycle and recharge of wastewater for other municipal and productive uses.
- Ensure that all drinking water supply systems are designed and constructed in line with the national drinking water quality standards and all municipal discharges comply with National Environment Quality Standards (NEQS).
- Install water treatment plants at existing drinking water supply schemes where required and incorporate water treatment facilities in all new drinking water supply schemes.
- Ensure development of water safety plans for all drinking water supply systems.
- Develop and sustain regular drinking water quality monitoring & surveillance, and institute mechanisms for remedial action.
- Increase public awareness about water borne and water related diseases (including polio), nutrition and hygiene, and enhance the role of communities for household water treatment/storage, water safety and conservation, and safe hygiene practices.
- Ensure that drinking water supply projects are nutrition sensitive and integrated in health, nutrition and school health programs.
- Institutionalize Water, Sanitation & Hygiene (WASH) in schools (infrastructure and 3 starts) and introduce curricular change to incorporate health, nutrition and hygiene and improve safe water and sanitation practices among school children.
- Institute adaptation measures and disaster risk reduction and mitigation strategies to minimize the impact of climate events on drinking water supply system.

3.3.14 Sindh Sanitation Policy, 2017

The goal of the Provincial Sanitation policy is to ensure that the entire population of Sindh has access to a safely managed sanitation service and sanitary environment that is also nutrition-sensitive and hygienic. The motto of the policy was ‘Saaf Suthee Sindh’ (Neat and Clean Sindh).

The key targets of this policy are:

- To eradicate open defecation from Sindh province by 2025, while 70%villages 0f 13 high priority districts achieve the status of open defecation free by 2020.
- That 100% household in Sindh have access to and use sanitary latrines by 2025, while 70% of rural households in high priority districts will achieve this by 2020.
- To strengthen and implement liquid waste management with sewer lanes and covered/improved drains with 85% coverage of urban areas and 60% coverage in rural areas.
- To create and develop wastewater treatment mechanisms to cover 75% of urban areas and 40% rural areas by 2025.
- To implement integrated solid waste management with 100% coverage in urban area and 60% in rural areas by 2025.

3.3.15 Unified cantonments building bye-laws-2019 Karachi region, dated 09-12-2019

These byelaws are required for regulating the erection and re-erection of, or additions and alteration to buildings in the Karachi cantonment areas. These regulations shall apply to the whole Karachi Cantonment area. Under these regulation following are the important information related to design and operation of this project.

A. Categories of Development Works

Category – I

- Bungalow on plot up to 399 Sq. Yds. (333.6 Sq. m) having habitable floors i.e., G + 2 Floor.
- Any other building on plot up to 120 Sq. Yds. (100. 33Sq.m) with height up to 33 ft. (10 m).
- Any non-obnoxious warehouse having height up to 35 ft. and/ or having area of plot up to 1100 Sq. Yds. (919 Sq. m)
- Any other building with total floor area up to 20,000 Sq. Ft (1858.74 Sq. m) and/ or height up to 50 ft. (15.2m), other than category II & III.
- All Residential Bungalows

Category – II

Public use buildings
Commercial
Industrial Buildings above three floors (including ground floor) having total floor area more than 14,000 Sq. Ft (1300.64 Sq. m) or
Span more than 40 ft. or
Ground floor height more than 15 ft. buildings for essential facilities
Public sale buildings.

Category – III

Plots/Building situated in High Density Zones

Category – IV

Town Planning works and Land Development Work

B. Temporary Works in Connection to Buildings Operations (Safety and Security Measures)

Site Hoardings: No person shall start building works on a site abutting on a street without having first provided hoarding or barriers to the satisfaction of the Board along the whole length of such site so as to prevent danger or injury to the public or the persons employed in the work, provided that these Bye-laws do not apply in case of building works in connection to Structures situated at least fifteen feet away from a public street and being not more than twenty-five feet in height.

Use of Public Streets: No part of any street shall be used in connection with the construction, repair, or demolition of any building except with the written permission of the Board. Any person holding such permission shall put up if and maintain to the satisfaction of the Board, fences, or barriers to separate the building work from such street. Where such separation is not possible, he shall make arrangement for the security of public to the satisfaction of the Board.

Obstruction to Be Lit Marked: Any person causing any building material or other things to be deposited, any excavation to be made, or any hoarding to be erected shall at his own expense cause sufficient and adequate red lights to be fixed upon or near the same and shall continue such lights every night from sunset to sunrise while such materials, hoardings, things, or excavation remain. In addition to above, red flags of reflectorized material shall be provided during daytime.

Any excavation is to be sufficiently fenced to a height of at-least 4ft. (1.21m) until it is filled up.

Utility Services Not to be Obstructed: All materials, hoarding fences or other obstruction on any street shall be kept clear of any fire hydrants if any and other utility services installation or alternative arrangements shall be made, and precautions shall be taken according to the laid clown procedure of the utility agencies and to the satisfaction Of the Board of divert to keep clear of obstruction of any roadside or other drain during the period of temporary obstruction.

Removal of Obstruction after Completion of Works: All obstruction shall be removed within seven days of the completion of the work and the street and all drains and public utility installation shall be left in clean, tidy and in serviceable conditions.

Dangerous Obstruction: If any material, excavation or any other things near or on any street shall be in the opinion of the Board dangerous to the passers-by along such street the Board shall cause the same to be removed, protected or enclosed so as to prevent danger there from and shall be entitled to recover the expenses thereof from the owner of such materials or from the person who made such hoarding, excavation or other things to become dangerous.

Stability of Adjacent Building: No excavation or dewatering or earthwork or demolition of a building which is likely to affect the stability of adjacent building shall be started or continued unless adequate steps are taken before and during the work to prevent the collapse or damage of any adjacent building or the fall or any of it.

Filling of Excavated Site: A sit once excavated shall not be kept open and idle for a period beyond the validity period plan Paling which the Board, shall not revalidate the building plans and in case of any mishaps the owner shall be responsible for life and property of the effected.

Adequate Safety Measures:

- Adequate safety measures shall where necessary be provided and used to protect any persons from failing on earth, rock, or other material of or adjacent to any excavation or earth work.
- Material shall not be placed or stacked near the edge of any excavation to endanger persons working below.
- No load shall be placed or moved near the edge or any excavation where it is likely to cause a collapse of the side of the excavation or endanger any person.

- Where vehicles or machineries are used close to any excavation there shall be measures to prevent the vehicles or machineries from over-running and failing into the excavation or causing collapse of any side of the excavation.
- In all buildings of greater than twenty feet height temporary rails, scaffolding or barriers shall be installed during construction at the edge of slabs and around all opening such as lift, stairwell etc.

Supervision of Demolition Work: The demolition of a building and the operations incidental thereto shall only be carried out under the direct supervision of a professional.

Safe Loading: No roof, floor or other part of the building shall be so overloaded during demolition and construction with debris or materials as to render it unsafe.

Scaffolds:

- Suitable and sufficient scaffolds shall be provided for all work that cannot safely be done from the ground or from part of the building or from a ladder or other available means support and sufficient safe means of access shall be provided to every place at which any person has to work at any time.
- Every scaffold and means of access and every part thereof shall be adequately fabricated with suitable and sound material and of required strength to ensure stability. All scaffolds, working platforms gangways, runs and stairs shall be maintained to ensure safety and security.
- All vertical members of scaffolds on ground level facing roadside shall be adequately wrapped with spongy material up to a height of at least seven feet and for any horizontal member if used, up to a height of seven feet from ground, shall be wrapped all along its length with such material.

Roadside Protection:

- To ensure adequate safety or the pedestrian and other road users, all buildings having a height of over ground two floors should have adequate arrangement by way of providing protective covering of suitable material.
- Adequate provision of safe passage for pedestrian shall be provided in case the scaffolding covers part of the road or footpath.

Working Platform:

- Every working platform from which a person is liable to fall which is more than seven feet height shall be at least two feet Wide provided the platform is used as a working platform only and not for the deposit of any material.
- A clear passageway at least one and half feet wide shall be left between one side of any working platform and any fixed obstruction or deposited materials.

Guard Rails: Every side of a working platform, gangway and stair shall be provided with a suitable guard-rail of adequate strength, to a height of at least three feet and three inch above the platform, gangway, or steps.

Ladders: Every ladder shall be of good construction, sound material and adequate strength for the purpose for which it is used.
Every ladder shall be securely fixed when in use and shall not have any missing or defective rungs.

Work on Slopping Roofs:

- Where work is to be done on the sloping surface of a roof, suitable precautions shall be taken to prevent persons employed from falling off.
- Suitable and sufficient ladders or boards, which shall be securely supported, shall be provided, and used to avoid concentration of loads leading to unsafe conditions.
- Where persons are employed in a position below the edge of sloping roof and where they are in position of being, endangered by work done on the roof, suitable precautions shall be taken to prevent tools or materials falling from such roofs to endanger such persons or passers-by.

Precautions for Raising and Lowering Loads: For raising or lowering loads or for suspending, them by either and or power operation the following precautions shall be observed, namely:

- No broken wire rope shall be used.
- No chain shall be used which has been shortened or joined to another chain by means of bolts and nuts.
- No chain or wire rope shall be used which a knot has tied in any part which is under direct tension.
- Provided with an efficient, device to prevent the displacement of the sling or load from the hook or of such shape as to reduce as far as possible the risk of such displacement.
- All debris and waste material during construction shall be disposed of through well-designed chutes from each level of under construction building of height over ground +two floors or more: and
- The vertical hoist platform used shall be enclosed or protected by proper barrier. Every opening of lift, shalt or other such vertical voids or Openings in slab etc. where a person is likely to fall shall be protected by safety barrier and property lit. Any area e.g., basement, where natural light is not available, or which is dark shall be so illuminated as to eliminate any risk of life or hazard to users.

C. Water Supply, Drainage and Sanitation

Minimum Storage Capacity for Category "II" & "III" Buildings

Minimum capacity of water storage tanks in buildings of Category "II" shall be:

- Overhead tank = 1 day+ 25% reserved for firefighting.
- Underground tank = 2 days out of the reserved capacity '25% shall he kept reserved for firefighting purposes by making suitable arrangements.
- Distribution of Water within the premises.
- The design of water supply pipe work, underground and overhead tanks shall be in accordance with the following schedule @ number of litres per head per day: Residential 35.
- Institutional- Day schools 45-100, Boarding schools 135-225, Medical hospitals 450 and Medical quarters hostels 135
- Assembly-Cinema, Theatre Auditorium etc. (per seat of accommodation) 45 Government or semi-public business 45
- Commercial - Restaurants 90. Shopping Centres per toilet fixture 200 and other commercial buildings 45
- Hotels 225
- Storage including warehouse 30.
- Service Station 200
- Bus/Truck Stands (per vehicle) 200
- Livestock (per animal) 45-150
- Poultry (per chicken) 45

Sanitation and Solid Waste:

- All medical & hospital waste shall be safely collected, 'transported and disposed of in accordance with the public health standards (as prescribed by Sindh Environmental Protection Agency) and up to satisfaction of the Board.
- All industrial waste shall be treated in accordance with the Sindh Environment Quality Standards (SEQS).
- All hospitals shall provide the disposal of medical waste as per Sindh Environment Quality Standard (SEQS).
- In all public sale projects, the central waste disposal system shall be provided by the builder/developer.

D. Fire Resistance and Fire Precautions

Every building shall comply with the provisions laid down in these Byelaws in respect of fire resistance and fire precautions, unless noted otherwise.
Standpipes System
Automatic Sprinkler System
Construction of Sprinkler System
Manual Fire Extinguishing in Public Buildings
Installation of Interior Fire Alarm System
Extinguishment of Fires
Fire Drills

Components of Fire Safety: The recommendations of fire safety commission regarding.

Following components shall be fulfilled: -

- Fire Door.
- Hydrant System.
- Installation of Fire Extinguishers.
- Fire Alarm System.
- Clear access and removal of obstructions.
- Evacuation plan and emergency lighting system.
- Emergency response team.
- Water Pump.
- Smoke Detectors

E. Parking Requirement

Parking requirement for motor vehicles specified in these Byelaws shall apply whenever.
A new building is constructed or a change of use of existing building is established.
OR
An existing building is altered and there is an increase in the floor area of the building, wherein additional parking requirements shall be totally applicable to the proposed addition only within the property limits as required under these Byelaws.

Parking Requirements/Standards

- Every 6 bedrooms for a hotel of three-star category and above. In addition to a per room requirement, parking space shall be provided for all other facilities e.g., restaurants, conference room etc.; @ 200 Sq. Ft. for restaurant and 300 Sq. Ft. for conference room per car.

- Every 3 beds for general ward and for 2 semi-private / private rooms and or 1 per consulting room / OPD of a clinical / medical service building. Additional parking @ 50% of above parking for management / Doctors parking.
- Every 100Sq.ft in places of all public assembly, unless specified as hereunder.
- Every 50 visitors who can be accommodated by an area or structure for sports activities.
- Every 1000 Sq. Ft. (92.93 Sq. m) of floor area of office space in an industrial building unit.
- Every 800. Sq. Ft of floor area of space for retail shopping, business offices, for all facilities of hotel.
- Every 4000 Sq. Ft. floor area of all educational institutions or minimum three fourth of motor vehicle parking space shall be provided per classroom whichever is more.
- Every 60 Sq. Ft of marriage lawn/hall of minimum plot area of 1000 Sq. Ft.
- Every 1000 Sq. Ft of floor area for all Flat Sites, commercial buildings & commercial-cum-residential building.
- Every 300 Sq. Ft of floor area of Cinema.
- For Cineplex parking shall be, calculated @ one car for two seats.
- Minimum one out of every fifty car parking stalls shall be dedicated for the disabled person at most convenient location.

3.3.16 Civil Aviation Rules, 1994

The Civil Aviation Rules 1994 has mandated it for all the builders and developers to obtain No Objection Certificate (NOC) from Civil Aviation Authority (CAA) under rule 68, section-3 of Civil Aviation Rules, 1994 for “Height Clearance” for projects/buildings within the radius of 25km of all airports. The rule 68, section 3 (Safe Guarding at Aerodromes (68) Limitation of obstructions) reads as under: “No person shall erect any temporary or permanent structure, nor position a vehicle or other mobile object on or in the vicinity of any aerodrome to which these rules are applicable, that will be within the clearance area, or will protrude through an obstacle limitation surface, at that aerodrome”.

3.3.17 Building Code of Pakistan, Fire Safety Provisions 2016

The Building Code of Pakistan-Fire Safety Provisions-2016 provide rules for fire prevention, life safety in relation to fire and fire protection of building and structures as prescribed. All the federal and provincial governments, organizations, authorities, both public and private are mandated to adopt and implement Building Code of Pakistan-Fire Safety Provisions-2016, as notified. Any construction and modification of buildings in violation of Building Code of Pakistan (Fire Safety Provisions-2016) shall be considered as violation of professional engineering works as specified under clause (xxv) of section 2 of the Act.

The implementation and enforcement of this bye-law shall vest with the Authority Having Jurisdiction (AHJ) within their respective jurisdictions and circles as follow:

- Building Control, Housing and Development Authorities
- District Administration
- Tehsil or Town Administration
- Municipal Administration
- Station Headquarters (Army, Air Force and Navy)
- Cantonment Administration
- Union Council Administration
- Autonomous Bodies
- Industrial Estates
- Directorates of Civil Defense
- Export Processing Zones

- Other Federal/Provincial Authorities as and when notified

This Bye-law shall come into force upon being notified and all the concerned AHJs shall implement the same immediately in the prescribed manner.

All relevant AHJs shall ensure compliance and implementations of this Code and accordingly adopt or amend their relevant regulations, Bye-laws or rules as the need be.

This Bye-law shall apply to both new and existing buildings.

- Buildings permitted for construction after the adoption of these Provisions shall comply with the provisions stated herein for new buildings forthwith.
- Existing buildings constructed prior to adoption of these provisions shall comply with the provisions stated herein as soon as possible but not later than three years of notification of these provisions; and
- Minimum fire protection requirements such as provision of fire alarm and detection system, fire extinguishers, emergency response plans and fire drills shall however be in place as soon as possible but not later than one year of notification of these provisions.
- Any person who fails to comply with this Bye-law or fails to carry out an order made pursuant to these provisions, or violates any condition attached to a permit, approval, or certificate shall be subject to the penalties in accordance with the regulations of AHJ.

3.4 Labor Laws

3.4.1 Sindh Occupational Safety and Health Act, 2017

The Act devised to make provision of occupational safety and health conditions at all workplaces for the protection of persons at work against risk of injury arising out of the activities at work places and for the promotion of safe, healthy and decent working environment adapted to the physical, physiological and psychological needs of all persons at works.

The proponent and project contractor(s) will be bound by the Act to comply the provisions of this Act.

3.4.2 Employment of Child Act, 1991

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

The proponent and project contractor(s) will be bound by the ECA to not allow any child labor or bonded labor at the Subproject site.

3.4.3 The Bonded Labor System (Abolition) Act, 1992

Article 11(2) of the Constitution of the Islamic Republic of Pakistan prohibits all forms of forced labor. In accordance with this Article, The Bonded Labor System (Abolition) Act, 1992 provides for the abolition of bonded labor system in the country. Under section 4(2) of this Act, no person shall make any advance under, or in pursuance of, the bonded labor system or compel any person to render any bonded labor or other form of forced labor. The practice of bonded labor has become

a punishable offence after enactment of this act (with imprisonment for a term which shall not be less than two years nor more than five years, or with fine which shall not be less than fifty thousand rupees, or with both). Vigilance Committees are formed at the district level to keep an eye on the working of law and help in rehabilitation of freed bonded labor.

The proponent and project contractor(s) will be bound by the Act to compel its labor and the provisions of this Act will be ensured.

3.4.4 Workmen's Compensation Act, 1923

Workmen's Compensation Act, 1923 provides for the compensation to be paid by employer to workers or their legal heirs in case of death, permanent total disablement, permanent partial disablement and temporary disablement during working.

The project contractor(s) is liable to pay compensation in case of any accidents and proponent will ensure the compensation as per this Act.

3.4.5 Minimum Wages Ordinance, 1961

Section 9 (1) of this ordinance states that no employer shall pay any worker wages at a rate lower than the rate declared under this Ordinance to be the minimum rate of wages for such worker. 9 (2) Any employer who contravenes the provisions of this section shall be punishable with imprisonment for a term which may extend to six months or with fine.

The Subproject contractor(s) is liable to pay at least minimum wages to its unskilled labor and proponent will ensure payment of not less than the minimum wage as specified above.

3.4.6 The Industrial and Commercial Employment (Standing Orders) Ordinance, 1968

The ordinance which applies to construction industry and contractor, does not specify the hours of working in one shift however, standing orders under this act state that the periods and hours of work for all classes of workmen in each shift shall be exhibited in Urdu and in the principal language of workmen employed, in the industrial or commercial establishment on notice boards maintained at or near the main entrance of the establishment and at the time-keeper's office, if any.

The Factories Act, 1934 (Section-34), Mines Act, 1923 (Section 22-B, C), Shops and Establishment Ordinance, 1969 (Section 8) and Road Transport Ordinance, 1961 (Section-4) are used to determine working hours and rest time in different industries which are not applicable for construction works conducted by Contractor. Section 34 of the Factories Act provides that "no adult worker shall be allowed or required) to work in a factory for more than 48 hours in a week; if the factory is seasonal, 50 hours a week and if the work is of continuous nature, he may work for 56 hours in a week. As for the daily hours, these may not be more than 9 hours a day (in case of seasonal; 10 hours). Any adult worker is required to work overtime, if asked, and the rate of overtime payment is double the usual pay (Section 47). Overtime is not payable to the contract workers, employed on piece rate basis.

3.4.7 The Protection against Harassment of Women at the Workplace Act 2010

The Act was promulgated on March 11, 2010 to make provisions for the protection against harassment of women at the workplace. It states that each organization shall constitute an Inquiry Committee within thirty days of the enactment of this Act to enquire into complaints under this Act. The Inquiry Committee shall hold an inquiry against the charges and statement of allegations within

three days of receipt of a written complaint. The Inquiry Committee if found the accused to be guilty, shall pose the penalties described in the Act.

The Grievance Redressal Mechanism as described in this ESMP is based on this Act and Grievance Redress Committee formed for this Subproject will cater protection against women harassment at workplace based on the provisions of this Act.

A Code of Conduct at the Workplace will be developed by CC to provide protection and safety to women against harassment and will be followed during the whole construction period.

3.4.8 ILO Conventions - Ratifications for Pakistan

Pakistan has ratified 08 fundamental and 26 technical ILO conventions in which following are relevant to the project:

- C029 - Forced Labor Convention, 1930 (No. 29)
- C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
- C138 - Minimum Age Convention, 1973 (No. 138)
- C001 - Hours of Work (Industry) Convention, 1919 (No. 1)

C029 - Forced Labor Convention, 1930 (No. 29)

Article 1 of the convention states each member undertakes to suppress the use of forced or compulsory labor in all its forms within the shortest possible period. Article 2 of the convention states that the term forced or compulsory labor shall mean all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily.

C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)

For the purpose of this Convention, discrimination includes any distinction, exclusion or preference made on the basis of race, color, sex, religion, political opinion, national extraction or social origin, which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation.

C138 - Minimum Age Convention, 1973 (No. 138)

Article 1 of the convention states that Each Member which ratifies this Convention shall specify, in a declaration appended to its ratification, a minimum age for admission to employment or work within its territory and on means of transport registered in its territory; subject to Articles 4 to 8 of this Convention, no one under that age shall be admitted to employment or work in any occupation.

C001 - Hours of Work (Industry) Convention, 1919 (No. 1)

The term industrial undertaking under this convention includes (c) construction, reconstruction, maintenance, repair, alteration, or demolition of any building, railway, tramway, harbor, dock, pier, canal, inland waterway, road, tunnel, bridge, viaduct, sewer, drain, well, telegraphic or telephonic installation, electrical undertaking, gas work, waterworks or other work of construction, as well as the preparation for or laying the foundations of any such work or structure;

Article 2 of the Convention states that the working hours of persons employed in any public or private industrial undertaking or in any branch thereof, other than an undertaking in which only members of the same family are employed, shall not exceed eight in the day and forty-eight in the week. The limit of hours of work prescribed in Article 2 may be exceeded in case of accident, actual

or threatened, or in case of urgent work to be done to machinery or plant, or in case of "force majeure", but only so far as may be necessary to avoid serious interference with the ordinary working of the undertaking.

3.4.9 Gender Equality as part of Constitution of Pakistan 1973

The Constitution of Pakistan contains a range of provisions regarding gender equality, in particular, provides the principle of equal rights and equal treatment to all citizens/ persons, without any distinction including on the basis of sex:

- Article 3 calls upon the State to eliminate all forms of exploitation.
- Article 4 provides for the right of individual to enjoy the protection of law and to be treated in accordance with the law. This applies to the citizens as well as “to every other person for the time being within Pakistan” without distinction. This article also clearly states that certain rights cannot be suspended.
- Article 25 ensures equality before the law and equal protection of the law and states that there shall be no discrimination on the basis of sex alone.
- Articles 25(3) and 26(2) allow the state to make special provisions for the protection of women and children.
- Article 26 & 27 provide for equal access to public places and equality of employment in the public and private sector.
- Articles 11 & 37 (g) prohibit trafficking in human beings as well as prostitution.
- Article 32 makes special provisions for the representation of women in local Government.
- Article 34 directs the state to take appropriate measures to enable women to participate in all spheres of life and social activities.
- Article 35 asks the state to protect the marriage, the family, the mother and the child.
- Article 37 (e) directs the state to make provisions for securing just and humane conditions of work ensuring that children and women are not employed in vocations unsuited to their age or sex, and for ensuring maternity benefits for women in employment
- Articles 51 & 106 provide for the reservation of seats for women in the legislatures.
- The articles of laws Constitution of Pakistan are relevant as it would deal with employment of male and female labor having different religion, political affiliation, sect, color, caste, creed, ethnic background for the construction of proposed Project.

3.4.10 Labor Laws as part of Constitution of Pakistan 1973

The Constitution of Pakistan contains a range of provisions with regards to labor rights, in particular:

- Article 11 of the Constitution prohibits all forms of slavery, forced labor and child labor;
- Article 17 provides a fundamental right to exercise the freedom of association and the right to form unions;
- Article 18 proscribes the right of its citizens to enter upon any lawful profession or occupation and to conduct any lawful trade or business;
- Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and
- Article 37(e) makes provision for securing just and human conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment.
- Labor law is controlled at both provincial and national levels with compulsory employment agreements containing the terms set out by the labor laws. The labor laws are a comprehensive set of laws in Pakistan dealing with the following aspects:
- Contract of Employment;

- Termination of Contract;
- Working Time and Rest Time;
- Working hours;
- Paid Leave;
- Maternity Leave and Maternity Protection;
- Other Leave Entitlements;
- Minimum Age and Protection of Young Workers;
- Equality
- Pay Issues;
- Workers' Representation in the Enterprise;
- Trade Union and Employers Association Regulation; and
- Other Laws.

3.4.11 Sindh Bonded Labor (Abolition) Act 2015

The Act is gender sensitive; an anti-discrimination clause is added to each new proposed Law in accordance with ILO requirement viz: “No discrimination shall be made on the basis of sex, religion, political affiliation, sect, color, caste, creed, ethnic background in considering and disposing of issues relating to the enforcement of this Act”. In all proposed Laws the cognizance has been changed from that of the Judicial Magistrate to the Presiding Officer Labor Courts who is a Session Judge.

Bonded labor will not be allowed or utilized for the project.

3.4.12 The Sindh Minimum Wages Act, 2015

To provide the regulation of minimum rates of wages and various allowances for different categories of workers employed in certain industrial and commercial undertakings and establishments.

This Act will be applicable to the Project to ensure that the minimum wages and allowances should be given to the Project labor (skill and unskilled employed for the construction of the proposed Project.

3.4.13 Sindh Prohibition of Child Employment Act, 2017

Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines, or any other hazardous employment. In accordance with this Article, the Prohibition of Child Employment Act (PCEA) 2017 disallow child labor in Sindh. The PCEA defines a child as a person who has not completed his/her fourteenth years of age, and an adolescent means a person who has completed fourteenth year of age but has not completed eighteenth years of his age. No child shall be employed or permitted to work in any establishment including construction, but an adolescent can be employed or permitted to work under strict guidelines provided in the PCEA and rules. An adolescent shall not be employed in any hazardous work included in the schedule to the PCEA.

Not allow any child labor in during the project.

3.4.14 Special Technology Zone Authority Ordinance, 2020

The ordinance establishes Special Technology Zones Authority, which will primarily be responsible for planning, policy formulation, execution, operations, monitoring and evaluation of zones and have the power to grant license to zone developers and zone enterprises for carrying out activities related to zones. Functions of authority include identify, create and upgrade technological and

scientific clusters and industrial support systems within zones including, but not limited to, inter-alia, research and development centers, skill development centers, training institutes, data centers, universities, hospitals, and other hard and soft infrastructure related to successful execution of zones.

3.4.15 Pakistan Environmental Assessment Procedures, 1997

The Pakistan Environmental Protection Agency prepared the Pakistan Environmental Assessment Procedures in 1997. They are based on much of the existing work done by international donor agencies and Non-Governmental Organizations (NGOs). The package of regulations prepared by PEPA includes:

Policy and Procedures for Filing, Review and Approval of Environmental Assessments;
Guidelines for the Preparation and Review of Environmental Reports;
Guidelines for Public Consultation
Guidelines for Sensitive and Critical Areas; and
Sectorial Guidelines

3.5 International Conventions and Guidelines

3.5.1 IUCN Red List

The Red List is published by IUCN and includes those species that are under potential threat of extinction. These species have been categorized as:

Extinct (EX): Species in which the last individual has died or where systematic and time-appropriate surveys have been unable to log even a single individual

Extinct in the Wild (EW): Species whose members survive only in captivity or as artificially supported populations far outside their historical geographic range

Critically Endangered (CR): Species that possess an extremely high risk of extinction as a result of rapid population declines of 80 to more than 90 percent over the previous 10 years (or three generations), a current population size of fewer than 50 individuals, or other factors (such as severely fragmented populations, long generation times, or isolated habitats)

Endangered (EN): Species that possess a very high risk of extinction as a result of rapid population declines of 50 to more than 70 percent over the previous 10 years (or three generations), a current population size of fewer than 250 individuals, or other factors

Vulnerable (VU): Species that possess a very high risk of extinction as a result of rapid population declines of 30 to more than 50 percent over the previous 10 years (or three generations), a current population size of fewer than 1,000 individuals, or other factors

Near Threatened (NT): Species that are close to becoming threatened or may meet the criteria for threatened status in the near future

Least Concern (LC): A category containing species that are pervasive and abundant after careful assessment

Data Deficient (DD): A condition applied to species in which the amount of available data related to its risk of extinction is lacking in some way. Consequently, a complete assessment cannot be performed. Thus, unlike the other categories in this list, this category does not describe the conservation status of a species.

Not Evaluated (NE): A category used to include any of the nearly 1.9 million species described by science but not yet assessed by the IUCN.

3.5.2 The Convention of Conservation of Migratory Species of Wild Animals, 1979

The Convention on the Conservation of Migratory Species of Wild Animals (CMS), 1979, requires countries to take action to avoid endangering migratory species. The term "migratory species" refer to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. These parties are also required to promote or co-operate with other countries in matters of research on migratory species.

The Convention contains two appendices. Appendix I contain the list of migratory species that are endangered according to the best scientific evidence available. For these species, the member states to the Convention are required endeavor to:

- Conserve and restore their habitats.
- Prohibit their hunting, fishing, and capturing, harassing and deliberate killing.
- Remove obstacles and minimize activities that seriously hinder their migration.
- Control other factors that might endanger them, including control of introduced exotic species.

3.5.3 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.

3.5.4 IFC – Performance Standards

As part of this policy, it was agreed that all agreed advisory activities, all advice, and training will be consistent with the IFC's Performance Standards (PS), which consist of the following:

1. Performance Standard 1 – Assessment and Management of Environmental and Social Risks and Impacts
2. Performance Standard 2 – Labor and Working Conditions

3. Performance Standard 3 – Resource Efficiency and Pollution Prevention
4. Performance Standard 4 – Community Health, Safety, and Security
5. Performance Standard 5 – Land Acquisition and Involuntary Resettlement
6. Performance Standard 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources
7. Performance Standard 7 – Indigenous Peoples
8. Performance Standard 8 – Cultural Heritage

These Performance Standards help IFC advisory and investment clients manage and improve their environmental and social performance through a risk and outcomes-based approach. The desired outcomes are described in the objectives of each Performance Standard, followed by specific requirements to help clients achieve these outcomes through means that are appropriate to the nature and scale of the activity and commensurate with the level of environmental and social risks and/or impacts.

As part of their involvement in any potential activity, IFC conducts an environmental and social due diligence in line with these Performance Standards. IFC weighs the costs and benefits of the proposed business activities and articulates its rationale and specific conditions for the proposed activity, where IFC only funds activities that are expected to meet the requirements of the Performance Standards within a reasonable period of time.

3.5.5 Applicability of IFC's Environmental and Social Performance Standards

Table 3.1 - Applicability of IFC's Performance Standards

Performance Standard (PS)	Applicable	Not Applicable	Remarks
PS 1 Assessment and Management of Environmental and Social Risks and Impacts	✓		The proposed ESIA has taken into consideration various environmental and social risks that could arise during different stages of projects and corresponding mitigation measures have been given to minimize or eliminate them.
PS 2 Labor and Working Conditions	✓		The proposed project and its entailing activities will result in short- & long-term employment. Measures for labor protection against potential hazards during the course of project construction have been described in the report and shall be enforced by project proponent.
PS 3 Resource Efficiency and Pollution Prevention	✓		Best practice of energy efficiency will be adopted in the building design. The project is targeting the LEED Gold certification.
PS 4 Community Health, Safety, and Security	✓		Communities in the project area have been consulted during the course of the ESIA study. Measures to alleviate possible negative impacts of project to the communities have been aptly described in the report.

PS 5 Land Acquisition and Involuntary Resettlement		x	The land has been acquired by the proponent. No resettlement is envisaged from the project activities.
PS 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources	✓		The mangrove forest area is located just outside the western boundary of the project in Gizri Creek. However, it will not be impacted. Nevertheless, appropriate mitigation measures are required.
PS 7 Indigenous Peoples		x	No known indigenous or other vulnerable people exist at and in proximity of project site.
PS 8 Cultural Heritage		x	No cultural / religious heritage sites have been reported near the project site.

3.6 Comparison of International and Local Environmental Quality Standards

The IFC-E&S Policies requires application of pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards. The E&S principle states that when host country regulations differ from these standards, the EA will achieve whichever is more stringent.

In order to select the most stringent standards applicable, a mix of local (SEQS) and international (IFC) regulations have been selected. The IFC EHS Guidelines, General EHS Guidelines: Environmental, Noise Management has noise level guidelines for daytime and night time, which are applicable. Considering the overall lower baseline noise levels in the Project Area, it shall be ensured that the any increase in noise levels is minimized as far as possible. Also, Project related noise levels in the Project Area are not allowed to increase the existing levels by 3dB or more. Furthermore, it shall be ensured that all necessary noise mitigation measures are implemented to minimize the noise levels in the Project Area.

A comparison of applicable local and international guidelines for ambient air quality has been provided in Table below. In the case of most pollutants, the SEQS standards for ambient air quality are more stringent in comparison to WHO/IFC standards. The most stringent parameters for each respective pollutant are highlighted in green. However, the comparison will be made with both IFC/WHO and SEQS standards.

Table 3.2 - Comparison of International & Local Ambient Air Quality Standards

Sr. No.	Pollutants	WHO/IFC		SEQS	
		Avg. Time	Standard	Avg. Time	Standard
1	SO2	24 hr. 10 min	20 ug/m3 500 ug/m3	Annual Mean 24 hrs.	80 ug/m3 120 ug/m3
2	CO	-	-	8 hrs. 1 hr.	5 mg/m3 10 mg/m3

3	NO2	1 yr. 1 hr.	40 ug/m3 200 ug/m3	Annual Mean 24 hrs.	40 ug/m3 80 ug/m3
4	O3	8 hrs.	100 ug/m3	1 hr.	130 ug/m3
5	TSP	-	-	Annual Mean 24 hrs.	360 ug/m3 500 ug/m3
6	PM10	1 yr. 24 hr.	20 ug/m3 50 ug/m3	Annual Mean 24 hrs.	120 ug/m3 150 ug/m3
7	PM2.5	1 yr. 24 hr.	10 ug/m3 25 ug/m3	Annual Mean 24 hrs.	15 ug/m3 35 ug/m3
* In instances where the airshed is significantly degraded and the pollutant levels are already exceeding the ambient pollutant concentrations provided in the table above, it shall be ensured that the Project activities cause as small an increase in pollution levels as feasible, and amounts to a fraction of the applicable short term and annual average air quality guidelines or standards as established in the Project specific environmental assessment.					

Similar to the standards for air quality, the comparison of noise standards provided in Table below clearly shows that SEQS standards for noise are more stringent in comparison to the IFC standards. The only exception is the daytime noise level standard for Industrial areas where the IFC standard is more stringent i.e., 70 dB(A) in comparison to SEQS i.e. 75 dB(A). However, the comparison will be made with both IFC/WHO and SEQS standards.

Table 3.3 - Comparison of Local & International Noise Standards

Sr. No.	Category of Area/Zone	Limit in dB(A) Leq			
		SEQS		WHO/IFC	
		Day Time 06:00 – 22:00	Night Time 22:00-06:00	Day Time 07:00 – 22:00	Night Time 22:00-07:00
1	Residential area (A)	55	45	55	45
2	Commercial area (B)	65	55	70	70
3	Industrial area (C)	75	65	70	70
4	Silence zone (D)	50	45	55	45
* In instances where baseline noise levels are already exceeding the standards above, it will need to be ensured that the Project activities do not cause an increment of more than 3 dB(A) from the baseline noise levels.					

A comparison of water quality standards provided in Table 3.4 and Table 3.5 clearly shows the SEQS standards for drinking water quality as compared to WHO standards.

Table 3.4 - Comparison of Local & International Drinking Water Standards

Sr. No.	Parameter	Units	SEQS	WHO Standards
1	Temperature (During Sample Collection)	OC	NS	NS
2	Color	Pt-Co	≤15TCU	<15TCU
3	pH	pH unit	6.5-8.5	6.5-8.5
4	Turbidity	NTU	<5	<5
5	Total, Hardness	mg/L	<500.00	NS
6	Total Dissolved Solid (TDS)	mg/L	<1000.00	<1000.00
7	Total Suspended Solid (TSS)	mg/L	NS	NS
8	Ammonia	mg/L	NS	NS
9	Fluoride F-	mg/L	<1.50	1.50
10	Sulfate (SO4-2)	mg/L	NS	NS
11	Chloride (Cl-)	mg/L	<250.00	250
12	Nitrate (NO3)-	mg/L	<50.00	50.00
13	Odor	-	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable
14	Taste	-	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable
15	Sodium	mg/L	NS	NS
16	Iodine	ppm	NS	NS
17	Arsenic (As)	mg/L	< 0.05	0.01
18	Iron (Fe 3+)	mg/L	NS	NS
19	Zinc (Zn 2+)	mg/L	5.0	3.0
20	Conductivity	µS/cm	NS	NS
21	Bicarbonate	mg/L	NS	NS
22	Nitrite	mg/L	<3	3
23	Magnesium	mg/L	NS	NS
24	Calcium as Ca	mg/L	NS	NS
25	Phosphate	mg/L	NS	NS
26	Potassium	mg/L	NS	NS
27	Boron	mg/L	<0.3	0.3
28	SAR Iodine (I)	mg/L	NS	NS
29	Aluminum	mg/L	< 0.2	0.2
30	Antimony	mg/L	<0.005	0.02
31	Cadmium	mg/L	0.01	0.003
32	Mercury	mg/L	<0.001	0.001
33	Nickel	mg/L	<0.02	0.02
34	Selenium	mg/L	0.01	0.01
35	Barium	mg/L	0.7	0.7
36	Total Chromium	mg/L	<0.05	0.05
37	Copper	mg/L	2	2
38	Lead	mg/L	<0.05	0.01
39	Cyanide (CN)	mg/L	<0.05	0.07
	Manganese	mg/L	<0.5	0.5
40	Total Coliforms	cfu/100ml	0/100 ml	0/100 ml
41	Fecal Coli forms (E. Coli)	cfu/ml	0/100 ml	0/100 ml

NS = Not Specified
* The standards highlighted in green for each respective pollutant are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed Project. However, the comparison will be made with both WHO and SEQS standards.

Table 3.5 - Comparison of Surface Water Standards

Sr. No.	Parameter	Units	SEQS	WHO Class V (Agriculture)	FAO Standards
1	Temperature	OC	--	--	--
2	pH	pH unit	6-9	<5.3	6.0-8.5
3	COD	mg/L	150	>30	--
4	(BOD5)	mg/L	80	--	--
5	Solids, Total dissolved (TDS)	mg/L	3500	--	0-2000
6	Solids, Total suspended (TSS)	mg/L	200	--	--
7	Chloride	mg/L	1000	--	0-1065
8	Fluoride (F-)	mg/L	10	--	--
9	Oil & grease	mg/L	10	--	--
10	Phenols, Total (Phenolic Compounds)	mg/L	0.10	--	--
11	Cyanide(CN-)	mg/L	01.00	--	--
12	Anionic Detergents as MBAS	mg/L	20.00	--	--
13	Sulfate (SO4-2)	mg/L	600	--	0-960
14	Sulfide (S)	mg/L	01.00	--	--
15	Ammonia NH3	mg/L	40.00	--	--
16	Cadmium (Cd)	mg/L	0.10	>0.0039 mg/L	--
17	Chromium (Cr) as Hexavalent & Trivalent	mg/L	1.00	>0.016 mg/L	--
18	Copper (Cu)	mg/L	1.00	>0.018 mg/L	--
19	Lead	mg/L	0.50	>0.082 mg/L	--
20	Nickel	mg/L	1.00	>1.4 mg/L	--
21	Zinc	mg/L	5.00	>0.12 mg/L	--
22	Iron	mg/L	8.00	--	--
23	Manganese	mg/L	1.50	--	--
24	Selenium	mg/L	0.50	--	--
25	Silver	mg/L	1.00	--	--
26	Arsenic	mg/L	1.00	>0.36 mg/L	--
27	Barium	mg/L	1.50	--	--
28	Magnesium	mg/L	--	--	0-61
29	Nitrate	mg/L	--	--	0-10
30	Sodium	mg/L	--	--	0-920
31	Boron	mg/L	6.00	--	0-2
32	Mercury	mg/L	0.01	>0.0024 mg/L	--
33	Chlorine	mg/L	01.00	--	--
34	Total Toxic Metals	mg/L	02.00	--	--
35	Turbidity	NTU	NS	--	--
36	Oxygen, Dissolved	mg/L	NS	--	--

37	Pesticides	µg/L	NS	--	--
38	Nutrients as Potassium	mg/L	--	--	0-2
39	Nutrients as Nitrogen	mg/L	--	--	--
40	Nutrients as Phosphorous	mg/L	--	--	--
41	Total Coliform	MPN/100ml	--	--	--
42	Fecal Coliform	MPN/100ml	--	--	--
NS = Not Specified * The standards highlighted in green for each respective pollutant are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed Project. However, the comparison will be made with both WHO and SEQS standards.					

As per the above comparisons, the SEQS are more stringent than international standards for most of the environmental parameters. Nevertheless, in the assessment that will be conducted, the individual more stringent standard for each parameter shall be utilized as the standard for environmental compliance, where each of these have been highlighted in green in the above tables.

4 ENVIRONMENTAL & SOCIAL BASELINE

This section details the physical and ecological environmental conditions of the microenvironment and macro environment of the project area. Discussion on the natural environment covers the physical areas including geology, climate conditions, water resources and air quality. Overview of vegetation and natural habitats are included in the ecological section.

The project located in Korangi Creek Cantonment, Karachi at the extreme southern end along Gizri Creek. In macroenvironment, Korangi Creek Industrial Park (KCIP) is located in the north of the project site and Pakistan refinery in the east. The project borders the Gizri Creek at its southwestern boundaries.

View of Project site

View of the Creek

Camels Found Nearby Grazing

Figure 4.1 - Views of the Project Site

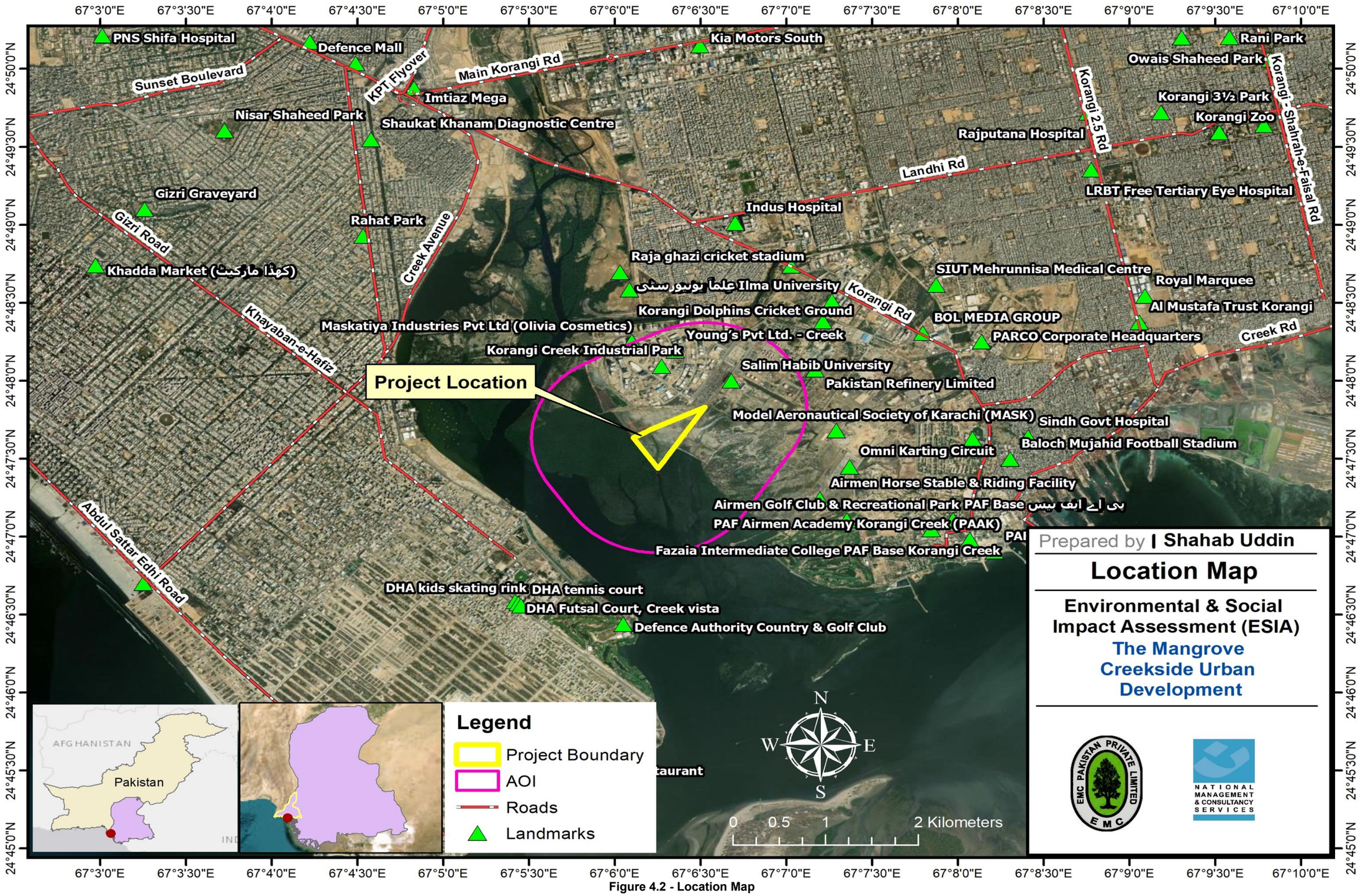


Figure 4.2 - Location Map

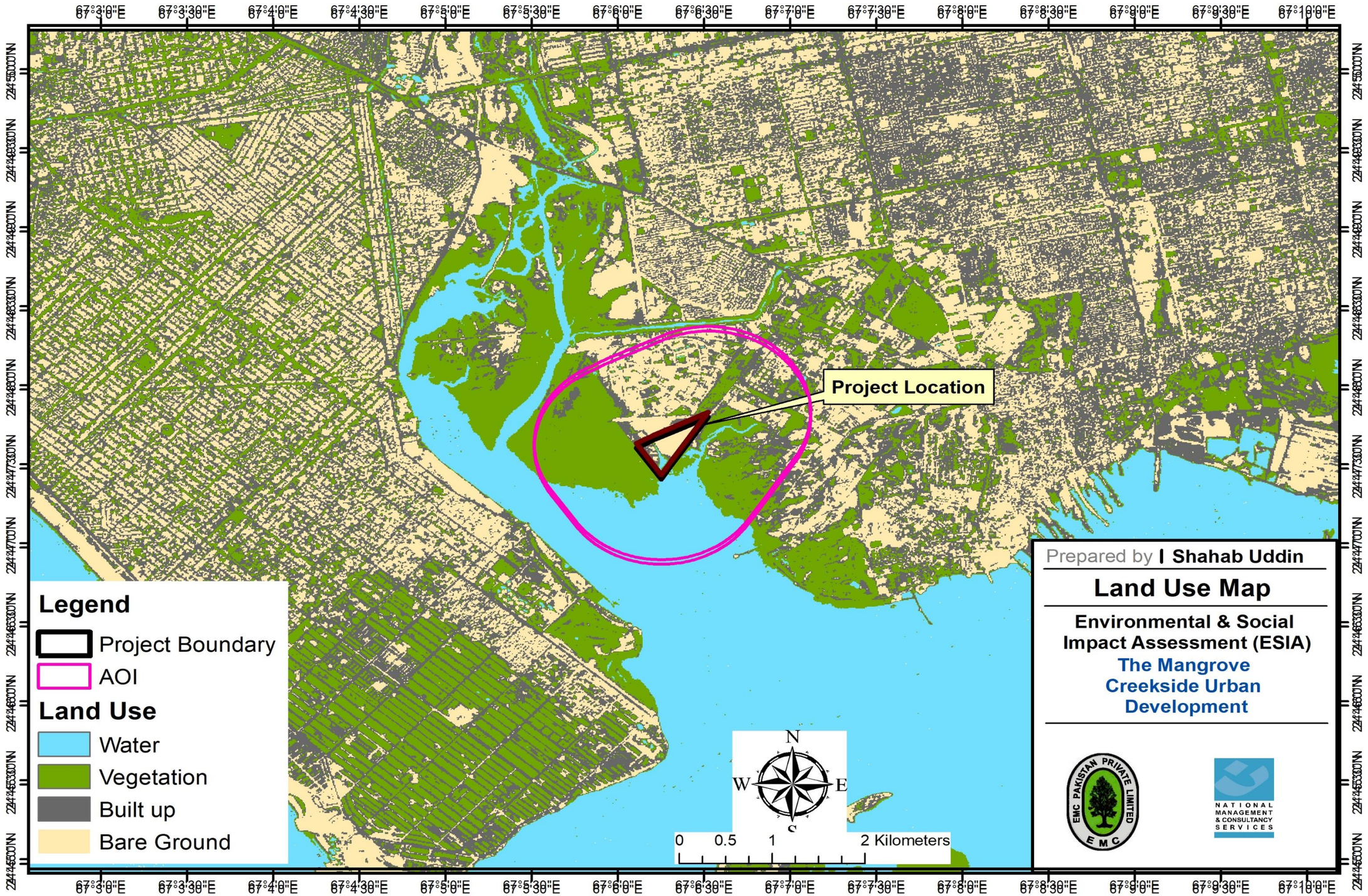


Figure 4.3 - Land Use Map

Figure 4.4 - Macroenvironment of Project Site

4.1 Physical Environment

4.1.1 Geography and Geomorphology

The project site is located at 24° 47.618'N and 67° 6.274'E along the Gizri Creek at its southwestern boundary, within the environs of Korangi Creek Cantonment surrounded by a vacant plot at north, KCIP, Pakistan Refinery and other industrial units.

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 Project is located in the coastal zone of Karachi in the south. The zone makes thin fringe in the south and south west of the Karachi region. A cross section from the east to west includes the following area: Rehri, Ibrahim Haidri, Gizri, Clifton, Kemari, Mauripur, Sandspit, Hawks Bay and Cape Monze3. The main landscape features of variable magnitude are tidal mudflats, mangrove forests, sand bars, estuary, tidal inlets, abrasion platforms, sand mounds, etc.

4.1.2 Geology, Soil and Sediments

Karachi and adjoining areas have plains, hills, rivers, valleys and coasts as diversified physical features. Rocks ranging in age from Eocene to recent, deposited under shallow marine to deltaic conditions are exposed. Karachi is a part of major synclinorium stretching from Ranpathani River in the east to Cape Monze in the west. Mehar and Mol mountains lie in the north. Within the synclinorium a number of structures such as Pipri, Gulistan-e-Jauhar, PirMangho and Cape Monze are exposed. The presence of concealed structures under the Malir River Valley, Gadap and Mauripur plains can fairly be deduced.

The geology of Karachi consists of sedimentary rocks having two ranges known as Kirthar range and Pub range. The soil of Karachi city is classified into two types, the loamy sandy and gravelly soils of river valleys and alluvial cones near the coast line and shallow loamy gravelly soils and rock outcrops plateau.

The ten boreholes were drilled at the project site using the rotary wash boring method. Clay and sand were encountered up to the maximum explored depth of 30m. Tricone and clay bits were used to drill the 4-inch borehole.

The subsurface deposits up to the explored depth consist of the following units:

Silty fine to medium grained sand
Silty Clay

Following sub-sections describe the strength characteristics of these geological units along with the groundwater conditions at the site.

1. **Silty Fine Sand**

These soil deposits are found from a depth of 0-18 meters below the existing ground level at the locations of the boreholes, except boreholes 5, 6, 7 and 9. The sand deposits vary from medium dense to very dense state of compactness. Direct shear tests conducted on the remolded samples indicate high shearing resistance varying from 25 degrees to 38 degrees.

2. **Silty Clay**

The silty clay layer is encountered at two different depth horizons in all the boreholes. In BH 1 hard silty clay was found from 25-30 m below the existing ground level. In boreholes 5, 6, 7 and 9 silty clays have been encountered from existing ground level to about 3m below existing ground level. The clay encountered in the boreholes can be classified as soft to stiff, based on the SPT data. The clay can be classified in the “CLML” group of Unified Classification System.

[3] Hamid, G., Mallick, K. A., Bilal, M., Azma, I., & Zohra, S. Z. I. R. (2012). Geomorphology of Karachi with a brief note on its vegetation. *International Journal of Biology and Biotechnology (Pakistan)*.

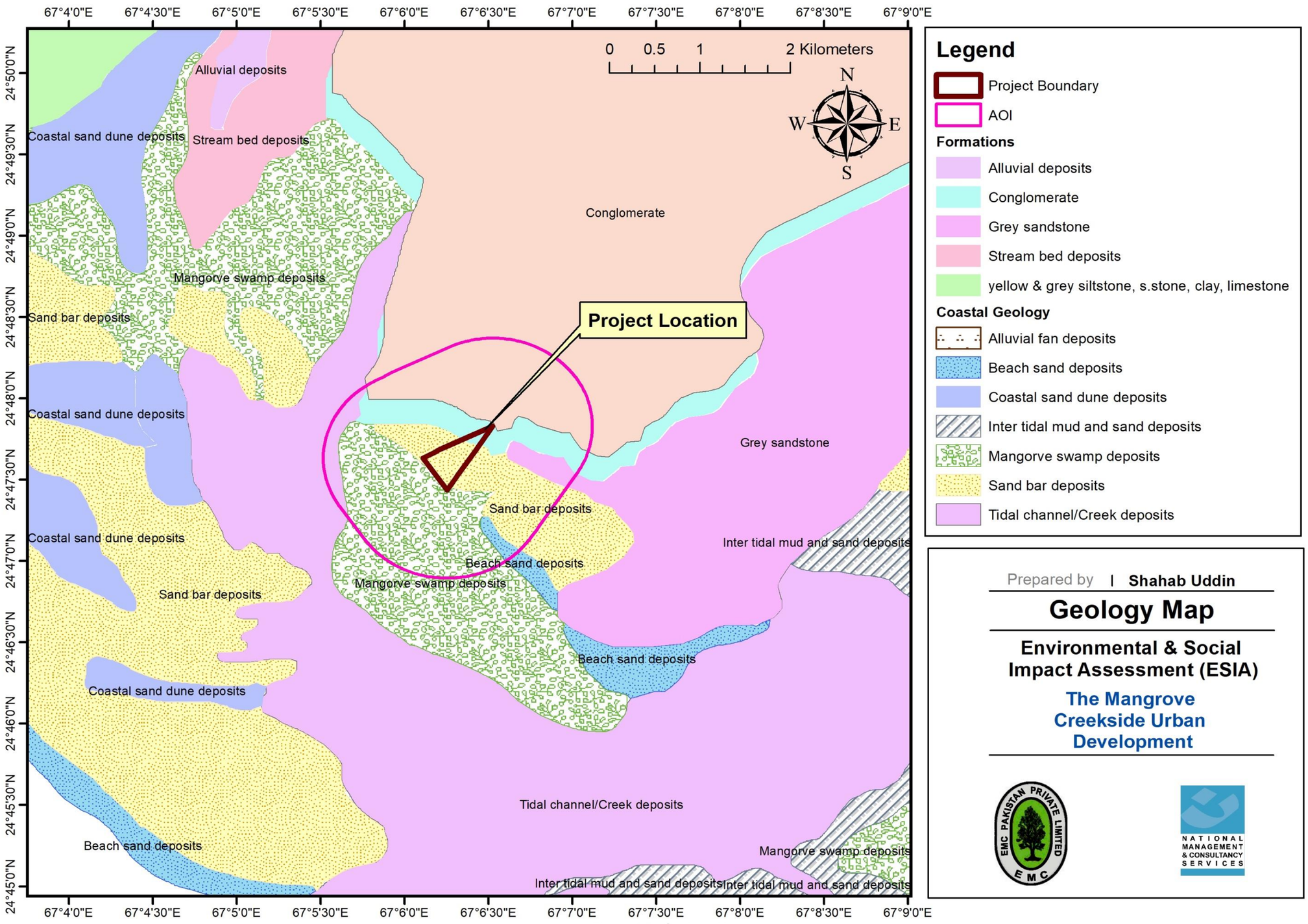


Figure 4.5 - Geology Map

The soil in the near Gizri and Korangi Creek is rich in salts including sodium chloride, sodium carbonate and nitrates with some calcium, which comes from shell fragments. Generally, the thickness of soils increases in the south-east direction. The maximum thickness of soils developed on alluvial deposits and dissected plateau are noted in some areas including Korangi Creek. The subsurface rocks in project area comprise Gaj Formation of Miocene age. The trend of subsurface rocks is north-east and south-west orientations. The columnar section up to the depth of 500 ft revealed that the rocks are mainly composed of silty sand with subordinate clayey layers. The sand is highly conductive and transmissive. The lower units are comprised of limestone which is fossiliferous in nature[4].

4.1.3 Coastal Sediments

The coastal areas of Karachi get sand supplements from both the ocean and the land sources. Ocean currents can move sediments form the open oceanic area along the coast to build beaches. Unrestricted movement of dry silt/fine sand dunes on the coast and other landward sand deposits provide sand to coastal areas and beaches in response to the forces of wind and waves. Coastal lands may experience long-term erosion under some conditions. For instance, if sea level is rising, the beach must eventually migrate landward or drown. This causes coastal land behind the beach to erode. Also, if the supply of sand from the landward or seaward side is reduced, the beach will erode the land behind it to maintain a constant sediment supply. This creates a condition called coastal erosion. High energy waves during the SW Monsoon period of June July and August will cause the beach to change its shape (or profile). This is due to the fact that the additional wave energy has to be absorbed, the beaches and dunes will give-up sand to the waves which carry it seaward and drop it on the bottom. This raises the seafloor and flattens the overall profile of the beach. Waves then shoal and break further offshore, minimizing their erosive effects.

4.1.4 Sediment Accumulation

The accumulation rate in Gizri creek sediment core varied in the range of 0.14–2.13 kg/m^2 per year (mean accumulation rate 0.84 kg/m^2 per year) with increasing trend from bottom to top. Accumulation rate is generally higher in uppers layer as compared to bottom. The bottom sediments appeared to be deposited in 1890[5].

The type of soil at the project site is lithosol. The soil map of the macroenvironment of the project site is presented below.

[4] Khan, A., & EghbalBakhtiari, A. (2017). Groundwater assessment of coastal aquifers in Karachi: impact of seawater intrusion. *Int J Ground Sediment Water*, *6*, 248.

[5] Chaudhary, M. Z., Khan, K., Ahmad, N., Mashiatullah, A., Javed, T., Yaqoob, N., ... & Abid, J. (2021). Sediment accumulation rates in Karachi coastal area Pakistan using 210 Pb dating method. *Journal of Radioanalytical and Nuclear Chemistry*, *327*(1), 13-20. https://doi.org/10.1007/s10967-020-07519-5

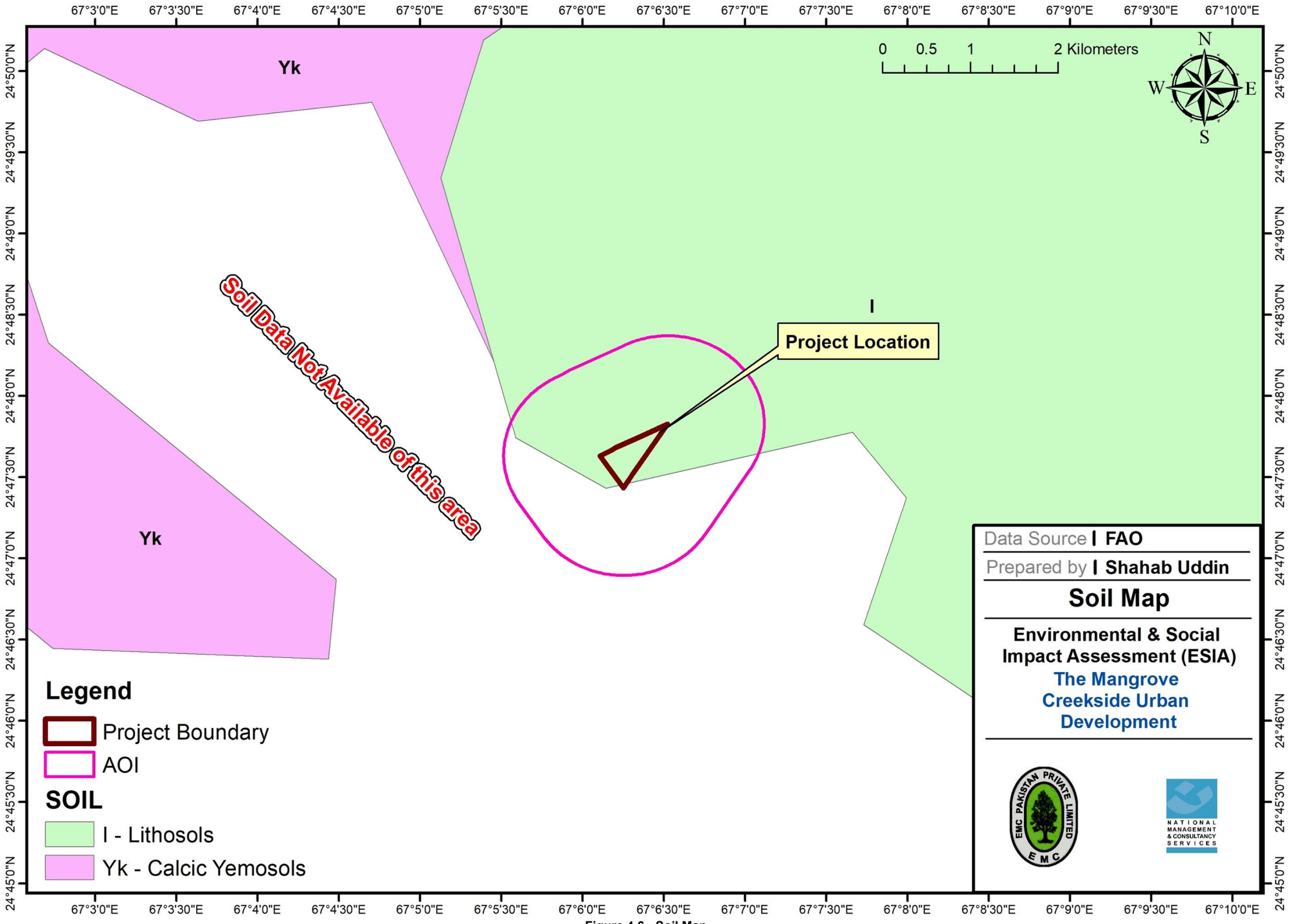


Figure 4.6 - Soil Map

4.1.5 Topography

Karachi is built on coastal plains with scattered rocky outcroppings, hills and coastal marshlands. Coastal mangrove forests grow in the brackish waters around the Karachi Harbour, and further southeast towards the expansive Indus River Delta. The sand is very fine and quite different from the sand found at Manora. A significant accretion takes place at the Clifton beaches. This coastline has for the period of last 100 years been reported to advance at an average rate of 30 Ft/year. The sediments consist of very fine silt with varying contents of coarser mica flakes. The coast east of Clifton Beach is sandy and extends up to Gizri Creek where the Malir River carrying the industrial effluents from the Landhi Industrial Area and Korangi Industrial Area, mixed with untreated urban wastewater, drains into the sea.

The plains and hills of the coastal belt: The southern stretch of the district follows the coastal strip of Korangi and Gharo creeks, demarcating the northern side of the old Indus delta. An area to south of the east-west base line of triangular outline of Karachi division subsided and was covered by the sea, making a shallow basin. In course of time the deltaic deposits of the Indus filled up this shallow basin, whereas the up-throw part to the north of the fault line made a coastal edge. Figure below illustrates the topographic profile of the Project area. Detailed Topographic report of the project site is presented in annexures.

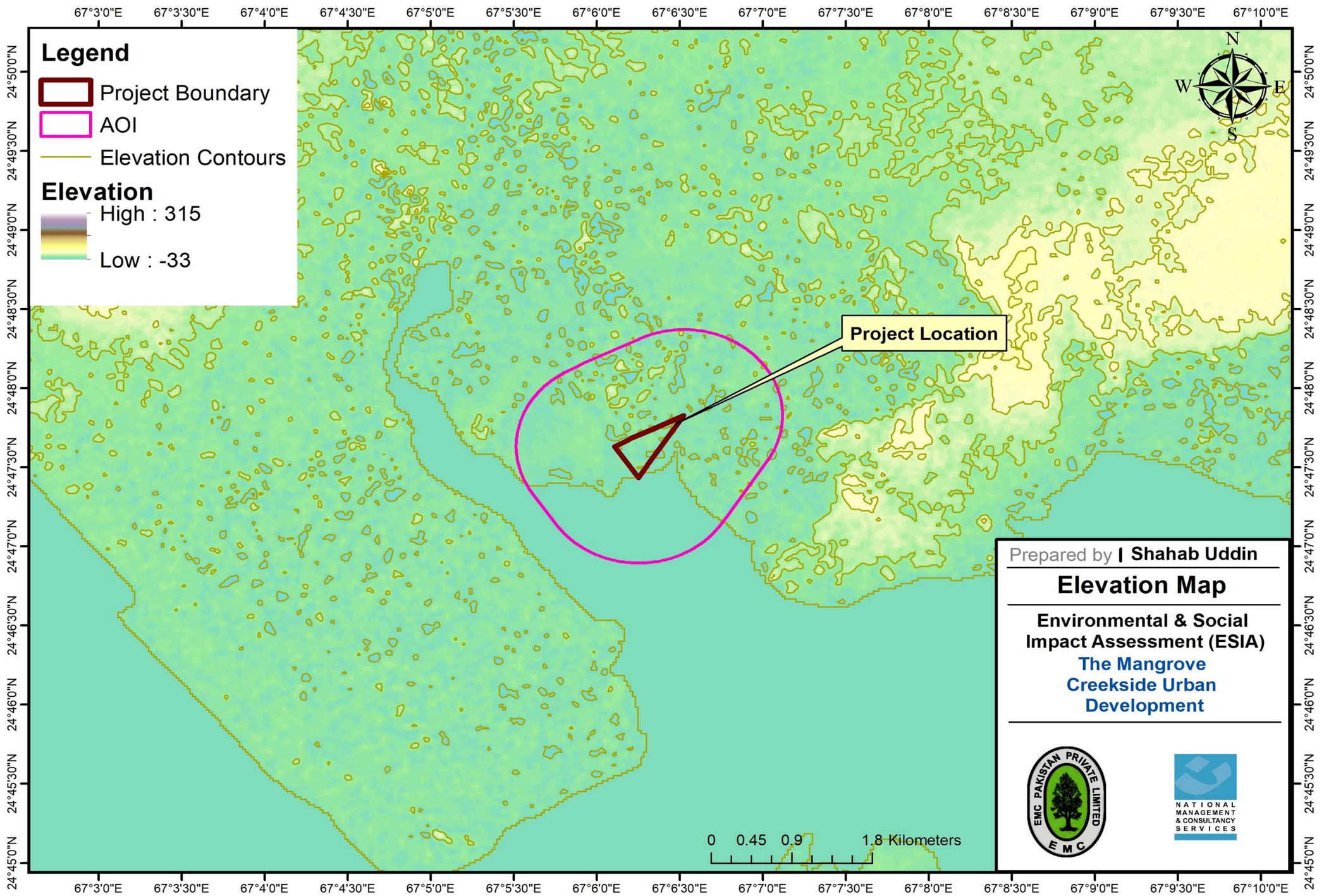


Figure 4.7 - Topographical Map

The topographical survey of the project site was undertaken by project consultant. The topographic map created is presented below showing the plot is flat surface with 30-35% of the area is water logged due to the proximity of creek. The site is protected by field bunds to avoid flooding. The topographic map shows that the southwestern bund of the project site is bounded by mangrove trees.

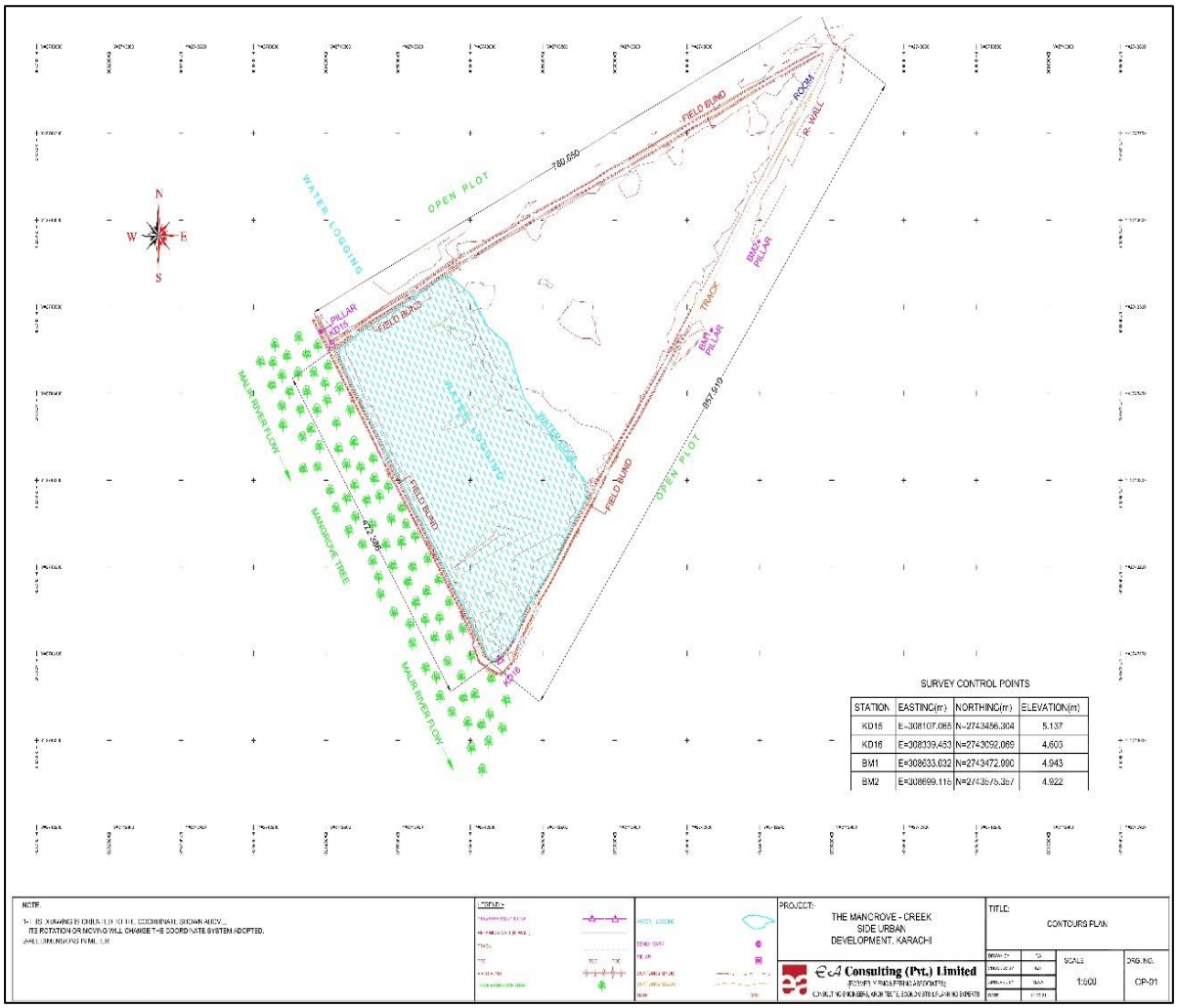


Figure 4.8 - Topography of Project Area

4.1.6 Seismicity

Seismotectonic Study for macroenvironment 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. 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:

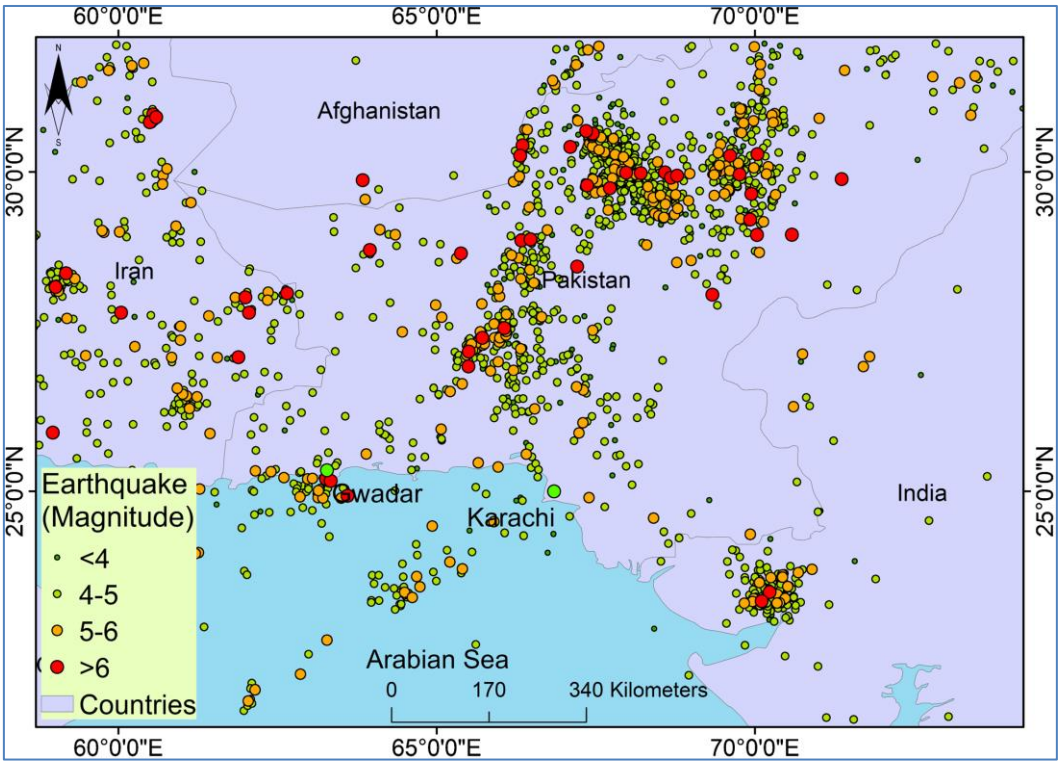


Figure 4.9: Earthquake recorded (1950–2019) in the Arabian Sea and its surroundings[6]

4.1.7 Liquefaction Features Caused by Earthquake

Liquefaction is a total loss of strength due to undrained restructuring. Disturbance, by shearing or vibration, destroys soil skeleton, with loss of grain contact and decrease of porosity, soil load is transferred to pore water, water pressure>normal stress=0, and soil acts as a liquid. Drainage reduces pore water pressure, allows grain contact and thixotropic recovery of strength[7]. Strong shaking produces liquefaction in the fine sands and silts during the earthquake. This causes the mineral grains to settle and expel their interstitial water to the surface. If the pore-water pressure rises to a level approaching the weight of overlying soil, the granular layer behaves as a viscous liquid rather than a solid and leads to collapse of even engineered structures. Liquefaction has been abundant in areas, where groundwater lies within 10 meters of the ground surface[8]. Investigators typically have designated sites as "Liquefied" on the basis of the presence of surficial liquefaction features, such as venting of sediment to the surface (i.e., sand boils), ground cracking associated with liquefaction (e.g., lateral spreading), or surface settlements. Other evidence of liquefaction includes tilting or settling of overlying structures and floating of underground structures[9]. A study investigated the "sinking" of a water tower in 2006 near Clifton area and speculated about liquefaction due to mild earthquakes[10].

[6] 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.
[7] Waltham, T. (2009). *Foundations of engineering geology*. CRC Press.
[8] Hussain, V., Sheikh, S. A., Tabrez, A. R., & Anjum, S. (2004). Liquefaction effects of Bhuj earthquake on Thar, Indus delta region of Sindh, Pakistan. *Segmite International*, *1*(1), 39-42.
[9] Olson, S. M., & Stark, T. D. (2002). Liquefied strength ratio from liquefaction flow failure case histories. *Canadian Geotechnical Journal*, *39*(3), 629-647.
[10] Mahmud, S. A., & Sheikh, S. A. (2008). Earthquake Shocks and Liquefaction Threat to Dha and Clifton areas, Karachi Pakistan. A Case Study. In *Geotechnical Engineering for Disaster Mitigation and Rehabilitation* (pp. 398-405). Springer, Berlin, Heidelberg.

4.1.8 Climate

The climate of the macroenvironment can be characterized by dry, hot and humid conditions and in general terms it is moderate, sunny and humid. Climatic conditions of the whole region are influenced in summer by the monsoon winds from the West and in winter by winds from North (Quetta). There is a minor seasonal intervention of a mild winter from mid-December to mid-February followed by a long hot and humid summer extending from April to September, with monsoon rains from July to mid- September. The average annual rainfall is about 160 mm, of which 70% to 80% falls during the monsoon months of July, August and September. The annual maximum rainfall varies from 2.5 mm to 487 mm. The maximum rainfall recorded in one day is 205 mm in July 2009 and maximum annual rainfall is 487 mm in 1994. The summer temperatures are high, rising to over 46°C on some days. The winters are mild, although the night temperatures are quite low (up to 1.3°C) when the northern winds invade the area. The mean sea level (MSL) average atmospheric pressure during June to August is around 1000 mbar. From Nov to Feb average MSL pressure rises up to 1018 mbar. The relative humidity ranges from about 90% in the morning during May-September to 24% in the evening during December-January.

4.1.8.1 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 Air Port represents climatic conditions for the region. The mean monthly maximum and minimum temperatures, recorded during 2001-2022 in Karachi to describe the weather conditions are shown in Table 4.1 and 4.2 respectively.

Table 4.1 - Mean Monthly Maximum Temperature 'C

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
2022	24.6	30.1	35.2	37.4	36.8	35.7	33.3	32.1	33.7	35.7	32.9	29.6	33.1
Source: Pakistan Meteorological Department													

Table 4.2 - Mean Monthly Minimum Temperature 'C

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

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
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
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
2022	12.8	15.9	21.6	25.5	28.1	28.6	27.4	27.1	26.8	22.7	19.3	13.2	22.4
Source: Pakistan Meteorological Department													

4.1.8.2 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. The average rainfall is 217 mm and most of it is received in the month of July.
Occasional winter rains are also received in the months of December –February as result of NE winds which count 15-25% of total rainfall.

Table 4.3 - Average Monthly Precipitation (mm) at Karachi Airport

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	0.0	0.0	0.0	0.0	0.0	10.6	73.6	16.2	N/A	0.0	0.0	0.0	33.46
2002	0.0	2.4	0.0	0.0	0.0	N/A	N/A	52.2	N/A	0.0	0.5	0.4	13.87
2003	6.4	21.8	0.0	0.0	0.0	16.3	270.4	9.8	N/A	0.0	0.2	0.0	54.15
2004	13.7	0.0	0.0	0.0	0.0	N/A	3.0	5.6	N/A	39.3	0.0	4.3	13.18
2005	6.6	12.8	N/A	0.0	0.0	N/A	N/A	0.3	54.9	0.0	0.0	17.1	18.34
2006	N/A	0.0	N/A	0.0	0.0	0.0	66.2	148.6	21.9	0.0	3.1	61.3	60.22
2007	0.0	13.2	33.4	0.0	0.0	110.2	N/A	N/A	N/A	N/A	N/A	N/A	52.26
2008	8.0	Trace	1.1	0.0	0.0	0.0	54.0	37.5	Trace	0.0	0.0	21.0	24.32
2009	3.0	Trace	0.0	Trace	0.0	2.6	159.9	44.0	68.9	0.0	0.0	1.5	55.68
2012	0.2	0.0	0.0	0.0	0.0	Trace	Trace	8.1	121.0	0.0	0.0	22.8	152.1
2013	Trace	20.0	2.8	30.0	0.0	Trace	5.5	105.4	4.0	1.2	0.0	0.0	168.9
2014	Trace	0.0	12.4	0.0	1.3	Trace	1.1	9.9	1.4	0.0	4.6	0.0	30.7
2015	0.3	2.1	2.8	0.0	0.0	Trace	46.6	1.4	Trace	0.0	0.0	0.0	53.2
2016	3.1	0.0	Trace	0.0	0.0	65.8	1.9	96.9	Trace	0.0	0.0	0.0	167.7
2017	41.5	Trace	0.0	0.0	0.0	58.8	33.3	65.6	26.4	0.0	0.0	6.6	232.2
2018	Trace	Trace	0.0	0.0	0.0	Trace	Trace	0.8	Trace	0.0	0.0	Trace	0.8
2019	39.4	Trace	2.2	0.0	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	0.0	16.9	167.8
2022	28.5	0.4	0	0	0	21.6	348.3	127.9	43.4	0	2.6	0	572.7
Source: Pakistan Meteorological Department													

The record for rainfall of PMD at Karachi Airport (2001-2022) suggests that July and August are the wettest months and that the maximum rainfall recorded in Karachi during 2001-2022 period was 270.4 mm during the month of July 2003, while the maximum annual rainfall was 372.9 mm during the year 2010, followed by 474.2 mm in 2020.

The probability that precipitation will occur has been found to vary from different days of July and August at Karachi throughout the 1992-2012 period. Precipitation most likely occurs around August 4, in 35% of all days. Precipitation is least likely around April 27, occurring in 2% of all days.

Thunderstorms are the most severe type of precipitation observed during days was 38% precipitation. They are most likely around August 12, when it is observed during 12% of all days. Drizzle is the most severe precipitation observed during 34% of those days with precipitation. It is most likely around July 30, when it is observed during 14% of all days. Moderate rain is the most severe precipitation observed during 22% of those days with precipitation. It is most likely around July 28, when it is observed during 8% of all days. When precipitation does occur, it is most often in the form of thunderstorms (40% of days with precipitation have at worst thunderstorms) and cloud burst, drizzle (36%), moderate rain (19%), and light rain (5%).[11]

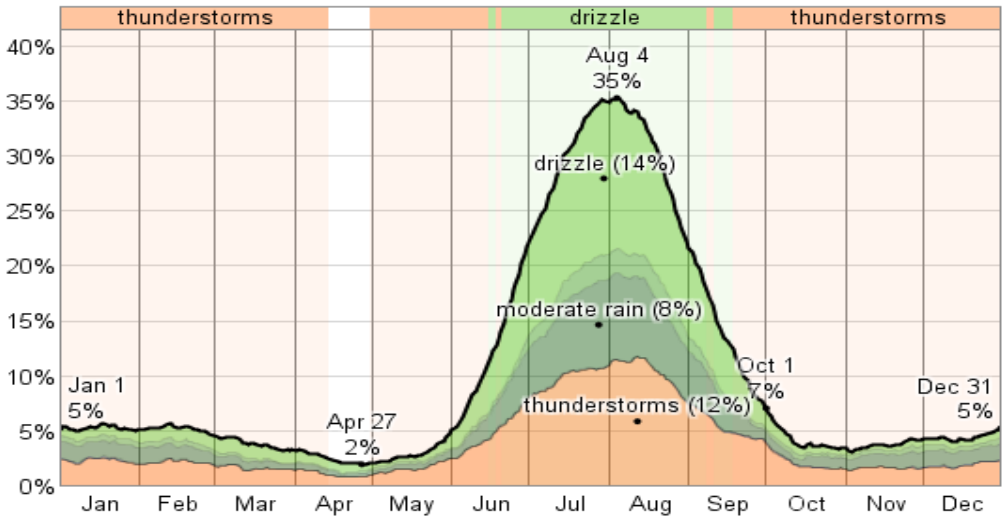


Figure 4.10 - Fraction of days on which different types of precipitation is observed

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 were 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.

[11] *Average Weather for Karachi (https://weatherspark.com/averages/32864/Karachi-Sindh-Pakistan).*

4.1.8.3 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 4.4 - 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
2022	40.5	39.1	37.7	47.1	55.3	62.1	74.7	79.1	66.3	42.0	49.4	36.5	52.5
Source: Pakistan Meteorological Department													

4.1.8.4 Wind Speed and 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.

Table 4.5 - 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
2022	6.8	7.9	8.9	9.9	12.5	12.5	9.5	7.0	8.8	7.0	6.1	4.8	8.5
Source: Pakistan Meteorological Department													

Table 4.6 - 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	S39W	S39W	S46W	S51W	S50W	S45W	S45W	S48W	S46W	S46W	S42W	S18W
2019	S24W	S65W	S45W	S44W	S42W	S37W	S48W	S46W	S53W	S35W	N59E	N55E
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
2022	N45E	S54W	S57W	S59W	S57W	S56W	S62W	S59W	S60W	S48W	S32W	S32W
Source: Pakistan Meteorological Department												

4.1.8.5 Urban Heat Island (UHI) Effect

The term "heat island" describes built environment that are hotter than nearby natural areas. An urban heat island refers to a city or metropolitan area that is significantly warmer than its surrounding natural areas due to human activities. The temperature difference usually is larger at night than during the day and is most apparent when winds are weak. UHI is most noticeable during the summer and winter seasons. It is estimated that the annual mean air temperature of a city with 1 million or above inhabitants can be 1–3°C warmer than its surroundings. In the evening, the difference can be as high as 12°C. The heat island can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality.

The city of Karachi has been growing exponentially in terms of urbanization and population growth. The city hosts more than 22 million population with a density of 4,115 persons per kilometer square (km2). The urban area density has increased from 233 km2 in 1947 with a population size of 0.4 million to 3,566 km2 in 2004 with a population size of 14 million (Qureshi et al., 2008). Rapid urbanization and global warming have initiated UHI effect over the city. A strong incidence of UHI is generally associated with a severe heat wave hazard in terms of sensible temperature. UHI effect is the unique feature of the June 2015 heat wave in Karachi. It is expected that with growing global warming incidence and poor coping strategies, UHI would become a major health risk for the vulnerable segment of population in mega-cities around the globe such as Karachi.

Causes of Urban Heat Island Effect: The principal reason for the night time warming is the retention of short-wave solar radiation absorbed during the day time by the building material consisting of concrete and asphalt. These materials are commonly used in urban areas for pavement and roofs that have significantly different thermal and radiative properties compared to the surrounding rural areas. This causes a change in the energy balance of the metropolitan area, often leading to higher temperatures than surrounding rural areas. This energy is then slowly released during the night as a long wave radiation, making cooling a slow process. Because of this phenomenon, the minimum temperatures of Karachi remained extremely high during the heat-wave event.

There are several causes of an urban heat island effect in Karachi.

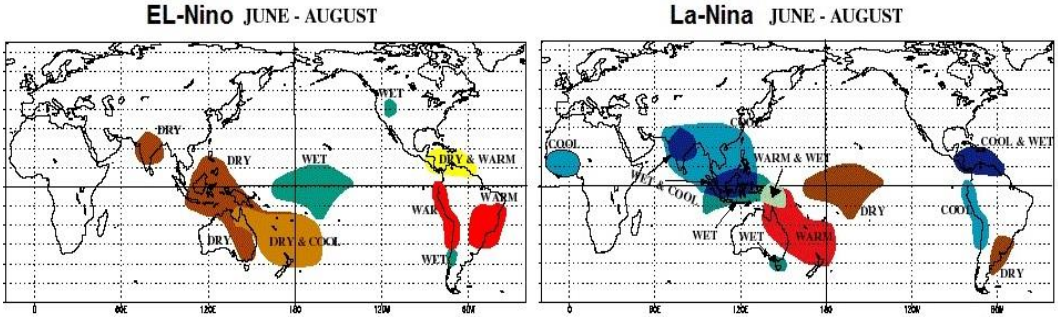
- Reduced and slow process of evapotranspiration due to shrinking green areas and spaces in the city. With a decreased amount of vegetation, the city loses the shade, cooling effect of trees and the removal of carbon dioxide.
- Geometric effects in terms of rising number of tall buildings are a significant contributing factor to urban heat island effect. Over the years, the number of tall buildings within the city has increased that provide multiple surfaces for the reflection and absorption of sunlight, and thus increasing the efficiency with which the city is heated. This is called the "urban canyon effect". Another effect of increased number of buildings is the blockage of wind, which also inhibits cooling by convection and pollution from dissipating.

- Waste heat from automobiles, air conditioning, industry, and other sources also contributes to the UHI. High levels of pollution in urban areas can also increase the UHI, as many forms of pollution change the radiative properties of the atmosphere.

Aside from the effect on temperature, UHI can produce secondary effects on local meteorology, including the altering of local wind patterns and humidity, which have been discussed in the previous section. The UHI effect described above has been one of the major causes of unprecedented large number of heats related deaths in Karachi. Future climate scenarios suggest that the frequency of this kind of disasters may increase with the rise of temperature in future.

4.1.8.6 Impact of Climate Change – Karachi

A UK-based climate change expert has warned that there will be an exceptional change in the temperatures in Pakistan as a whole in the coming years, but that the province of Sindh will be less affected as compared to the other provinces of the country. Karachi may however face the threat of rising sea levels by the year 2100, at about 8 feet below sea level. The UK-based climate change expert said that climate change could influence monsoon dynamics and cause summer precipitation levels to drop, as well delays in the start of the monsoon season. While another report said that the impact of climate change in Karachi will deepen by 2030. Due to global warming the coastline of Karachi is likely to be flooded due to rising sea levels. Many seminars and public gathering are held in the city to make the government and public fully aware of global warming, speakers at the seminar have urged the government to prepare long and short-term plans to reduce the impact of global warming on natural resources. Karachi also faces the threat from super cyclones which are said to increase their intensity and momentum in years to come.



List of cyclones that affected Karachi and the Sindh coast: Cyclones that form in the Arabian Sea do not usually hit Karachi or the Sindh coast, during 1902, 1907, 1944, 1964, 1985, 1999, 2007 and 2010, cyclones made landfall in the Sindh coast including Karachi. Other cyclones that are listed below caused rains as remnants.

- In May 1902, a cyclonic storm struck the coast in the vicinity of Karachi.
- In June 1907, a tropical storm struck the coast near Karachi.
- On 27 July 1944, a cyclone left some 10,000-people homeless in Karachi.
- On 12 June 1964, a deadly cyclone made landfall near Karachi.
- On 15 December 1965, a powerful cyclone slammed the city with 10,000 casualties.
- In May 1985, a cyclonic storm made a landfall in the eastern direction of Karachi. The cyclonic storm in 1985 which was moving towards Karachi actually had weakened over the sea while still a few 100 Kilometers away south of Karachi.
- In November 1993, a category 1 cyclone approached the Sindh-Gujarat border but dissipated due to high vertical shear over open waters.
- In June 1998, remnants of the category 3 Gujarati cyclone (the 5th strongest cyclone of the Arabian Sea) killed 12 people near and in the city.

- In May 1999, again a category 3 major cyclone (the 4th strongest cyclone of Arabian Sea) hit near the city; this Cyclone killed 700 people in Sindh including Karachi. It is the strongest cyclone recorded in Pakistan.
- In May 2001, the powerful category 3 cyclone (the 3rd strongest cyclone of the Arabian Sea) hit the Indian border of Gujarat. It caused rain along the Sindh coast, but no damage was reported.
- In October 2004, a severe cyclonic storm, Cyclone Onil, approached the Sindh coast but later recurred back to the sea; it caused heavy rain that killed 9 people in Karachi.
- In early June 2007, super cyclonic storm Gonu (the strongest cyclone in the Arabian Sea) caused strong gusty winds in the metropolis with light rainfall as the storm was moving towards Oman.
- In June 2007, a cyclonic storm, Cyclone Yemyin, passed near the city and killed 200 people before moving towards Baluchistan where it killed 380 people.
- In November 2009, remnants of Cyclone Phyan caused gusty winds along the Sindh coast including Karachi. However, six Pakistani fishermen were trapped in the storm later rescued by the Indian Navy.
- In June 2010, Cyclone Phet (the 2nd strongest cyclone in the Arabian Sea), once a powerful category 4 cyclone, made landfall near the city as a weak tropical depression, with a total 14 casualties in and near the city.
- In November 2010, remnants of Cyclone Jal caused drizzle with dusty winds in Karachi while it caused light to moderate rainfall in southeastern Sindh.
- In November 2011, the outer bands of cyclone Keila brought drizzle to the city while moderate showers to the Makran coast.

List of Notable floods in Karachi: Most of the flooding in Karachi occurs due to the monsoon season. But due to the enhancement of the city's infrastructure flooding has been controlled. But still excessive and irregular rains can lead to major flooding in the metropolis. Following are some of the major floods in the city;

- On 7 August 1953, the city received its record-breaking 24-hour rainfall causing widespread flooding about 278.1 millimeters (10.95 in) rain was recorded.
- On 1 July 1977, Karachi received its third highest rainfall of 207 millimeters (8.1 in) in 24 hours, it caused massive flooding in the city and killed 248 people in the city.
- In 2003, massive flooding during monsoon season devastated the Sindh, two days of rainfall of 284.5 millimeters (11.20 in) created havoc in the city.
- In 2006, after two year of drought period heavy rainfall lashed the city during the monsoon season, but the city came to standstill on 17 August when widespread rainfall of 77 millimeters (3.0 in) created flood-like situation in the city killing 13 people and submerging roads, low-lying areas and underpasses with rainwater.
- In 2007, almost all the rains that occurred in this monsoon season brought flooding with it, During the month of June Cyclone Yemyin created havoc in the city from 21 June to 26 June 2007 110.2 millimeters (4.34 in) of heavy downpour was recorded which killed 228 Karachiites on 23 June, then from 9 August to 11 August a strong tropical depression brought massive flooding in the city with 191 millimeters (7.5 in) of rain killing 21 people and submerging low-lying areas and underpasses. While on 22 August a monsoon depression once again flooded the city with 80 millimeters (3.1 in) of rainfall killing 10 people.
- On 18 July 2009, there was severe flooding due to a tropical depression, in which city's second highest rainfall of 245 mm (9.6 in) occurred in just 4 hours, killing 20 and injuring 150 people. Another flooding event occurred on August 31, 2009 when a well-marked low pressure was present over Sindh, the rainfall was recorded to be around 147 mm (5.7 in).
- On September 13, 2011, life was crippled in the city due heavy rainfall that caused urban flooding in the city. The rainfall was recorded to be around 145 mm (5.7 in).

- In Aug & Sep 2019, life in the city was crippled due to multiple spells of heavy rain that caused urban flooding and loss of life and property.
- 9 Jul 2020, spells of heavy rain caused urban flooding in several areas of city, causing loss of life and property, mainly due to electrocution.
- The hours-long spell, which began before sunrise and continued till night, broke previous records of rainfall recorded in the city during August 2020. The Met department said that Karachi had received 345mm of rainfall so far in August, breaking the previous record of 298mm reported in August 1984.

List of droughts in Karachi: Drought-like conditions in the city are not common but if the Monsoon season fails to deliver rains, then drought emerges. Following is some of worst drought in Karachi city.

- The major drought in Karachi as well as for whole Pakistan was from 1996 till 2002, peaking from 1998 till 2001. While in 2002 drought conditions started to dissipate. The drought of 1998-2001 was considered worst in 50 years.
- In 2004, no rain occurred in the city as well as in Sindh province but during the month of October heavy downpour lashed different parts of Sindh due to Cyclone Onil.
- In 2005, the drought conditions continued, but a post-monsoon low pressure dumped heavy rains during 12 and 13 September.
- In 2009, drought conditions emerged during the summer season in suburban areas of Karachi, due to El Nino phenomenon and caused drought during the winter season but the monsoon rains of 2009 were above-normal.

List of dust storms in Karachi: Windstorms generally occur when a monsoon system or tropical storms is moving towards the city. However, dust storms sometimes occur in winter seasons due to Western Disturbance. Dust storms also occur before the onset of monsoon season, they are locally known as ‘Andhi’ in the country. Following is a list of windstorms as well as dust storms that occurred in the city, however windstorm generated by a tropical storm is not mentioned in this list.

- On September 1, 1926, A windstorm hit Karachi but not much is known about this storm.
- On May 31, 1986, A blinding dust storm hit the city for 15 minutes that toppled trees and advertising signs, overturned vehicles and tore down electrical wiring. It reduced visibility to near zero and blew down flimsy wood and bamboo shanties in Karachi, at least 11 persons were killed and more than 250 injured. The dust storm of 67 mph (108 km/h) occurred due to the interaction between the strong cold airflow and monsoon depression present over north-western Gujarat.
- On July 4, 1994, a windstorm generated by monsoon low pressure system killed 26 people in the city.
- On June 23, 2007, a massive dust storm hit the city followed by a heavy downpour, the interaction between a strong low-pressure system and the outer bands of Cyclone Yemyin which was still over western India as a tropical depression caused 69 mph (111 km/h) windstorm that uprooted billboards, trees, traffic signals and caused 200 deaths in the city due to the collapse of roofs of many houses in the port city.
- On February 22, 2008, a dust storm struck the city which reduced the visibility to merely 500 meters, the dust storm was due to the westerly winds that were coming from the desert regions of Baluchistan.
- On March 19, 2012, a mild dust storm hit the city that caused 65 km/h winds to blow in the city while the visibility dropped to just 200 meters.
- On May 19, 2012, a weak dust storm gripped the metropolis with highest wind of 72 km/h.
- At least 4 killed as gusts, dust storm battered Karachi on June 3, 2020.
- Loss of property reported as dust storm battered parts of Karachi on Jul 5, 2020.

4.1.8.7 Air and Noise Quality

Real-time ambient air quality assessment for 03 days was conducted at different locations of the project area. The purpose of the assessment was to develop the baseline conditions as well as to predict any negative impact of air emissions generated from nearby industrial facilities on the project site, especially from Pakistan Refinery Limited (PRL). The assessment mainly focused on the routine operations of the refinery especially the flaring activities undertaken by the Refinery and whether the emissions generated from these activities are reaching the project site and pollutes the project site air quality.

03 sampling points have been selected around the project site to monitoring ambient air quality using portable air quality instrument placed on the site for 08 hr on each sampling point. The sampling points are so selected that it will capture any air pollutants streams reaching the site from all directions. Night time sampling is also required to capture the refinery operations at night. HAZ Scanner EPAS Sr# 9118145 was used to monitor ambient air quality. The locations selected are shown in below map.

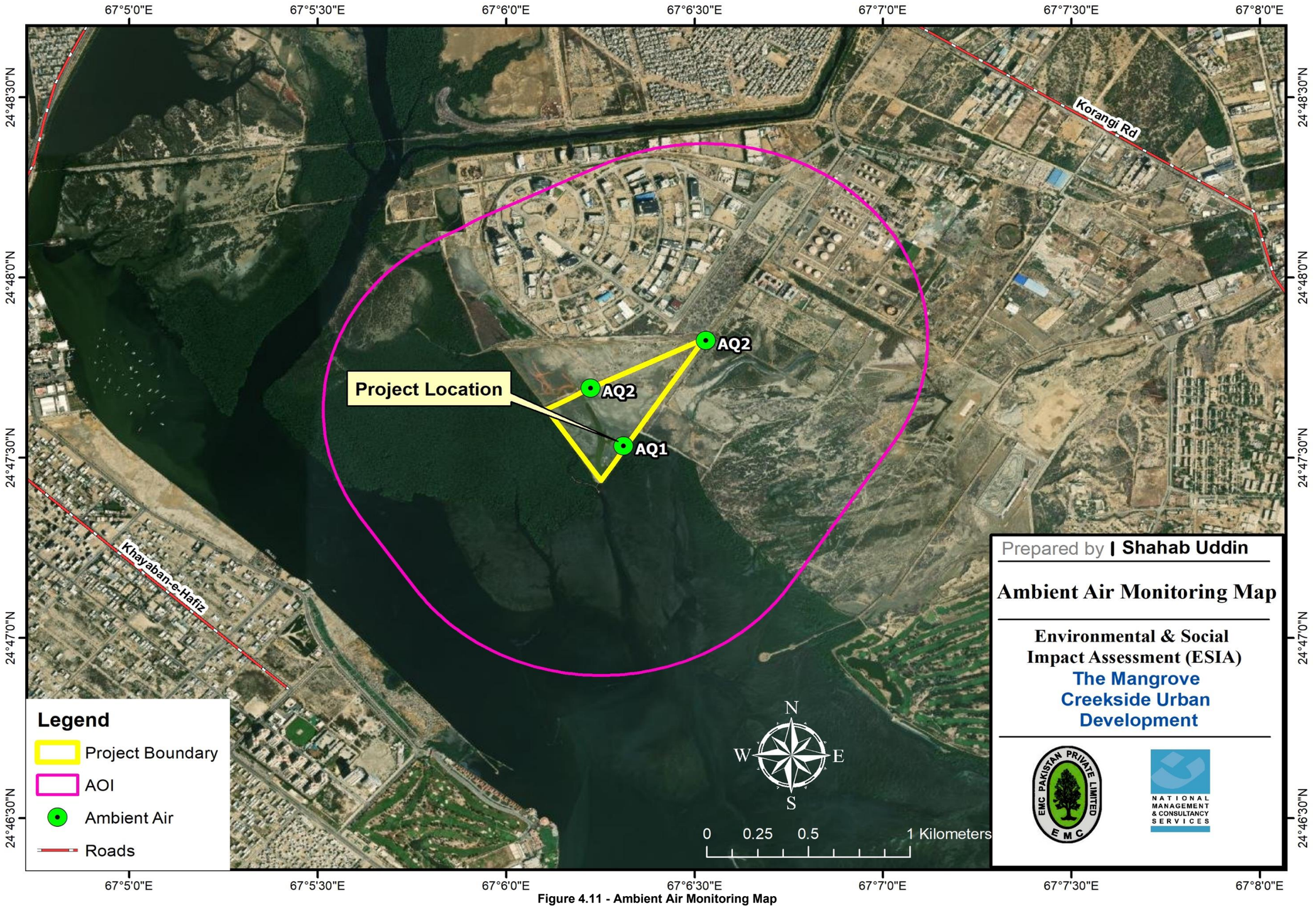


Figure 4.11 - Ambient Air Monitoring Map

Figure 4.12 - Pictures from Ambient Air Monitoring

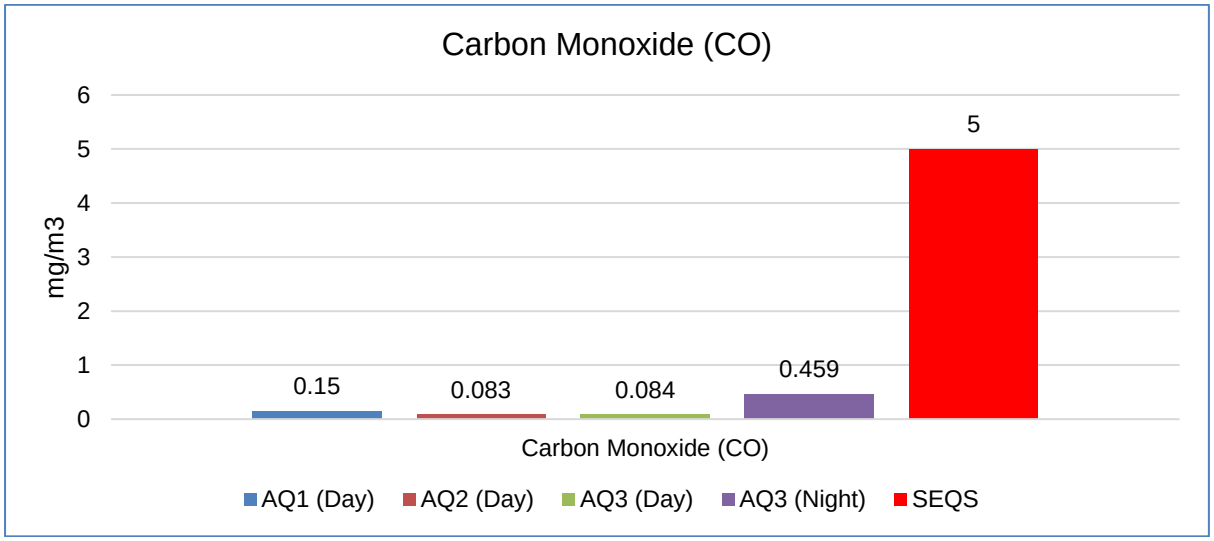
The results of air quality assessment are summarized in the below table. All the lab monitoring reports are attached as annex.

Table 4.7 - Ambient Air Quality Monitoring Results

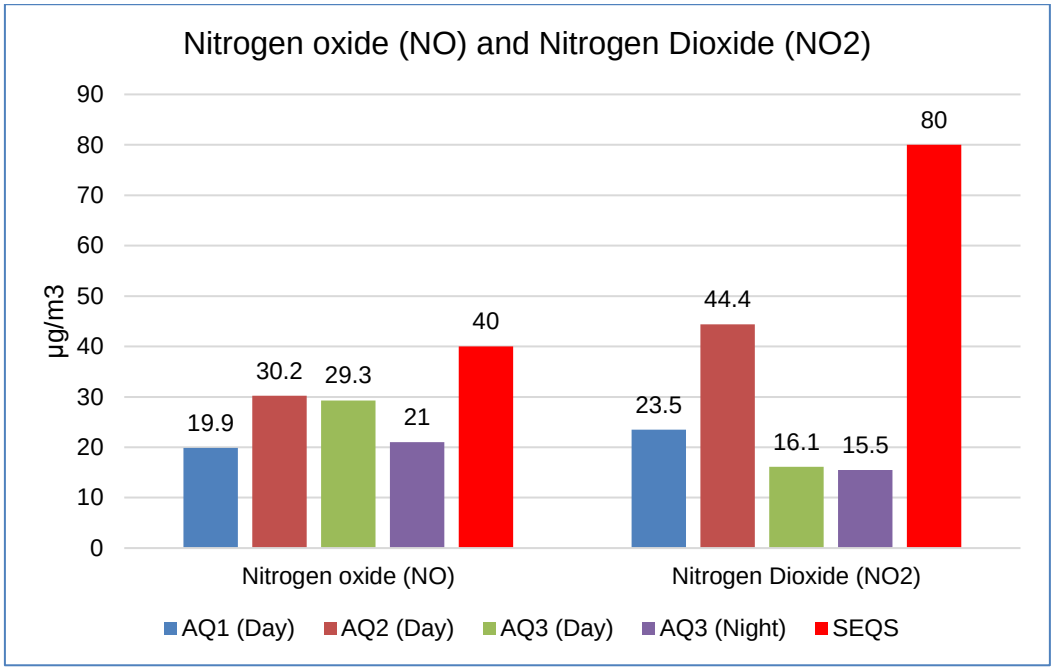
	CO (mg/m3)	NO (µg/m3)	NO2 (µg/m3)	SO2 (µg/m3)	PM10 (µg/m3)	PM 2.5 (µg/m3)	SPM (µg/m3)	Lead (µg/m3)
AQ1: 24°47'32.60"N, 67°06'19.07"E (Day - 08/02/2022)								
Min	0.00	05	18	28	23	04	102	**ND**
Max	0.26	35	33	51	112	51	182	
Avg	0.15	19.9	23.5	38.2	72.8	28.1	138.0	
SEQS	5	40	80	120	150	75	500	**1.5**
AQ2: 24°47'41.01"N, 67°06'12.47"E (Day - 09/02/2022)								
Min	0.01	15	14	31	46	28	106	**ND**

Max	0.13	46	73	62	59	41	176	
Avg	0.083	30.2	44.4	45.3	52.6	34.8	133.8	
SEQS	5	40	80	120	150	75	500	**1.5**
AQ3: 24°47'48.50"N, 67°06'29.61"E (Day - 11/02/2022)								
Min	0	5	11	26	28	12	96	
Max	0.18	44	22	43	69	38	134	**ND**
Avg	0.084	29.3	16.1	33.6	42.1	23.8	114.4	
SEQS	5	40	80	120	150	75	500	**1.5**
AQ3: 24°47'48.50"N, 67°06'29.61"E (Night - 11/02/2022)								
Min	0.09	12	12	18	44	21	106	
Max	1.09	31	19	31	131	42	194	**ND**
Avg	0.459	21.0	15.5	24.5	79.6	31.0	142.6	
SEQS	**5**	**40**	**80**	**120**	**150**	**75**	**500**	**1.5**

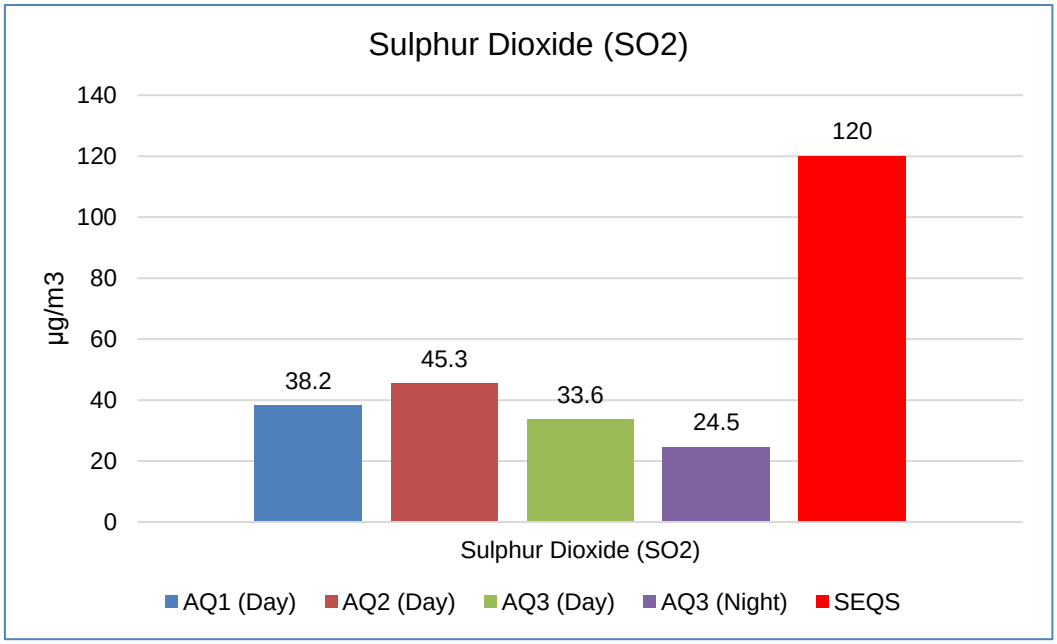
The results are graphically represented below to understand the variations in the samples and compliance with the standard.



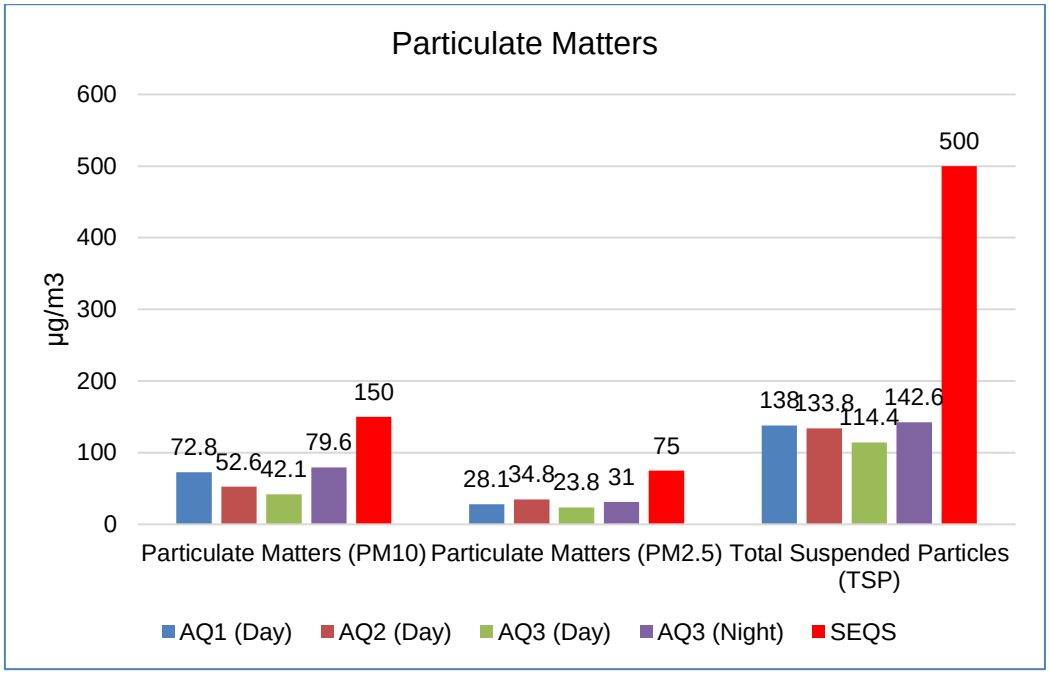
Carbon Monoxide (CO) results from incomplete combustion of fuel and mainly emitted from engines, generators and burning of wood and waste. It is also part of flare gas. The above graph shows that the concentration of CO in the ambient air at all 03 locations is well within the SEQS limits. The variation in concentration does not show any sign of probable source which can create the nuisance for the project site.



Nitric oxide (NO) and Nitrogen Dioxide (NO2) also resulted from combustion of fuel and mainly emitted from engines and generators. It is one of the main products of combustion. It is also part of flare gas. The above graph shows that the concentration of NO and NO2 in the ambient air at all 03 locations is well within the SEQS limits. The variation in concentration does not show any sign of probable source which can create the nuisance for the project site.



Nitric oxide (NO) and Nitrogen Dioxide (NO2) is resulted from combustion of fossil fuel containing sulfur, mainly diesel, furnace oil and coal, and it is mainly emitted from engines and generators running on diesel and furnace oil. It is also part of flare gas and flaring in the refinery is undertaken to convert H2S into SO2. The above graph shows that the concentration of SO2 in the ambient air at all 03 locations is well within the SEQS limits. The variation in concentration does not show any sign of probable source which can create the nuisance for the project site.



Particulate matter including PM10 and PM2.5 is mainly generated from construction activities and running or traffic on unpaved road. It is the indication of dust emissions. It is also generated from engines and vehicles. The above graph shows that the concentration of Particulate matter including PM10 and PM2.5 in the ambient air at all 03 locations is well within the SEQS limits. The variation in concentration does not show any sign of probable source which can create the nuisance for the project site.

The above results of all ambient air quality parameters show the general ambient air quality of Karachi under SW prevailing wind. As the project site is located along the coast, therefore, the dispersion of pollutants is so good that the pollutants disperse into the atmosphere easily. The results not only developed a baseline condition for the project's construction and operation activities but also concluded that there is no harmful effect prevailing on the project site from pollutants emitted from PRL and KCIP industries.

Secondary data (EMC 201812) collected from the ESIA reports of projects undertaken in the microenvironment authenticate the above results and the ambient air quality parameters analyzed near Masjid Ayesha and Bhittai Colony were well within the SEQS limits. The results are shown below for the comparison.

Table 4.8 - Ambient Air Quality Results near Masjid Ayesha, DHA

Date	Time	SO2 (µg/m3)	NO µg/m3)	NO2 (µg/m3)	CO mg/m3)	O3 (µg/m3)	SPM µg/m3)	PM 10 (µg/m3)	PM 2.5 (µg/m3)	Lead (µg/m3)
SEQS		120	40	80	5	130	500	150	75	1.5
03/10/18	10:00	41.2	26.8	31.2	1.95	66.3	321	123	59.8	0.157
03/10/18	11:00	41.9	27.2	31.8	1.76	66.9				
03/10/18	12:00	43.6	28.9	32.4	1.83	67.2				
03/10/18	13:00	42.9	27.7	33.6	2.10	68.7				
03/10/18	14:00	40.8	28.4	30.8	2.02	67.4				
03/10/18	15:00	43.1	28.6	33.2	2.09	67.8				

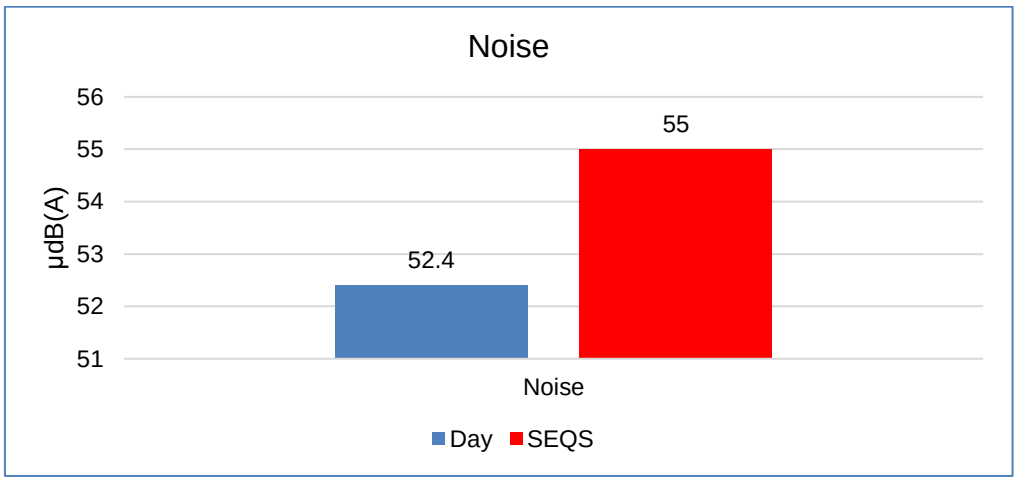
[12] Environmental and Social Impact Assessment (ESIA) Study of PSO Keamari Korangi Link Pipeline Project (KKLP-II) – EMC 2018 Archive

03/10/18	16:00	39.8	26.9	32.7	2.06	65.9				
03/10/18	17:00	42.7	25.7	30.9	1.87	68.2				
Legend: **ND: Not Detected**										

Table 4.9 - Ambient Air Quality Results near Bhittai Colony

Date	Time	SO2 (µg/m3)	NO (µg/m3)	NO2 (µg/m3)	CO (mg/m3)	O3 (µg/m3)	SPM (µg/m3)	PM 10 (µg/m3)	PM 2.5 (µg/m3)	Lead (µg/m3)
SEQS		120	40	80	5	130	500	150	75	1.5
03/10/18	10:00	23.7	20.1	18.6	0.92	48.2	362	118	44.7	0.149
03/10/18	11:00	24.8	21.6	19.2	0.98	49.1				
03/10/18	12:00	26.8	21.8	19.6	1.01	49.3				
03/10/18	13:00	25.9	19.8	18.2	1.08	48.9				
03/10/18	14:00	24.3	20.6	17.9	1.04	48.2				
03/10/18	15:00	26.7	20.4	19.0	1.06	47.9				
03/10/18	16:00	26.2	19.7	18.9	0.96	48.6				
03/10/18	17:00	25.7	21.3	18.4	1.05	49.2				
Legend: **ND: Not Detected**										

Similarly, Noise Quality Data has been obtained onsite by the EMC surveyors and the results with are summarized in the below graphs. The results show that noise levels at project site are within the SEQS limits for day-time residential area.



4.1.8.8 Road Network Infrastructure

Karachi district covers an area of 3,706.83 km2 and is served by a well-established network of major roads. The total road length in Karachi city is approximately 10,000 km. Local roads accounted for 93%, while the highways and arterial roads for less than 5%. There are three highways namely Super Highway (M-9), National Highway (N-5), and RCD highway (N-25), and six arterial roads: Korangi Road, Shahrah-e-Faisal Road, University Road, Shahrah-e-Pakistan Road, Chaudry Fazal Ellahi Road, and RCD Highway. Lyari Expressway was opened to traffic for north-to-south direction only.

The project site (40-acre plot) sits between the national industrial park to the north and a dense area of mangrove to the west. The larger portion of the site has access to views of the mangrove

and coastline. Apart from industrial zoned land surrounding the site, a university also lies to the north and is within walking distance to the site.

The significant number of vehicle ownership is observed among the employees of the industries, creating a substantial number of vehicular trips. Another important aspect of this project is the nearby universities, which attract significant traffic and cause congestion on the north side of the project.

The road network serving the project area includes Pakistan Refinery Road, Korangi Creek Industrial Park Road, Salim Habib University Road and Korangi Creek Road.

4.1.8.9 Traffic

The area under consideration in this study is located in Korangi Creek Industrial Area. The project area lies beside the sea front mangroves in Korangi Creek. The Korangi Creek has also planned several industrial and high-rise multi-land use schemes in the project vicinity. One of which is The Mangrove Creekside Development, Karachi, which would result in major trip generation / attraction from all across the city. The road closest to the project is Pakistan Refinery Road. The traffic of the project shall use the junctions on the Korangi Creek Industrial Park Road to access or egress the development. This road also gets traffic from all other areas of Korangi and therefore carries significant traffic at present. The land use around project vicinity is primarily industrial under development. However, there are couple of universities also located within the project vicinity.

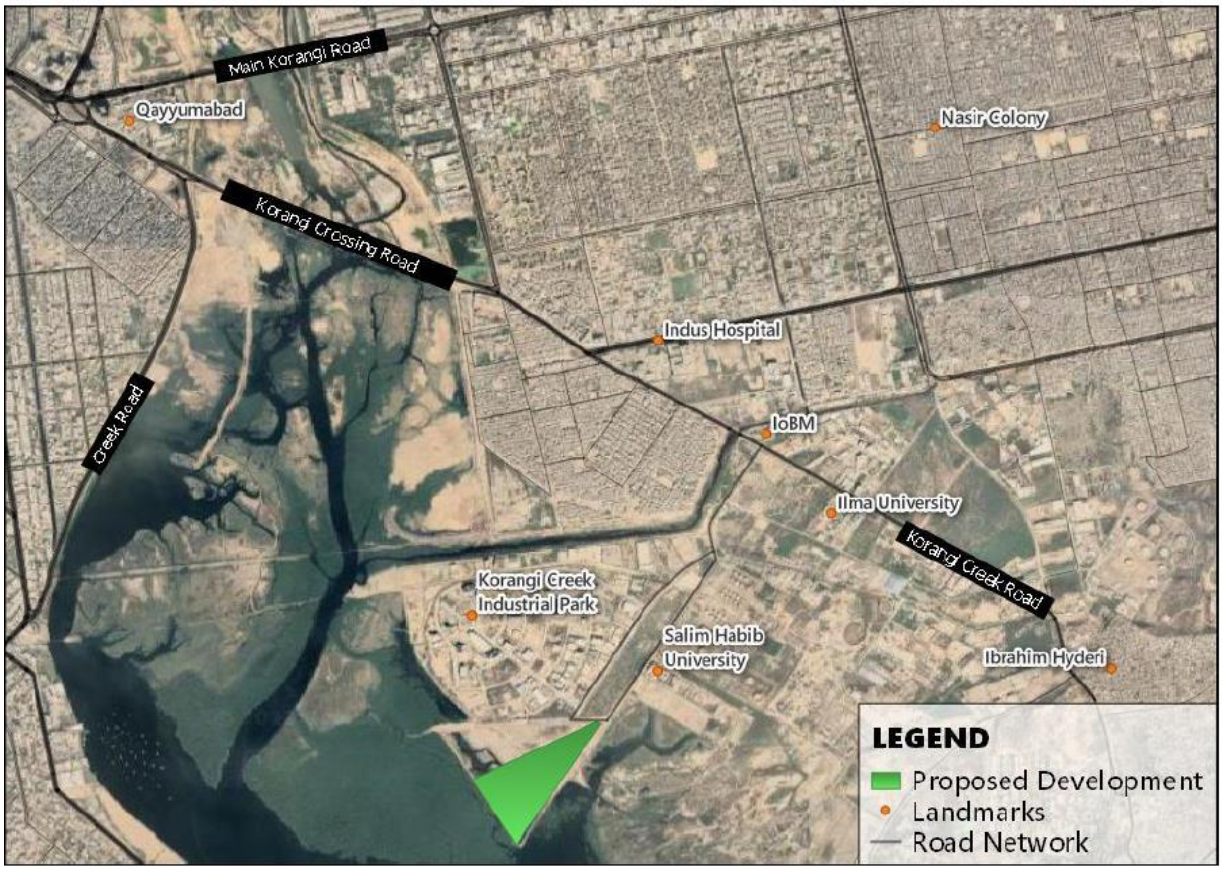


Figure 4.13 - Proposed Development & Nearby Landmarks

There are 4 major roads available in the project's vicinity:

- Pakistan Refinery Road
- Korangi Creek Industrial Park Road
- Salim Habib University Road
- Korangi Creek Road

The existing transportation mix is predominantly private cars with very small proportion of motorcycles. Since there are not many developments exist at present in the project vicinity, no major traffic circulation is recorded.

Existing Major Junction within the Study Area

a) Junction 1

This junction is a three-legged un-signalized junction. It is located between Korangi Creek Road and Pakistan Refinery Road. At this junction, turning movement counts would help to determine the traffic coming to and from the development from all directions.

Figure 4.14 - Existing Major Junctions within the Study Area

Figure 4.15 - Turning Movement Count Survey Data on Junction 1

Expected Junctions after the development of Project

Junctions 2,3 & 4 do not exist today but after the development of the project these junctions will play a vital role in entering and exit of project's traffic. These junctions will connect all three entrances of the project with the 100 feet wide external road.

Figure 4.16 - Expected Junctions Near Project

4.2 Hydrology of Microenvironment

4.2.1 Hydrogeology

Hydro-geologically, the city of Karachi lies in the Hub River Basin and the Malir River Basin. The Malir River Basin is drained by the Malir River and the Lyari River. The aquifer of Karachi is, therefore, mainly recharged by seepage from Hub River, Hub Dam as well as the Malir and the Lyari Rivers. The Malir and Lyari Rivers are mainly recharging alluvial aquifers of Quaternary age in the coastal parts of Karachi city[13].

4.2.2 Surface Hydrology

Malir River basin has total catchment area of about 1,850 square kilometer around southeastern boundary of Karachi. Malir River system consists of two major streams, Mol and Khaddeji, and three tributaries named Konkar, Thaddo and Sukkan. River flows southwards and westwards through Gizri Creek and discharges finally into the Arabian Sea. The central part of the river basin is made-up of sediment deposits comprising coarse conglomerate, sand stone, clay stone and limestone, whereas, the lower plain is composed of alluvial deposits. In the lower plain, the river is wider and shallower and gets braided. The river ultimately discharges into Arabian sea via Gizri Creek. The project site is adjacent to the creek and at the discharge basin of Malir River. Some

[13] Khan, A., & EghbalBakhtiari, A. (2017). Groundwater assessment of coastal aquifers in Karachi: impact of seawater intrusion. *Int J Ground Sediment Water*, *6*, 248.

part of the project site is inundated because the water seeps into the site from the creek despite of having field bunds.

4.2.3 Coastal Water Quality

The Gizri creek receives industrial and municipal effluents from the Malir river as well as from several industries and power stations. The highly degraded discharges from the Malir have negatively impacted the environment in this creek14. Based on physicochemical coastal water monitoring and assessment, a study15 revealed that oil slicks were observed in Gizri creek and Korangi creek area. The presence of these oil slicks may be attributed to fishing and shipping activities as well as effluents of Korangi Industrial Area discharged into Gizri Creek through a drain. The temperature of surface seawater of Karachi coastal waters was found to range between 27ºC-29ºC during July-October (post SW monsoon) and 19.8ºC-21ºC during November (early NE monsoon). Low salinity (28.286 ppt and 31.918 ppt) and pH (7.75) were observed at the top end at Gizri Creek during low tide where the polluted effluents are discharged and influence the seawater at the creek. At high tide, 36.5 ppt and 39 ppt of salinity have been recorded at Gizri creek. A very high concentration of suspended load was found at Gizri Creek Tip (177.6 ppm and 10 ppm). The particulate organic matter (POM) in the upper layers of the sea consists mainly of detritus and phytoplankton which constitute an extremely important part of the marine food chain. At Gizri Creek, 7.15 mg/l of POM was found. The survey along the creeks in eastern side of Karachi revealed that among the creeks Gizri creek was considerably affected by oily wastes mostly released from industrial wastes and Pakistan refinery effluents discharged through drains and Malir River and the concentration of total oil and grease in Gizri creek.

Moreover, biodegradation of waste under anaerobic conditions generate bed smelling compounds which creates odour nuisance. The sizeable addition of various chemicals in the creek of industrial and domestic origin and the waste oil from defective motor boats further aggravates the problem. The heavy pollution load has virtually converted this ecologically important creek in to a sewage drain. The insufficient water circulation accumulates toxic pollutants which jeopardize the marine ecosystems. The creek also undergoes a slow ongoing erosion and accretion process.

Water quality in the microenvironment (Surface Water- Gizri Creek) was conducted by EMC Study Team. The results of water quality monitoring are presented below:

Table 4.10 - Surface Water Quality of Gizri Creek

No.	Parameters	LDL	Units	Results	Test Method
1	pH value	0.01	-	8.1	USEPA 150.1
2	Biochemical Oxygen Demand (BOD)5 at 20°C	0.1	mg/L	991.4	Hach method
3	Chemical Oxygen Demand (COD)	1	mg/L	4957	Hach 8000
4	Total Suspended Solids (TSS)	1	mg/L	9	Hach 8006
5	Total Dissolved Solids (TDS)	1	mg/L	34400	Hach 8160
6	Oil & Grease	0.001	mg/L	1.2	APHA 5520-D
7	Cyanide (as CN-) total	0.001	mg/L	0	Hach 8027
8	Ammonia (NH3)	0.1	mg/L	10.1	Hach 10031
9	Lead (Total)	0.001	mg/L	0.001	ASTM-D3559
10	Mercury (Total)	0.001	mg/L	0.001	ASTM-D3223
11	Dissolved Oxygen (DO)	0.1	mg/L	3.8	Hach 10360

[14] https://aquadocs.org/handle/1834/33251
[15] Zaqoot, H. A., Khan, S. H., Ansari, A. K., & Qureshi, K. (2009). Assessment of water quality in the coastal environment of Karachi bordering northern Arabian Sea. *Journal of Flood Engineering*, *1*(1), 5-19.

12	Total Hardness (as CaCO3)	0.1	mg/L	9800	Hach 8213
Source: EMC Study Team					

The results of water quality monitoring of Surface Water at Gizri Creek show that pH in the water samples was found slightly alkaline (pH = 8.1) whereas the Dissolved Oxygen (DO) was only 3.8 mg/L. High Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) values were observed in the water samples at about 991.4 and 4,957 mg/L, respectively which represents the contamination of sewerage and industrial wastewater entering in the creek via Malir River. Total Dissolved Solids (TDS) were very high (34,400 mg/L) which is the representation of seawater. The concentration of Oil and Grease was 1.2 mg/L. Ammonia (NH3), and Total Hardness (as CaCO3) were also recorded having value 10.1 mg/L and 9,800 mg/L, respectively. The BOD and COD values of the creek water concludes that the water is significantly contaminated with sewerage and industrial effluent.

Figure 4.17 - Pictures of Surface Water Quality Sampling at Gizri Creek

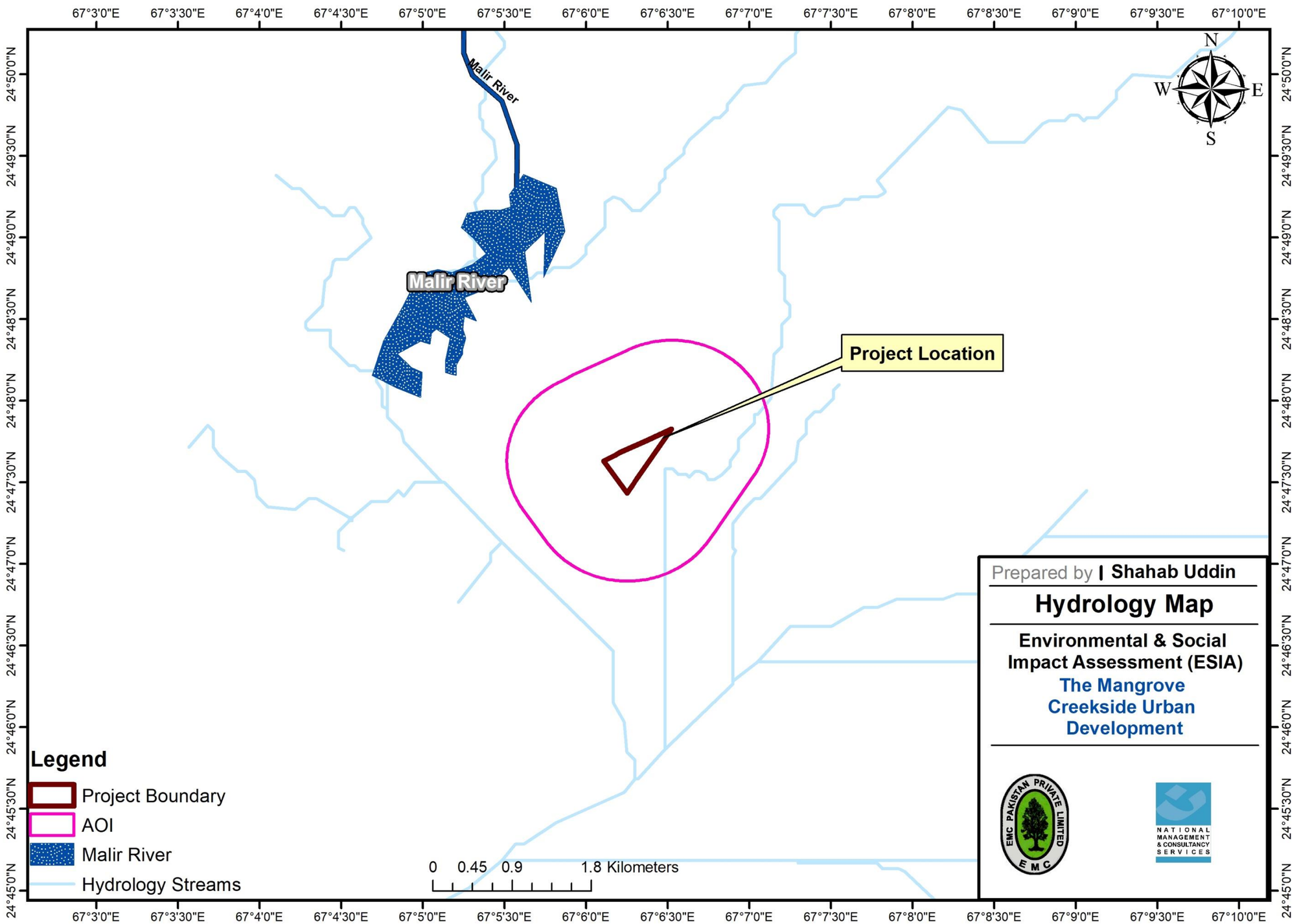


Figure 4.18 - Hydrology Map

4.2.4 Coastal Hazards

When climate shifts from the norm, the whole ecological cycle is disrupted. Karachi has suffered from severe precipitation events and heat waves, cyclones and tsunamis, urban flooding issues, storms and strong wind waves.

4.2.5 Seawater Intrusion

At a time, the creeks of Indus River delta from Gizri Creek to Sir Creek were filled with fresh water of Indus River. But now the situation has changed entirely; it is observed that all the creeks from Gizri Creek to Sir Creek are filled with the saline water of Arabian Sea. Saline water of Arabian Sea is increasing vastly on surface and sub-surface area of the coastal districts of Sindh and badly affected by salinity of Arabian Sea. Gizri and Korangi Creek are one of the potential sites for seawater intrusion in Karachi[16].

4.2.6 Sea Level Rise

Sea level rise, caused either by climate change or manmade structure could increase the, flood related deaths, damage to property as well as the environment, including the loss to territorial sea resulting in the negative change in the relative value of the coastal areas of the society. It has been concluded by several researchers that extreme events may become more frequent because of sea level rise, the increased ocean temperature may result in the change in the frequency, duration, and intensity of tropical cyclones. The increasing trend was observed in various studies conducted for this purpose which notified that. If the present trend of sea level rise (SLR) at Karachi continues that way. the sea level rise along the Pakistan Coast will become 50 mm in the next 50 years, Since the rising rates of sea level at Karachi happen to be within the global range of 1-2 mm/year, the trends may be treated as eustatic sea level rise i.e, the rise is due to thermal expansion of sea water, However, the higher base provided by SLR for storm surges and tides would be particularly important for the Indus delta. where the beach slope is only about 0.1 degree[17].

4.2.7 Cyclone and Storms

The Arabian Sea is known to be frequented by general cyclonic storms and some of these had been among the worst cyclonic storms of the world from their severity point of view. In 2021, a massive dust storm hit Karachi on 18th May, as a result of Cyclone Tauktae neared coastal areas in Sindh. Gusty winds blew through the city with sporadic showers in reported in some areas too. Temperature in Karachi was recorded at 43°C on 18th May, 2021 afternoon. But the weather changed all of a sudden in the evening.

4.2.8 Tsunami

Based on an overview of tsunami hazard study[18], an approximate map of tsunami hazard levels along the coastlines of Iran, Pakistan, and Oman is illustrated below. It is observed that the presented map only depicts a general outlook of tsunami hazardous areas. The vulnerability of an area to tsunami hazard depends on different factors, including the population density. Karachi, Chabahar, Muscat and Sohar are ports with the highest population density along Arabian Sea. The

[16] Khan, M. K., Ayoub, W., Saied, S., Hussain, M. M., Masood, S. S., Siddique, A., & Khwaja, H. A. (2019). Statistical and Geospatial Assessment of Groundwater Quality in the Megacity of Karachi. Journal of Water Resource and Protection, 11(03), 311. https://www.scirp.org/html/5-9403563_91196.htm

[17] Wells, J.T. and Coleman, J.M. 1984. Deltaic morphology and sedimentology, with special reference to the Indus River delta. In: Haq, B.U. and Milliman, J.D. (Eds) *Marine Geology and Oceanography of Arabian Sea and Coastal Pakistan*. Van Nostrand Reinhold, New York, pp. 85–100.

[18] Rashidi, A., Dutykh, D., Shomali, Z. H., Keshavarz Farajkhah, N., & Nouri, M. (2020). A review of tsunami hazards in the Makran subduction zone. *Geosciences*, *10*(9), 372.

population and economic growth along these coastlines increase their exposure to tsunami risk and imply the importance of vulnerability assessment.

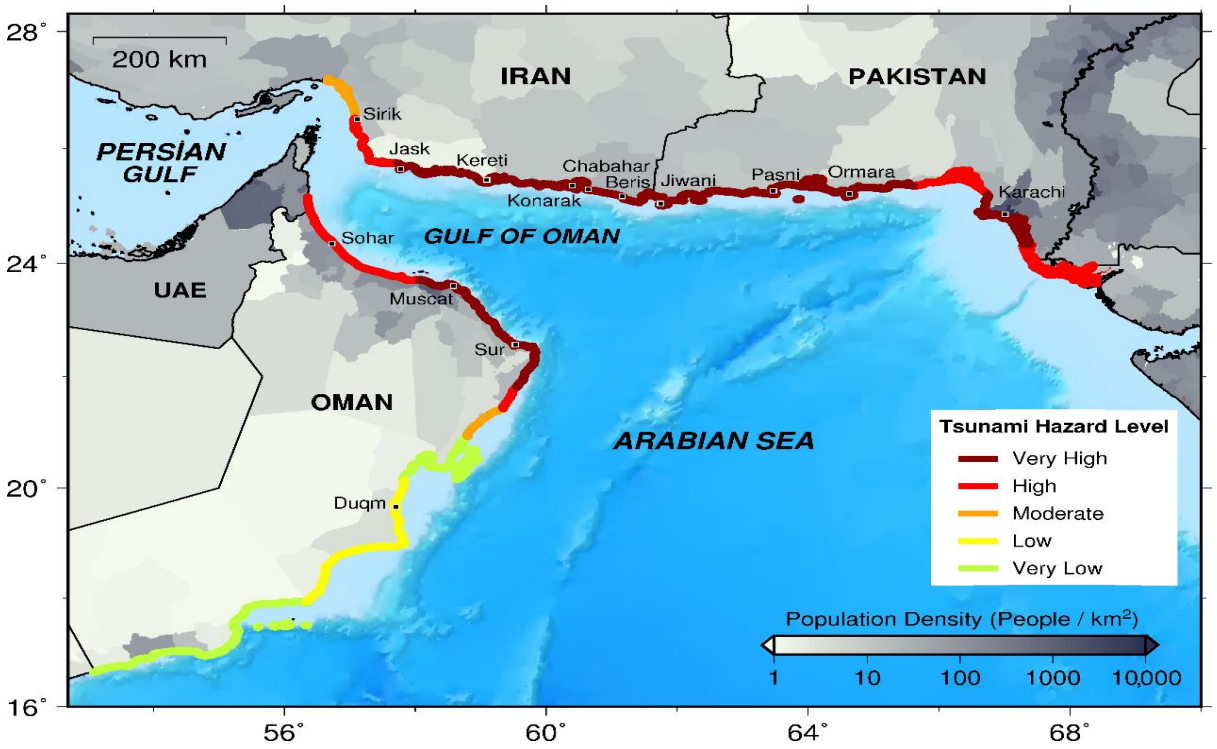


Figure 4.19 - Tsunami Hazard Level Map of Countries Bordering Arabian Sea
(Source: Rashidi et al., 2020[18])

4.3 Ecological Baseline

Macroenvironment (Karachi): 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 urbanization throughout the expansion of the city of Karachi. This has degraded the physical environment & the biological environment. Flora species was recorded in the macroenvironment of project area such as Conocarpus, Acacia nilotica (Sindhi Babur), Capparis decidua (Kirar), Ficrus religiosa (Pepul), Azadirachta indica (Neem), Prosopis juliflora (Devi) and Saveda fruticosa (Lani). 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.

The impoverished as well as degraded environment resulting from non-availability of surface as well as groundwater and discharge of untreated wastewater into Lyari and Malir River has irreversibly reduced the biodiversity of the indigenous as well as introduced vegetation and hence it offers very little chance for the survival / growth of fauna in the macroenvironment of project area. There are even otherwise no habitats of large and small animals, birds or reptiles within the surveyed area.

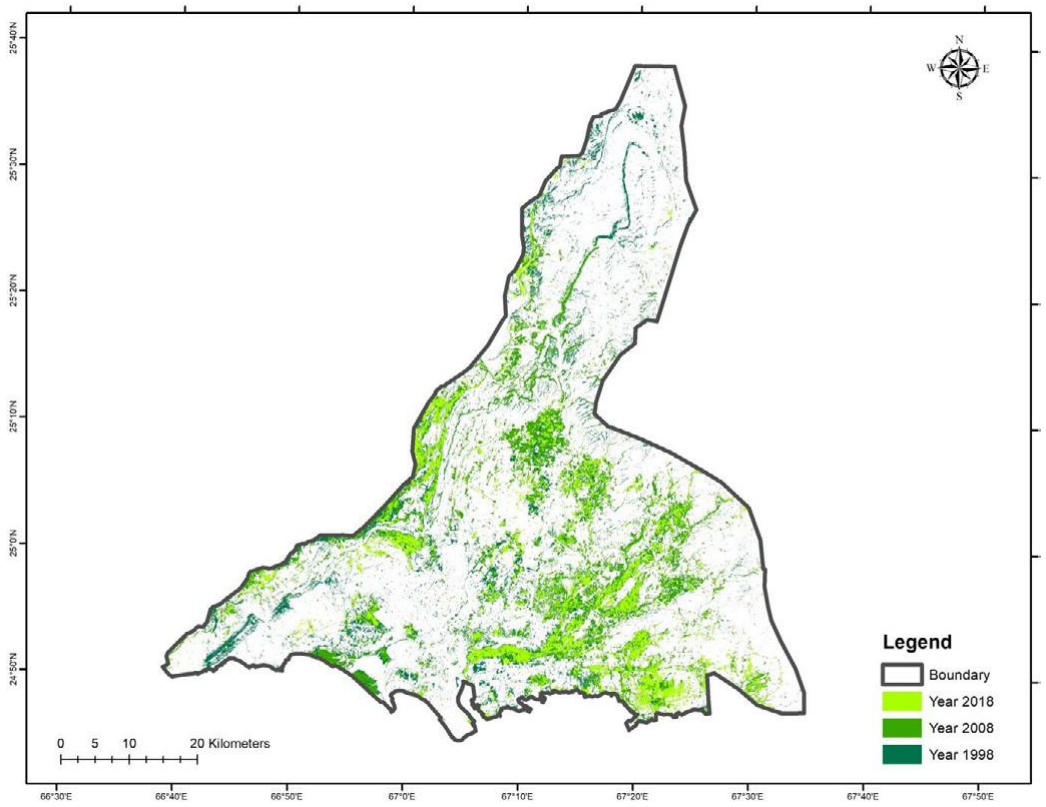


Figure 4.20 - Vegetation Trends in Karachi

4.3.1 Flora

The number of species of various taxa recorded by a study19 shows that a total of 138 species of flora and fauna were recorded from the samples collected at 7 different sampling sites of Gizri creek. The number of angiospermic plant species (monocots and dicots) were low in all the sampling sites because of the saline water at the sites.

The project site is a flat barren land free from any specie of flora which has biological importance. Some local shrubs are grown having no biological importance. However, the microenvironment of the project site has Mangrove trees which are, as per local legislation, enjoy a protected status. The area as per the Sindh Forest Department, called Deh Dih locality.

4.3.1.1 Mangroves

Karachi has very little green cover, but it does have 100,000 hectares of lush mangrove forests on its coast. Mangroves are trees that grow in a mixture of saline and fresh water. They are a nursery for shrimp and fish and are an important part of the ecological food chain. Mangroves are a natural barrier to storms and cyclones and they prevent erosion. They provide shelter to migratory birds, 110 species of which arrive between October and January along the Indus Flyway from Siberia. These include ducks, pelicans and flamingos[20].

The microenvironment of the project site along Gizri creek has mature mangrove trees flourishing in the polluted water of the creek which provides nutrients as well as fresh water in the form of sewage. The specie found and naturally grown outside the south-western boundary of the project site is Avicennia marina, commonly known as grey mangrove or white mangrove, is a species of

[19] Khan, M. A., Shaukat, S. S., Alamgir, A., & Zaheen, W. M. (2012). Impact of industrial effluent on the benthic biodiversity of Gizri creek, Karachi. *International Journal of Biology and Biotechnology.*
[20] https://herald.dawn.com/news/1153410

mangrove tree classified in the plant family Acanthaceae. Some trees are 10-15 years old while others are present in the form of a shrub.

Figure 4.21 - Mangroves Located Outside the Project Site

Figure 4.22 - Shrubs Located in & around the Project Site

4.3.1.2 Fungi and Algae

The number of algal species recorded were substantially higher than the angiosperms recorded at Gizri creek. Among the algae the most abundant species were Enteromorpha and Ulva. The blue-green algae recorded were Phormedium and Nostoc[19]. Based on a study, fourteen different taxa of fungi were isolated from different parts of black mangrove Avicennia marina growing in Korangi Creek and Clifton areas of Karachi. They were identified as Alternaria maritima, Aspergillus flavus, Aspergillus niger, A. sulfurus, Aureobasidium pullulans, Bispora sp., Botrytis sp., Cladosporium sp., Humicola sp., Mucor sp., Penicillium sp., Phoma sp., Pythium sp. and Rhizopus sp. The most diverse group of them all was Deuteromycotina and the most frequent and easily grown Zygomycotina[21]. Richness in species diversity in area may be due to the fact it is situated at the point of discharge of city's sewage and therefore is rich in organic matter.

4.3.2 Fauna

Only one species of sponge (Porifera) was recorded. Marine (benthic) nematodes were found in abundance and represented by 5 species. The most prominent group (phylum) was Nematoda which constituted 23.18 % of the total organisms collected from all the sampling sites. Gastropoda was the second group in abundance that accounts for 13.76%. Within Mollusca, Gastropods were represented by 3 species and bivalves by 2 species. Crustacea had low species richness and constituted 11%. In Crustacea the most abundant group was Ostrocoda (8.69%). In general, the biodiversity of the creek is low owing to heavy pollution load in the creek.

Figure 4.23: Benthic Species in Macroenvironment (Gizri Creek)

Taxa	Sampling sites							Total number of species	% Distribution
	S-1	S-2	S-3	S-4	S-5	S-6	S-7		
Flora									
Monocot (Graminae)	1	1	2	1	-	-	-	5	3.62
Dicots	1	-	1	1	2	-	-	5	3.62
Algae	3	2	4	2	3	1	-	15	10.86
Total number of plant species	5	3	7	4	5	1	-	25	18.11
Fauna									
Porifera (Sponges)	-	-	-	-	-	-	2	2	1.44
Nematoda (Round worm)	6	9	5	7	2	2	1	32	23.18
Gastropoda (Snail and Sea slugs)	4	3	5	3	2	1	1	19	13.76
Pelecypoda (Bivalves)	1	2	1	1	1	2	1	9	6.52
Annelida (Polychaeta)	2	2	1	1	1	1	2	10	7.24
Copepoda	-	-	-	-	1	1	2	4	2.89
Ostracoda	2	2	1	2	1	3	1	12	8.69
Total number of species	25	24	27	22	18	12	10	138	100

Source: Khan, M. A., Shaukat, S. S., Alamgir, A., & Zaheen, W. M. (2012). Impact of industrial effluent on the benthic biodiversity of Gizri creek, Karachi. International Journal of Biology and Biotechnology.

This system is swampy and once had a luxuriant growth of mangroves which have now been thinned out. Extensive biodegradation has taken place in the swamps where incidentally some molluscs, including those that bear black pearls, have managed to survive. This creek system used

[21] Mehdi, F. S., & Saifullah, S. M. (1992). Mangrove fungi of Karachi, Pakistan. *Journal of Islamic Academy of Sciences*, *5*(1), 24-27. https://jag.journalagent.com/ias/pdfs/IAS_5_1_24_27.pdf

to serve as the nursery for the young and juveniles of the fishes, shrimps' oysters and other marine bottom communities. However, the bio-diversity of the creeks has largely been reduced during the last two decades. The marine environment of Gizri Creek is under serious stress due to the discharge of industrial and domestic effluents from the metropolitan area as well as from the fishing villages, the port and shipping activities in Port Qasim and the fishing boats in the Ibrahim Haidri fish harbor[22].

Pictures of fauna near the project area are provided below:

Figure 4.24 - Pictures of Fauna around Project Site

[22] https://thekarachiwalla.com/2010/07/12/the-forgotten-mangroves/

4.3.2.1 Benthic Communities[23]

A benthic biodiversity study carried out revealed that a total of 138 species of flora and fauna were recorded from the samples collected at 7 different sampling sites along Gizri Creek.

Figure 4.25 - Sampling Sites for Benthic Survey

The number of angiospermic plant species (monocots and dicots) were low in all the sampling sites because of the saline water at the sites. The number of algal species recorded were substantially higher than the angiosperms recorded at Gizri creek. Among the algae the most abundant species were Enteromorpha and Ulva. The blue-green algae recorded were Phormedium and Nostoc. Like the flora, fauna was also poorly represented. Only one species of sponge (Porifera) was recorded. Marine (benthic) nematodes were found in abundance and represented by 5 species.

The most prominent group (phylum) was Nematoda which constituted 23.18 % of the total organisms collected from all the sampling sites. Gastropoda was the second group in abundance that accounts for 13.76%. Within Mollusca, Gastropods were represented by 3 species and bivalves by 2 species. Crustacea had low species richness and constituted 11% %. In Crustacea the most abundant group was Ostrocoda (8.69%). In general, the biodiversity of the creek is low owing to heavy pollution load in the creek.

4.3.2.2 Avi-Fauna

Following a survey, over 54 bird species were observed at the mangrove vegetations near the project site, comprising of over 18 migratory birds and 36 resident species. Of these 54, 37 species were common, 02 were abundant, and 15 less common. A complete list of the species observed are highlighted below:

[23] *Khan, M. A., Shaukat, S. S., Alamgir, A., & Zaheen, W. M. (2012). Impact of industrial effluent on the benthic biodiversity of Gizri Creek, Karachi. International Journal of Biology and Biotechnology (Pakistan).*

No.	Common Name	Scientific Name	Status		Occurrence			
			Migratory	Resident	Common	Abundant	Less Common	Rare
1.	Bank Myna	*Acridotheres ginginianus*		X		X		
2.	Bay-backed Shrike	*Lanius vittatus*		X	X			
3.	Black crowned Finch Lark	*Eremopterix nigreceps*		X	X			
4.	Black Drongo / King Crow	*Dicrurus macrocercus*		X	X			
5.	Black Kite	*Milvus migrans*		X	X			
6.	Black tailed Godwit	*Limosa limosa*	X				X	
7.	Black winged Stilt	*Himantopus himantopus*	X		X			
8.	Blue Rock Pigeon	*Columba livia*		X	X			
9.	Brahminy Kite	*Haliastur indus*		X	X			
10.	Caspian Tern	*Sterna caspia*	X				X	
11.	Cattle Egret	*Bubulcus ibis*		X	X			
12.	Chiffchaff	*Phylloscopos collybita*	X		X			
13.	Collared Dove	*Streptopelia decaocto*		X	X			
14.	Common Babbler	*Turdoides caudatus*		X	X			
15.	Common Kingfisher	*Alcedo atthis*		X	X			
16.	Common Sandpiper	*Actitis hypoleucos*	X		X			
17.	Crested Lark	*Galerida cristata*		X	X			
18.	Eurasian Curlew	*Numenius arquata*	X				X	
19.	Great Grey Shrike	*Lanius excubitor*		X	X			
20.	Grey Heron	*Ardea cinerea*	X		X			
21.	House Crow	*Corvus splendens*		X	X			
22.	House Sparrow	*Passer domesticus*		X		X		

No.	Common Name	Scientific Name	Status		Occurrence			
			Migratory	Resident	Common	Abundant	Less Common	Rare
23.	Indian Myna/Common Myna	*Acridotheres tristis*		X	X			
24.	Indian Pond Heron	*Ardeola grayii*		X	X			
25.	Indian Robin	*Saxicoloides fulicata*		X	X			
26.	Indian Roller	*Coracias benghalensis*		X	X			
27.	Indian Tailor Bird	*Orthotomus sutorius*		X			X	
28.	Intermediate Egret	*Egretta intermedia*	X				X	
29.	Kentish Plover	*Charadrius alexandrinus*	X				X	
30.	Large Egret	*Egretta alba*	X				X	
31.	Lesser Sand Plover	*Charadrius mongolus*	X				X	
32.	Little Brown Dove	*Streptopelia senegalensis*		X	X			
33.	Little Cormorant	*Phalacrocorax niger*	X		X			
34.	Little Egret	*Egretta garzetta*		X	X			
35.	Little Green Bee-eater	*Merops orientalis*		X	X			
36.	Little Ringed Plover	*Charadrius dubius*		X	X			
37.	Long-tailed Grass Warbler	*Prinia burnesii*		X			X	
38.	Pied Bushchat	*Saxicola caprata*		X	X			
39.	Pied Kingfisher	*Ceryle rudis*		X	X			
40.	Purple Sunbird	*Nectarinia asiatica*		X	X			
41.	Redshank	*Tringa totanus*	X		X			
42.	Red vented Bulbul	*Acrocephalus agricola*		X	X			
43.	Red-wattled Lapwing	*Hoplopterus indicus*		X	X			
44.	Reef Heron	*Egretta gularis*		X	X			
45.	Striated Babbler	*Turdoides earlei*		X	X			
46.	Temminck's Stint	*Calidris temminckii*	X				X	
47.	Terek Sandpiper	*Xenus cinereus*	X				X	

No.	Common Name	Scientific Name	Status		Occurrence			
			Migratory	Resident	Common	Abundant	Less Common	Rare
48.	Whimbrel	*Numenius phaeopus*	X				X	
49.	Whiskered Tern	*Chlidonias hybridus*		X			X	
50.	White breasted Kingfisher	*Halcyon smyrnensis*		X	X			
51.	White / Pied Wagtail	*Motacilla alba*	X				X	
52.	White-cheeked Bulbul	*Pycnonotus leucogenys*		X	X			
53.	White browed pied wagtail	*Motacilla maderaspatensis*	X				X	
54.	White eye	*Zosterops*		X			X	

4.4 Socio-Economic Baseline

The social baseline chapter provides a comprehensive review of the socio-economic conditions of the project area. This socio-economic profile is based on literature review and several primary data gathering activities including site visits, sample socio-economic survey of stakeholders in the area and consultations with primary and secondary stakeholders. This social baseline provides an overview of the socio-economic conditions of the people who reside and work in the project vicinity. It also includes an assessment of public utilities and social services (education and health facilities) in the area concerning the proposed construction and operation of The Mangrove Creekside Development.

International best practice for ESIA studies demands an alignment of the proposed project components with the applicable Sustainable Development Goals (SDGs) adopted by all UN Member States in 2015. The SDGs provide broad universal targets for reducing poverty, environmental degradation, injustice and important pillars of social upheaval that must be achieved by 2030. In March 2017, the global indicator framework was developed and agreed upon by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs) to monitor progress towards the achievement of these indicators. Moreover, all member states, including Pakistan, have developed national indicators linked to the global targets that provide the basis for a national effort of monitoring progress towards fulfilment of the indicators. The proposed project should be aligned with Goal 11 of the SDGs that requires all essential steps be taken to ensure development that is socially acceptable and environmentally sound.

The socio-economic baseline data in this chapter identifies the existing socio-economic trends in the area and the potential impacts of the project providing the basis for the development of a Social Management Plan. The social baseline is divided into macro and microenvironment of the project area. The macro-environment encompasses District Malir of Karachi Division. The discussion on macro environment covers the administrative setup, demography, education and health profile of the area. The immediate neighborhood of the project area is considered to be the micro-environment of the project and covers land use, education, health and utilities profile of the area.

4.4.1 Macro Environment

The description of baseline environment is presented below:

4.4.1.1 Administrative Context

The proposed project “The Mangrove Creekside Urban Development” falls within the jurisdiction of Korangi Creek Cantonment of District Malir. There are six subdivisions and two cantonments within District Malir which namely are Airport Subdivision, Bin Qasim Sub Division, Gadap Sub Division, Ibrahim Hyderi Sub Division, Murad Memon Sub Division and Shah Mureed Sub Division also two cantonments are there Korangi Creek Cantonment and Malir Cantonment. The Malir District covers a total area of 2,635 sq.km while Korangi Creek Cantonment covers an area of 22.2 sq.km.

4.4.1.2 Demography

The district comprised of people from various ethnic groups are residing in the project area including Sindhi, Punjabi, Pakhtuns, Urdu Speaking and Memons. Malir is the largest District of Karachi by area and is regarded as the countryside of Karachi City due to its open atmosphere and lush green farmlands. The population comprises middle and upper-middle classes while 25 percent falls in the category of lower middle class and the rest belong to the working class.

Table 4.11 - Demography

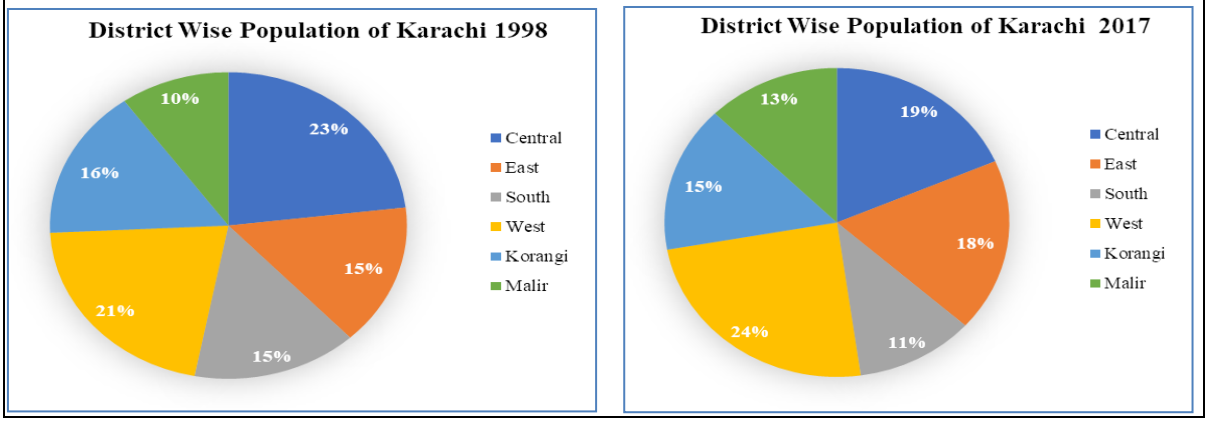
1998 Census	2017 Census	%Change (1998-2017)
DISTRICT MALIR		
976,193	2,008,901	106
Korangi Creek Cantonment		
34,177	57,745	68
Source: Pakistan Bureau of Statistics 2017 (PBS)		

The following table provides a comparison of district and sub-division population between 1998 and 2017 census for District Malir. The total population of District Malir was 976,193 in 1998 which increased to 2,008,901 in 2017, showing an annual growth of 3.86%. The total population of Korangi Creek Cantonment was 34,177 according to the 1998 census which increased to 57,745 in 2017, showing an annual increase of 2.79 %. The population of District Malir has more than doubled in the last 19 years.

Table 4.12 - Population of District Malir and Subdivisions (1998, 2017)

Name	Area (Km2)	Density (2017) (per Km2)	Population Census (1998)	Population Census (2017)	%Change/year (1998-2017)
District Malir	2,635	762.5	976,193	2,008,901	3.9
Malir Cantonment	60.6	2,294	44,464	139,052	6.2
Bin Qasim	440	561.3	108,045	247,141	4.4
Gadap	1,436	44.70	39,642	64,192	2.6
Ibrahim Hyderi	111	9,439	438,921	1,045,815	4.7
Korangi Creek	22.2	2,599	34,177	57,745	2.8
Airport	4.3	23,649	40,937	100,743	4.8
Murad Memon	197	1,649	214,900	324,275	2.2
Shah Mureed	355	84.33	16,414	29,938	3.2

Source: Pakistan Bureau of Statistics 2017 (PBS)



Compared to other districts of Karachi, District Malir was amongst the least populated districts of Karachi in 1998. Over the past few decades, the relative share of district Malir has increased to 13% of the entire population of Karachi due to the growth of lower-income settlements as well as small-medium sized apartment buildings and low-cost residential societies for the middle-income class of Karachi.

4.4.1.3 Urban Migration

Karachi has proliferated in the last few decades, and the metropolitan area has more than 23 million people, with a population density of over 24,000 people per square kilometer, or 63,000 per square mile. This means Karachi is denser than any other "megacity" with an urban population of more than 10 million except Dhaka and Mumbai. Regional and internal migration have also contributed to the substantial increase in the pace and scope of urbanization in Karachi. These population movements have brought rapid transformations in the social, economic and political fabric of Karachi. Urban migration has played a significant role in the rapid population growth of Karachi.

Year	Population	Increase/ Decrease Over Previous Census / Survey	No. of Years Between Surveys	Increase/ Decrease (%)	Average Annual Growth Rate (%)
1941	435,887	135,108	10	44.9	3.7
1951	1,137,667	701,780	10	161	11.5
1961	2,044,044	906,377	10	79.7	6.1
1972	3,606,746	1,562,702	11	76.5	5
1981	5,437,984	1,831,238	9	50.8	5
1998	9,802,134	4,540,422	17	86.3	3.5
2017	16,051,521	6,249,387	19	62.9	2.6

Malir was once famous for its fruit and vegetable farms; but, now due to severe scarcity of groundwater, these farmlands are being converted into residential areas, thus increasing urbanization and environmental degradation. District Malir attracts migrants who come from other districts, rural areas of Karachi and other provinces. Though it has already populated old residential

areas like Model Colony, Jaffar Yayyar Society, Shah Faisal Colony, Drigh Colony, Moinabad and Saudabad. Seeing increased demand of the people, Malir Development Authority was established in 1993 by the Government of Sindh in order to develop the area. MDA is specially focusing its energies towards the low-cost housing and design its schemes to give better residential facilities on affordable rates. Another important major development in Malir District is Bahria Town-Karachi with a total area of around 46,000 acres. It offers a quality lifestyle owing to its world-class amenities. Bahria Town, Karachi is located at a distance of 9 km from Super Highway and half an hour drive from Jinnah International Airport.

4.4.1.4 Transportation/Communication

As cities grow, the requirement of civic facilities also increases requiring continuous development, technological advancement and efficient management. Karachi city is among the fastest-growing mega port cities with a very high rate of urbanization where the need for transport infrastructure and services is growing rapidly. Massive traffic jams on the roads have become a common feature of Karachi while the situation is getting worse day by day. It has turned into an alarming situation which if not handled on priority basis would soon turn in to a deadlock, severely disrupting the economic activities in the city. The mushroom growth of vehicles is also a result of the failure of the government in providing sufficient low-cost public transport facilities. Currently, there are more than 4 million registered vehicles on Karachi roads. The number of vehicles registered in Karachi has increased by 1.13 million or 38% since 2013 with rickshaws rising sharply by 76% to 229,826, motorcycles by 50% to whopping 2.34 million and private vehicles by 18% to 1.28Mn in 201624. According to the Research Report of KCCI, August 2017, the ratio of the registered motorcycles is highest (57 %) and private vehicles are 31 %. The following graph shows the share of vehicles which have been registered in Karachi in 2017.

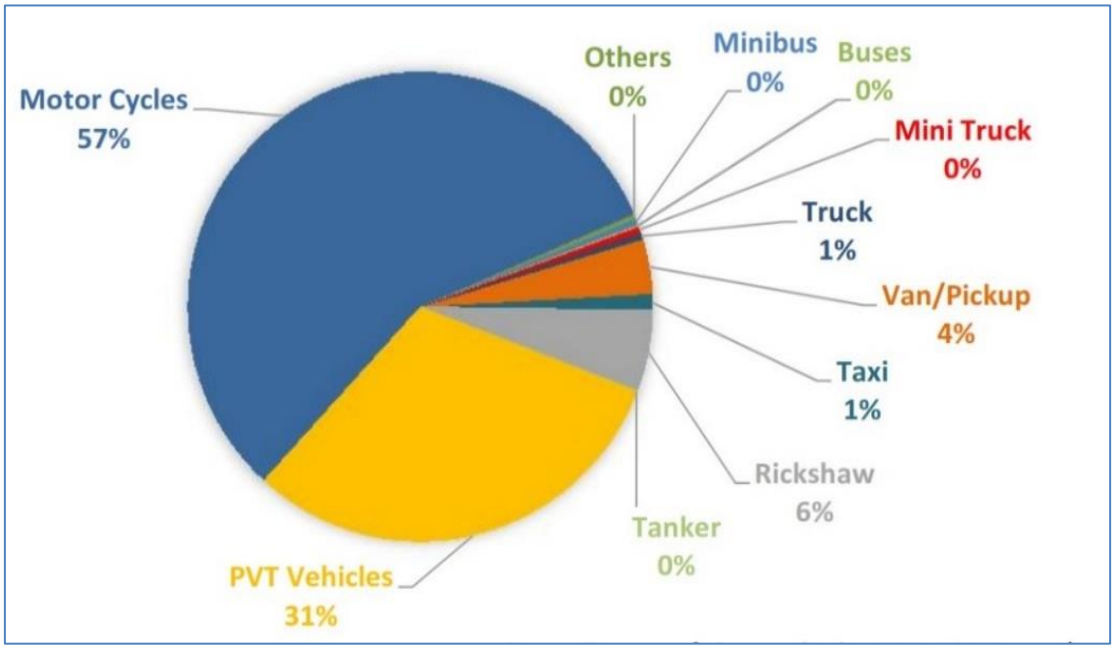


Figure 4.26 - Registered Vehicles in Karachi by Vehicle Type (2017)

The Malir District has an adequate communication network having metaled and spacious roads. It is the gateway to all heavy and light vehicles come from outside the city. Malir also provide a bridge to the Karachi port to the commercial goods which come here from around the world which are later transported all parts of Pakistan and Afghanistan, the Central Asian Republics, China, Iran, and India. The major roads which begin from the Malir are: Super Highway (M-9), is a 136-km long

[24] Research & Development Department, KCCI, August 2017: *Karachi Traffic Chaos, Jamming the wheels of Economy INFOANALYSIS*

6-lane motorway connecting the cities of Hyderabad and Karachi. It is a part of Pakistan's Motorways Network. M-9 is an upgrade of the existing Karachi-Hyderabad Super Highway by adding an extra lane on each side, along with a complete re-surfacing of the road. National Highway (N5) is a 4-lane 1,819-Km long road.

The other important roads in the district are: Jinnah Ave, Liaquat Road, Malir Cantt. Road, Model Colony Gadap Road and Malir Link Road (which connects with Super Highway). Local Buses / Wagons running in the district provide the cheapest mode of conveyance. It gives the passage to all bus services which commence from Karachi and go to upper Sindh, Balochistan, Punjab, KPK and Northern areas.

4.4.1.5 Education Facilities

Baqai Medical College, with affiliation of the University of Karachi started in 1988. In 1992, Baqai Foundation established the Baqai Dental College. It goes to the credit of Baqai's, which is the first ever Dental College to be set-up at Karachi. In July 1996 through a bill passed unanimously in Sindh Assembly and then approved by Governor of Sindh, through a special notification promulgated an ordinance, called Baqai Medical University Act of 1996 by virtue of it, Baqai Medical University came into existence. Baqai universities have developed various schools that specialize in those categories. Schools and colleges that come under this institute and are affiliated with it include Baqai Dental College, Institute for Pharmaceutical Sciences, Health Management Sciences, Hematology, Diabetology and Endocrinology. The university offers the best services for undergraduate and postgraduate students. Some of the major degrees and courses cater the field of information technology and medicine. The courses and programs offered by the university totally covers the field of medical. MBBS, D-pharmacy, BDS, BBIT, MSIT, Special training and courses of army, Doctorate in veterinary.

Founded as a Federally Chartered University in July 2000, FAST National University of Computer and Emerging Sciences is a premiere University of Pakistan, renowned for quality and impact of its students in the development of local software and other industries. The university has five modern campuses at Karachi, Lahore, Islamabad, Peshawar and Chiniot-Faisalabad. These campuses provide world class educational environment and recreational facilities to about over 11,000 students, around one quarter are female and over 500 skilled faculty members. For more than 30 years NUCES-FAST continues to play an important role in educating and fostering its students for their enlightened careers in Computer Science, Electrical Engineering and Management Sciences.

There are a number of schools, colleges and technical training centers in Malir District. The following statistics shows that District Malir has the highest number of schools and enrollment of students is encouraging. Enrollment of boys is higher than girls in Malir District. Similarly, the proportion of male teachers are higher than female teachers in the district.

Table 4.13 - 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										

Compared to other districts of Karachi, the number of schools with basic and advanced facilities in District Malir comes second in ranking. The table below shows that District Malir has 591 schools comparatively Central 607, South 482, West 363, Korangi 550 and East 264.

Table 4.14 - District-Wise Basic and Advanced 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							

4.4.1.6 Public Health Facilities

There are several public and private healthcare facilities in the Malir District. They include Malir Halt Hospital, Hassan General Hospital, Urban Health Centre Government Hospital, Sindh Heart Hospital, Zia Medical Hospital, Agha Khan University Hospital Medical Centre, Atia General Hospital and TB Chest Hospital are also in the jurisdiction of the district. The following table shows the number of health practitioners, there are 234 doctors and 25 paramedical personnel posted in different government hospitals of Malir District.

CMH (Combined Military Hospital) is located at PAF Rd, Malir Cantt, Karachi. This hospital has in-patient and out-patient facilities. It offers emergency service, specialist OPDs, Surgery, Pediatrics, Orthopedics, Gynae/Obs, ENT and Eye, ICU, Neonatal ICU, Medical ICU and so on. Almost 100 plus qualified consultants from all specialties and sub-specialists are available at CMH Malir Karachi.

Table 4.15 - 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: - BOS, Government of Sindh (Development Statistics of Sindh – 2018)											

The table below shows the number of health facilities available to cure different kinds of diseases in District Malir. The public health facilities in Karachi are highly centralized in a few locations and cannot cater to a large part of the population. The above-mentioned public health facilities data is not updated in the government records thus subject to some shortcomings.

Table 4.16 - 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	-	-	3,150	-	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-2018).														

4.4.2 Microenvironment

The proposed project activities involve the construction of a residential cum commercial building. The project is located near the Korangi Creek Industrial Park. The project site is surrounded by a number of existing and planned industrial developments. The major industries in the neighborhood are Sika Pakistan Pvt. Ltd., Universal Packaging Company (Pvt.) Limited, Mehran Mercantile Co., Tufail Chemical & Surfactants Pvt. Ltd., Maskatiya Industries Private Ltd (Olivia), Pakistan Refinery Limited, Hoora Pharma (Pvt.) Ltd Warehouse, MAL Pakistan Ltd. (Warehouse) and Salim Habib University.

4.4.2.1 Korangi Creek Industrial Park (KCIP)

KCIP is located on the edge outside the main residential area of a city but it has good transportation access through Karachi Sea Port (22 km), I.I. Chundrigar Road (13 km), Quaid-E-Azam International Airport (20 km), Super Highway (30 km), National Highway (34 km). KCIP has created two density zones for industries, one is Low Density Zone for Light Engineering, Food Processing, Consumer Food & Pharmaceutical Products, Garments / Value added Textiles, Packaging & Printing & Warehousing/Logistics. Whereas the other is High Density Zone for Commercial and Business Centers, Information Technology, Gems & Jewelry. KCIP is 50% completed further development work is in process Electricity, Gas and water is available in the park, road's structure is also completed.

4.4.2.2 Education

They have no schools in immediate vicinity of the project that it's an industrial area and no residential development in the immediate vicinity of the project. There are some major private institute and universities nearby the project site. These include Karachi Tools Dyes and Moulds Centre, Institute of Business Management, Ilma University, Karachi Institute of Economy & Technology (PAF-KIET) and Barrett Hodgson University. These places of higher education are located within 2 km of the project site except Salim Habib University that is located along the road that connects with the project location at a distance of 500 meters.

4.4.2.3 Health

There are few private and charity related healthcare facilities nearby the project area. The notable health facilities in the area include Mehrunnisa Hospital (SIUT) and Indus Hospital. In case of any incident at the workplace of any industry the case is transferred by the administration to the nearest private hospital or directly taken to the Jinnah or Civil Hospital.

4.4.2.4 Utilities

The water supply in the area falls under the jurisdiction of Cantonment Board Korangi Creek (CBKC). The industries are satisfied with the water supply because the industries ratio is low. The condition of solid waste in the project area is satisfactory. The respondents said that Cantonment Board Korangi Creek collect the waste on weekly basis but they have also restricted to throw any kind of industrial wastage in an open area. The majority of the industries were satisfied with the electricity supply in the area and there is no load shedding in Korangi Creek Industrial Zone. K.E gives prior notice for breakdowns if required in the maintenance process.

4.4.2.5 Traffic Condition

The main road through which the proposed project site can be accessed is Korangi Creek/ Korangi Crossing Road where the traffic flow is high due to the presence of Indus Hospital, Institute of Business Management (IoBM), Bol Media Group (Head Office) as well as the access road to the

Industries of Korangi Creek Industrial Park (KCIP) and Pakistan Refinery Limited. The road is maintained up till Salim Habib University after the university premises there is dirt track to get to the project's location. Adoption of the suggested mitigation measures, be an environmentally acceptable proposition.

5 STAKEHOLDER CONSULTATIONS

The participation of project stakeholders in project planning, design and implementation is now universally recognized as an integral part of environmental & social impacts assessment. Local communities, their representatives, government departments, national and international NGOs and the civil society at large may all be able to contribute to and benefits from, the dialogue directed at identified and resolving key project-related issues. Stakeholder consultation has become an important requirement of the ESIA study after the enactment of the guidelines for public consultation under the Pakistan Environmental Protection Act (PEPA) 1997. After the 18th Amendment to the constitution, the Government of Sindh passed the Sindh Environmental Protection Act 2014, which also stresses the important of engaging with the concerned primary and secondary stakeholders during the ESIA Study.

While in the short-term, the impacts might be felt only in the microenvironment of the project, in the long-term, the impacts may also spread to other nearby neighborhoods and activities including traffic management, the swift passageway for fire tenders and ambulance and stress on existing utilities. Instead of these perceived impacts, meaningful engagement with the project stakeholders has been carried out to identify the potential positive and negative impacts, assess the magnitude of these impacts from a social perspective and prescribe solutions that identify for the construction and operations phase of the proposed project.

5.1 Stakeholder Mapping

In order to better understand several stakeholder groups for this project, a stakeholder mapping exercise has been carried out whereby different stakeholder clusters and their interests in the project are discussed in this section:

Local People/Neighborhood: Individuals or groups in the local of the project site are apprised about the project background and context. Due to their proximity to the project site, they are often utmost vulnerable stakeholders, and thus, consultations with these stakeholders are directed throughout the project phase. The consultation exercise provides an opportunity to appraise the stakeholders regarding the consultation process, identify likely project impacts, and record concerns of local communities. Moreover, intensive stakeholder engagement during the planning stage of the project provides a basis for reducing the trust deficit and encourages confidence-building.

Proponents: The main aim of the project proponent, NMCS, is to accomplish the objectives of the project through cost-effective and sustainable activities. To this end, the project proponents have to recognize that strong associations and responsive relations with stakeholders would go a long way to achieve the project objectives. Therefore, the proponent has to strive to engage stakeholders at all levels from the outset; inform them regarding project goals, design, and alternatives. Moreover, they have to keep trying to create public understanding and acceptance of the proposal through a commitment to implement the promised objectives. They have to accomplish the project through general acceptance of the design and keep improving through the use of public inputs on alternatives and mitigation measures.

Government Agencies: The government agencies involved in the ESIA (Environmental and Social Impact Assessment) process is mandated to have their policy and regulatory responsibilities addressed in impact analysis and mitigation consideration. For the competent authority, an effective public involvement program will have to be ensured regarding project proposal that effectively incorporates environmental and social concerns. Moreover, in line with international standards, SEPA (Sindh Environmental Protection Act) stresses the proponent for evidence of CSR (Corporate Social Responsibilities) activities in the past and proposals for CSR activities in

the project vicinity. All through the ESIA review primary concern for SEPA is a transparent public consultation process and an efficient stakeholders' engagement plan that can address the concerns and suggestions of all stakeholders.

NGOs/Interest groups: Comments from NGOs and specific interest groups often provide a useful policy perspective on the project's methodology and implementation mechanisms. For example, due to the vast exposure of certain NGOs and interest groups, alternative measures for reaching the project goals may be advised that are more eco-friendly and socially acceptable. Their insights are also helpful in developing CSR activities and later in monitoring and evaluations.

5.2 Primary and Secondary Stakeholders

Primary stakeholders are those who have a direct interest in the project which includes residents, commercial entities, and institutions falling in the immediate environs of the project area. Secondary stakeholders include the relevant government agencies and public interest groups which may indirectly influence or be influenced by the project. The concerns and input from both primary and secondary stakeholders are important to identify the issues arising from the construction and operation phase of the project and propose mitigation measures that minimize the negative project impacts and enhance the positive ones.

Within the project vicinity, the primary stakeholders are Korangi Creek Industrial Park (KCIP) Office, Sika Pakistan Pvt. Ltd., Universal Packaging Company (Pvt.) Limited, Mehran Mercantile Co., Tufail Chemical & Surfactants Pvt. Ltd., Maskatiya Industries Pvt Ltd. (Olivia), Hoora Pharma (Pvt.) Ltd Warehouse, MAL Pakistan Ltd. (Warehouse) and Salim Habib University. The secondary stakeholders for this project include the utility companies that provide gas; electricity and water in the area including K-Electric, SSGC, and KWSB. Furthermore, the regulatory authorities mandated to ensure environmental protection in the city that falls under the remit of SEPA and compliance with building and construction laws which is looked after by SBCA. The complete list of the primary and secondary stakeholders for The Mangrove Creekside Development has been stated in the table below:

Table 5.1 - Stakeholder Identification & Mapping

Neighborhood	Korangi Creek Industrial Park (KCIP) Office Sika Pakistan Pvt. Ltd. Universal Packaging Company (Pvt.) Limited Mehran Mercantile Co. Tufail Chemical & Surfactants Pvt. Ltd. Maskatiya Industries Pvt Ltd. (Olivia) Hoora Pharma (Pvt.) Ltd Warehouse MAL Pakistan Ltd. (Warehouse) Salim Habib University
Proponent	M/S National Management & Consultancy Services
Government Agencies & Other Service Providers	Sindh Environmental Protection Agency (SEPA) Karachi Water & Sewerage Board (KWSB) K-Electric Sui Sothern Gas Company (SSGC)

	Sindh Building & Control Authority (SBCA) Korangi Creek Cantonment
NGOs/Interest groups	Shehri-CBE National Forum for Environment & Health (NFEH) Urban Resource Center Citizens for Environment (NGO)

5.3 Consultation Approach & Methodology

5.3.1 Consultation with Primary Stakeholders

A Neighborhood Survey was conducted to identify residential and commercial interests in the surrounding that may face direct impacts from the proposed development. The survey was conducted in two stages. In the first stage, several site visits were made to identify all stakeholders that either reside or work in the project environs and conducted an initial identification of potential positive and negative effects. Relevant public service institutions directly involved in service provision in the ranges were also identified.

During the second stage, a social survey field team from EMC Pakistan used a pre-designed semi-structured template to engage the residents, commercial interests, and public service institutions. Those stakeholders, who were not available at the first attempt, were re-visited on the same day or followed-up for their comments during the next few days. During each meeting, the project team introduced the project to the stakeholders, recorded their concerns, and provided contact details to enable stakeholders to share further comments over email or in writing. A 'Project Brief' providing the salient features of the project were also handed over to the available stakeholders as part of the information disclosure process.

Moreover, the team inquired about the current situation of the area such as the status of utilities, security and law and order situation in the project area from the residents near the project site. Several open-ended questions were also included in the questionnaire to ensure that the respondents could openly share their opinions and suggestions relevant to the study. The following table shows the stakeholders that were approached during the Neighborhood Survey.

Table 5.2 - Primary Stakeholders Consulted

S. No	Respondents	Stakeholder	Stakeholder Type
1	Mr. Safdar Ud Din (Admin Officer)	Korangi Creek Industrial Park (KCIP) Office	Industrial
	Mr. Kashif Noor (Admin Officer)		
2	Mr. Khalid Hussain (Warehouse Incharge)	Sika Pakistan Pvt. Ltd.	Industrial
3	Mr. Qaisar Khan (Security Incharge)	Universal Packaging Company (Pvt.) Limited	Industrial
4	Mr. Ishaque Khan	Mehran Mercantile Co.	Industrial

	(Security Gateman)		
5	Mr. Ezan (Admin Officer)	Tufail Chemical & Surfactants Pvt. Ltd.	Industrial
6	Mr. Waheed (Assistant Admin)	Maskatiya Industries Pvt Ltd. (Olivia)	Industrial
7	Mr. Mohammad Jalal (Security Guard)	Hoora Pharma (Pvt.) Ltd Warehouse	Industrial
8	Mr. Tamir Hussain (Admin Officer)	MAL Pakistan Ltd. (Warehouse)	Industrial
9	Mr. Arif (Security Supervisor)	Salim Habib University	Institutional

5.3.2 Consultation Feedback

The comments, concerns, and suggestions received from stakeholders during the neighborhood survey have been collated in this section. The comments solicited from stakeholders were helpful in the screening of the potential environmental & social aspects of the project. The social team from EMC initiated consultations in the project area, where the following major issues and concerns were raised by the primary stakeholders:

- The stakeholders appreciated the proposed project that will help to create the job opportunities for the people of the city; especially at a time when unemployment rate is high.
- The stakeholders suggested that proposed project will add its share in the improvement of the national economy in the form of flexibility to host corporation & start-ups.
- The stakeholders also identified the importance of residential quarter which provide inclusive housing and healthy exclusive apartments.
- Korangi Creek Industrial Park (KCIP) administration suggested, to secure the property of the proposed site, there should be proper security system in the proposed area to protect it from theft and robbery.
- The interviewers expressed hope that infrastructure and required amenities in the area will be provided and enhanced to ensure the required electrical, water and sewerage needs for such developments in the area.
- The Admin Officer of Tufail Chemical & Surfactants Pvt. Ltd. suggested the use of new machinery in-order to minimize noise pollution as well as cover the area with green curtains and use water sprinkling system for minimizing dust emissions.
- The Warehouse In-charge of Sika Pakistan Pvt. Ltd. suggested to use the building construction material from them as they are a Swiss based company following the same standards in Pakistan.
- The stakeholders suggested to cover the construction vehicles and should use the specific timings for the movement of construction material other than the peak timings of Salim Habib University.

Table No.5.2: Consultation Pictures with Primary Stakeholders

Consultation with Admin Officer, Korangi Creek Industrial Park (KCIP) Office

Consultation with Warehouse Incharge, Sika Pakistan Pvt. Ltd.

Consultation with Security Incharge, Universal Packaging Company (Pvt.) Limited

Consultation with Security Gateman, Mehran Mercantile Co.

Consultation with Admin Officer, Tufail Chemical & Surfactants Pvt. Ltd.

Consultation with Assistant Admin, Maskatiya Industries Pvt Ltd. (Olivia)

Consultation with Security Guard, Hoora Pharma (Pvt.) Ltd Warehouse

Consultation with Admin Officer, MAL Pakistan Ltd. (Warehouse)

Consultation with Security Supervisor, Salim Habib University

5.3.3 Consultation with Secondary Stakeholders

Whilst conducting a survey of the area in and around the project area, pertinent secondary stakeholders were also identified that may be involved in part in the development of the project or be affected through its development. An identification of these stakeholders is carried out and provided below:

Table 5.3 - Primary Stakeholders Consulted

S. No	Respondents	Stakeholder
1.	Mr. Khalid Hussain (Warehouse Incharge)	Sindh Wildlife Department
2.	Mr. Qaisar Khan (Security Incharge)	Sindh Forest Department
3.	Mr. Ishaque Khan (Security Gateman)	Sindh Environmental Protection Agency

5.3.4 Consultation Feedback

5.3.4.1 Sindh Wildlife Department

Brief Description of Sindh Wildlife Department

The Sindh Wildlife Department is responsible for the protection, conservation, and sustainable use of wildlife in the Sindh Province of Pakistan. The department operates under the Sindh Wildlife Protection, Preservation, Conservation and Management Act of 2020.

Summary of KII with Mr. Mumtaz Ali Soomro

Stakeholder	Location	Date	Key Informant
Sindh Wildlife Department	Saddar	5-12-2024	Mumtaz Ali Soomro, Deputy Conservator Wildlife

Mr. Soomro emphasized the importance of incorporating comprehensive monitoring and evaluation mechanisms throughout the project. He recommended that relevant departments be consulted to ensure proper oversight and alignment with regulatory frameworks. Regarding the potential removal of large trees, he underscored the need for timely notification to stakeholders and the implementation of appropriate compensation measures. He highlighted the relevant provisions under subsections 55, 56, 58, and 59 of the 2022 regulations, which pertain to the protection of forests and wildlife. Mr. Soomro further advised that any compensatory measures should prioritize reforestation efforts, ensuring the planting of additional trees to restore habitats and support the revival of bird and wildlife populations. Additionally, he requested a site visit to the TPL project to conduct a thorough assessment and provide informed feedback on the project's environmental impact.

5.3.4.2 Sindh Forest Department

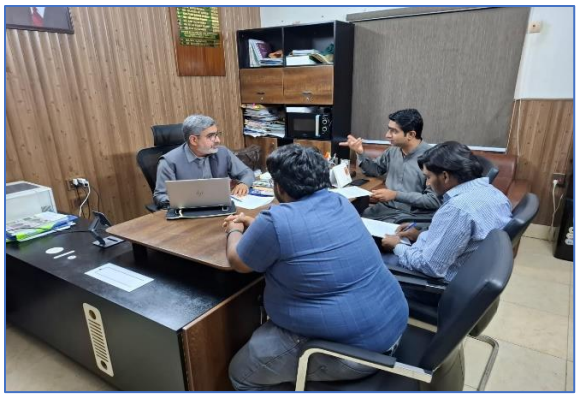
Brief Description of Sindh Forest Department

The Sindh Forest Department (SFD) is responsible for the sustainable management of Sindh's forest and wildlife resources. The SFD's mission is to maintain, restore, and enhance forest resources, promote public awareness and participation and strengthen institutional capacities.

Summary of KII with Mr. Shahzad Sadiq

Stakeholder	Location	Date	Key Informant
Sindh Forest Department	Malir	5-12-2024	Shahzad Sadiq, District Forest Officer

Mr. Sadiq highlighted that mangrove disturbances have occurred in the creek area during previous projects and emphasized the need to prevent such disruptions in the current project. He advised that if any disturbance to mangroves is unavoidable, appropriate compensation measures should be incorporated into the project plan. Additionally, he stressed the importance of verifying the legal status of the land, noting the prevalence of illegal land occupation in the area. In cases where forest land is involved, he underscored the necessity of obtaining a No Objection Certificate (NOC) from the Sindh Forest Department. Mr. Sadiq also requested a site visit to conduct a thorough assessment of the project's scope, particularly to determine which portions of forest land may be impacted and to provide guidance on compensation requirements.



5.3.4.3 Sindh Environmental Protection Agency (SEPA)

Brief Description of SEPA

The Sindh Environmental Protection Agency (SEPA) is responsible for administering and implementing the Sindh Environmental Protection Act of 2014. It focuses on pollution control, environmental conservation, and sustainable development.

Summary of KII with Mr. Imran Sabir

Stakeholder	Location	Date	Key Informant
SEPA	Korangi	5-12-2024	Imran Sabbir, Director Natural Resources

Mr. Sabir emphasized the importance of verifying and presenting all land documents to the Sindh Environmental Protection Agency (SEPA) for review. He advised that the project team must also obtain a No Objection Certificate (NOC) from the relevant cantonment authorities. Highlighting the prevalence of illegal land occupation in the area, he stressed the need for thorough verification of the land's legal status. He underscored the importance of ensuring that no mangroves are present within the project site, as they are a protected ecosystem and must not be disturbed. Mr. Sabir also raised concerns about the narrow access road leading to the project site. Given the project's large scale and the presence of nearby industrial areas, schools, and other facilities, he warned of the potential for significant traffic congestion during construction. He requested that the project team provide a comprehensive traffic management plan to address these issues and mitigate potential disruptions to the surrounding community. He stressed the necessity of conducting a comprehensive hydrological survey to assess the feasibility of the project in the area, considering factors such as water flow and drainage. He advised that the findings of the hydrological survey should be incorporated into the project report to demonstrate its viability and ensure that it does not adversely impact the local environment or infrastructure.

6 ANTICIPATED IMPACTS & MITIGATION MEASURES

6.1 Introduction

This section presents the screening process that identifies the environmental aspects and makes assessment of impact of different activities on the physical, biological and social environment. The screening process has through review of literature, primary as well as secondary baseline data, and expert judgment, made assessment of the potential impacts of said activities on the physical, biological, and socioeconomic environment of the Project. Mitigation measures have been proposed to reduce, minimize or compensate for the identified potential negative impacts and their adoption has been recommended. The report has taken cognizance of the construction activity which has intensified in the subject area during past few years.

The environmental aspects of the project as identified by situation analysis are related to the following:

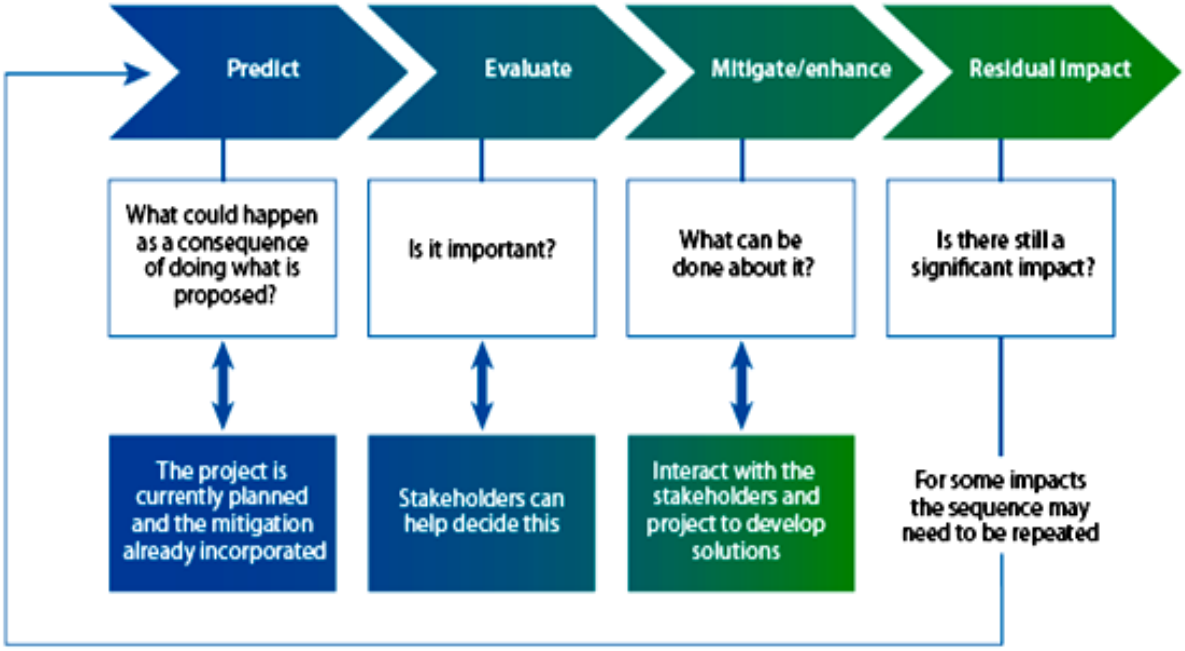


Figure 6.1 - Schematic of Impact Assessment

The environmental aspects of the project as identified by situation analysis are related to the following:

- Physical environment,
- Biological environment, and
- Socio-economic environment.

Screening of potential environmental impacts on the physical environment is related to:

- Siting of the Project
- Topography, Geology and Seismicity of the microenvironment
- Vulnerability of site to land erosion and liquefaction
- Availability of utilities including potable water at project site

- Air, water and noise pollution and other forms of nuisance during construction at site, and in the microenvironment (neighborhood) and macroenvironment of site
- Capacity of adjoining roads, traffic movement, and congestion, and
- Concerns on Security and Safety

6.2 Assessment of Aspects & Impacts related to Project Siting

- The ownership of the plot lies with the proponent and hence there is no question of land acquisition.
- The project site is primarily served by Korangi Crossing Road/Korangi Creek Road which connects with KPT Interchange towards northwest, eventually connecting with Korangi Road and Shaheed-e-Millat Expressway; southwards, it connects to deh Ibrahim Hyderi.
- To validate their claims on the site and on its being the only and hence the preferred alternative for establishment of their residential cum commercial building, the proponent is in process to obtain approvals from relevant government departments and agencies.
- This Project is not expected to cause displacement of population, loss of business and annoyance to the living environment, because the impacts will be limited to the built area of the complex having state of the art security, firefighting and fire prevention, traffic circulation and parking system for the occupants as well as visitors.
- The project site lies in proximity of Korangi creek Mangroves. However, necessary distances and buffers will be maintained and proportionate mitigation measures are devised to mitigate any impacts on the mangroves from proposed development.

6.3 Assessment of Impacts at the Construction and Operation Phases of Project

6.3.1 Building Stability

The proposed development will be a RCC framed structure. The different stages of construction including placement of foundation will have to be laid taking due consideration of the sub-soil structure, seismicity and liquefaction effects.

Mitigation Measures

The structural engineer(s) of the project will have to make sure that seismic considerations have been duly taken care of and Building Code (UBC)-2B, for moderate-to-severe seismic intensity has been adopted.

6.3.2 Erosion of Soil

Generally, the exposed soil after excavation for foundations is vulnerable to erosions and runoffs by rains. Such a situation is of temporary nature and short duration. It lasts only during the landscaping and concreting phase of construction at the site. Standards operating procedures have to be adopted to minimize the impact.

The following mitigation measures are recommended:

Mitigation Measures

- Covering the open soil during the construction phase till such time that the foundation is adequately concreted.
- Site will be appropriately covered all around to contain the fugitive dust emission within the microenvironment.

- Intensification in fugitive dust emission caused by erosion of soil will be mitigated by appropriate measures to reduce the level of impact to minor significance. Control of air emission during construction will be affected and the contractors will be mandated to adopt sound operating procedures such as the following:
- Exposed surface will be regularly wetted to effectively keep airborne dust levels to minimum
- Stockpiles of fine material will be wetted or covered with tarpaulin especially during windy weather conditions.
- Site workers will be mandated to wear dust masks especially during dry & windy weather conditions.

6.3.3 Excavation

The provision of foundation will require excavation below ground level. Once the material is removed, the void space will impact the integrity of the soil in the surrounding. Proponent will need to ensure the reduction of impact and safe disposal of the debris through the regular channel of waste contractors. The following mitigation measures will be adopted to protect the integrity of surrounding structures.

Mitigation Measures

Engineering study of sub-soil structure and impact analysis will be carried out to determine soil stability, load bearing capacity and geological and hydrogeological hazards.

It has been recommended that the piling, concreting and load testing has to be done under experts' supervision and nothing is left to speculation.

Fencing and obscuring the construction site to reduce the perception impact will be undertaken.

6.3.4 Construction Waste

Typical solid waste generated during construction includes wasted concrete, steel and wooden scaffolding, cement bags, excavated soil, wood remains etc. It is envisaged that the quantum of earth fill material will be significant. The waste generated has the potential to cause adverse impact on the surroundings if not properly managed and disposed to approved dumpsites by approved waste contractors. The excavated waste has the potential to block nearby drainage channels that could ultimately cause localized flooding, particularly during the monsoon season. Irregular storage of this waste may pose health hazards to the workers at site and commuters and visitors. The following measures have been recommended for management of the excavation procedure and disposal of construction wastes:

Mitigation Measures

- Site will be properly cordoned off by placing curtains all around.
- Unusable wastes will be transported to approved dumpsites.
- Excavated soil will have disposed of through the regular channel of the approved disposal contractor.
- Proper solid waste containers of adequate capacity will be provided to cater to daily waste generation.

6.3.5 Air Quality

The major source of air pollution during the construction phase will be dust emission due to earth works and gaseous emissions from construction equipment. The major source of air pollution when the Project is functional will be the pollutant emissions from the stand-by generators in case of

power breakdown and vehicular emissions from the entry and exit of owners and visitors' vehicles besides the emissions on and along the road.

Dust Emission: Particulate matter emitted during construction activities results in deterioration of ambient air quality in the vicinity of the source, and is usually a nuisance to the neighborhood and the communities in the neighborhood besides the construction workers. The main health hazards emanate from particles smaller than 10 microns (PM10) in particular PM2.5 as they are respirable. These particles are sufficiently charged to assume the properties of aerosols which on reaching the receptors have heavy impact on the respiratory system and on the surface of furnishings of the living environment. The impact on the environment would be considered significant if there is an increase in suspended particulate matter within and beyond the boundaries of the project site due to activities at the site, or if the dust affects local property or results in complaints from the community.

Potential sources of particulate matter emission during construction activities include earthworks (dirt or debris pushing and grading), exposed surfaces/storage piles, truck dumping, hauling, vehicle movement on unpaved roads, and concrete mixing and batching. The quantity of dust that is generated on a particular day depends on the magnitude and nature of activity and the atmospheric conditions prevailing on the day. Availability of Ready-mix on commercial scale has considerably reduced the level of emission of fugitive and construction sites are no longer required to have a batching plant.

The following mitigation measures have been recommended:

Mitigation Measures

- Water sprinkling and monitoring to ensure adequate suppression of dust will be a regular activity as long as the excavation activity lasts.
- Dust emission from soil piles and aggregate storage stockpiles will have to be reduced by appropriate measures like keeping the material moist by sprinkling of water at appropriate frequency and regularly monitored. Availability and use of ready-mix on commercial scale will considerably reduce the level of emission of fugitive at the project site.
- Construction materials that are fragile and vulnerable to raising visible dust will be transported only in securely covered trucks to prevent dust emission during transportation.
- The exposure of construction workers to dust needs to be minimized by provision of dust masks and mandating the workers to wear them.
- Vehicle and Equipment Exhaust: Combustion exhaust from vehicles and construction equipment can affect the ambient air quality of the site surroundings. The impact would be potentially significant when the ambient air quality deteriorates due to emissions from construction equipment and machinery or the generators etc. beyond the guidelines. The exhaust emissions include particulate matter, hydrocarbons, oxides of nitrogen, sulphur, and carbon.
- The emissions from operation of construction equipment and machinery as well as generators is not expected to be significant as to affect the ambient air quality of the area in view of enclosure of the construction area by curtains all around, provision of new equipment and machinery that should meet SEQS standards and will be duly maintained.

Adoption of following mitigation measures at the construction stage will ensure further reduction of emissions:

Additional Mitigation Measures

- All vehicles, generators and other equipment used during the construction will be properly tuned and maintained in good working condition in order to minimize emission of pollutants.

- The stack height of the generators will be vented through vertical stacks to minimize exposure at ground level.
- The noise and air emission from the project as a whole will be contained within its microenvironment by measures engrained in the design of the development. The mechanical area will be provided with noise abatement devices. Generator emissions will be controlled to acceptable levels by appropriating their locations and timely maintenance.

6.3.6 Construction Noise

Depending on the construction equipment used and its distance from the receptors, in particular the residents in the neighborhood and commuters travelling around the project roads, may be exposed to noise levels during the construction phase. The intermittent and peak noise levels are nuisance for living environment.

The following mitigation measures are recommended to reduce the noise level resulting from construction activities:

Mitigation Measures

- Reducing equipment noise at source by proper design, regular maintenance & repair of construction machinery and equipment.
- Minimizing noise impact from vehicles by lining the buildings with acoustic tiles and of back-up power generators by use of silencers and mufflers. Use noise-abating devices wherever needed and practicable.
- Introduction of meaningful traffic management plan in association municipal administration and traffic police department to restrain noisy vehicles from operation in the project area.

6.3.7 Occupational Health and Safety

Site-specific occupational health and safety hazards are also critical to be identified 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, chemical, and biological health and safety hazards. Contractor 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 or visiting the job shall review and acknowledge the JHA by their signature

Crane and Lifting Operations

For all Crane & Lifting Operations Contractor shall ensure full compliance with standard operating procedures. Contractor 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, Contractor 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.

Forklifts and Non-Road Vehicles

Contractor 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

Annual inspection shall be completed by a qualified third party, records of which shall be readily available at site.

Hazardous Substance Handling and Storage

Contractor should ensure that chemicals are handled and stored in accordance with the manufacturer recommendations found in the MSDS. Chemicals should be stored in a manner which will minimize releases to soil, groundwater or the atmosphere.

Containers and tanks which are used to store hazardous substances shall be:

- In good conditions
- Compatible with the material stored inside
- Closed when material is not being transferred into or withdrawn from them
- Flammable or combustible liquids shall not be stored in areas used for exits, stairways, or normally used for safe passages.
- Flammable chemicals shall be stored in flammable storage cabinets, room or building when the volume stored exceeds 25 gallons (95 liters).
- Electrical pumps shall not be used to transfer flammable or combustible liquids.
- Toxic chemicals shall be stored and handled as defined in the chemical MSDS.
- Explosive products should be handled and stored according to applicable regulations.
- Explosive storage shall be located away from corrosives, flammable, oxidizers, or acids.

Scaffolding

Contractor 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.

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.
- Administrative controls, such as job rotations and rest or stretch breaks will be implemented into the work processes.

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 away from walking paths, would be implemented.
- Excessive waste debris and liquid spills will be cleaned up regularly.
- Electrical cords and ropes will be located in common areas.
- Slip retardant footwear will be used where required.

Work at Heights

Falls from elevation associated with working with ladders and scaffolding are among the most common cause of fatal or permanent disabling injury at construction site. If fall hazards exist, a fall protection plan will be in place which includes one or more of the following aspects, depending on the nature of the fall hazard.

Mitigation Measures

- Training and use of temporary fall prevention devices, such as rails or other barriers able to support a weight of 200 pounds, when working at heights equal or greater than two meters or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface.
- Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards as well as fall rescue procedures to deal with workers whose fall has been successfully arrested.
- Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones, as well as securing, marking, and labeling covers for openings in floors, roofs, or walking surfaces.

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.

Other Site Hazards

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

Mitigation Measures

- It can be prevented through the implementation of project specific plans and other applicable management practices, including:
- Use of waste-specific PPE based on the results of an occupational health and safety assessment, including respirators, clothing/protective suits, gloves and eye protection.

Table 6.1 - 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		

6.3.8 Water Sourcing

Water required for construction activities would not be of such order as to result in its reduced availability for other consumers in the living environment (given that its sourcing will also not coincide with that of the public water resources). Conservation practices would nevertheless be adopted during the entire course of construction and operation.

Water will be obtained from city water supply, and in case of shortage, water bowsers will be utilized. The availability of ready-mix on commercial scale has greatly resolved the problem of availability of water in the initial stages. The drinking water need during the construction stage will be fulfilled through bottled from a bottled water supplier of repute. For operational phase, groundwater will be used through RO plant.

Adherence to the following measures will ensure efficient use of water during the subsequent stage of construction and operation:

Mitigation Measures

- Option for recycling of the wastewater and regeneration of the potable water from groundwater resources by adequate treatment may have to be explored since adequate water supply to the Karachi residents in the core areas is not assured despite the fact that the authorities are aware that the needs remain unfulfilled while the exorbitant taxes are unbearable.
- A complete record of water consumption during the construction and operation phase will be maintained.
- Water conservation practices will be adopted to prevent wastage of water.
- The water supply lines will be checked and repaired for leaks, if any, in order to reduce wastage of water.
- Use of water efficient sanitary fittings such as low flush toilets, water efficient shower heads, and aerators on faucets are recommended.

6.3.9 Soil Contamination

During the construction, the contractor shall be mandated to follow the SOPs with regard to handling, storage, transfer, use and final disposal of contaminants, if any by the proponent.
The following measures will continue to be adopted during the construction stage to reduce the chances of soil contamination:

Mitigation Measures

- Fuel oils, lubricants, and chemicals will be stored in designated areas, underlain with impervious lining. The construction site(s) will be provided with hard cover or tarpaulin lining to prevent contamination of soil.
- Washing and maintenance of vehicles and equipment will only be carried out at designated areas.
- 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.
- Contaminated soil will be removed and properly disposed after treatment such as by incineration by SEPA certified contractor.
- Hazardous Substances Rules 2014 will be adhered to for storage, transfer, subsequent handling and final disposal of any chemicals/substances during the operation stage.

6.3.10 Operation of Vehicular Traffic

The road network serving the project area includes Pakistan Refinery Road, Korangi Creek Industrial Park Road, Salim Habib University Road and Korangi Creek Road.

It is envisaged that there would be an increase in the flow of traffic volume during the construction phase. During the operation phase the project will have trip generation and attraction by residents, office staff and visitors. Vehicular traffic management will have to be undertaken seriously to restrain unnecessary traffic jams that may cause annoyance to the commuters travelling on the roads surrounding the project. The forthcoming construction activity is not likely to have adverse cumulative impact on the present flow of volume. The project provides sufficient parking as per Cantonment bylaws. The proponent is mandated to have their own traffic management plan which takes account of the traffic volume generated by future expansion in the area.

Existing Major Junction within the Study Area

a) Junction 1

This junction is a three-legged un-signalized junction. It is located between Korangi Creek Road and Pakistan Refinery Road. At this junction, turning movement counts would help to determine the traffic coming to and from the development from all directions.

Figure 6.2 - Existing Major Junctions within Project Area

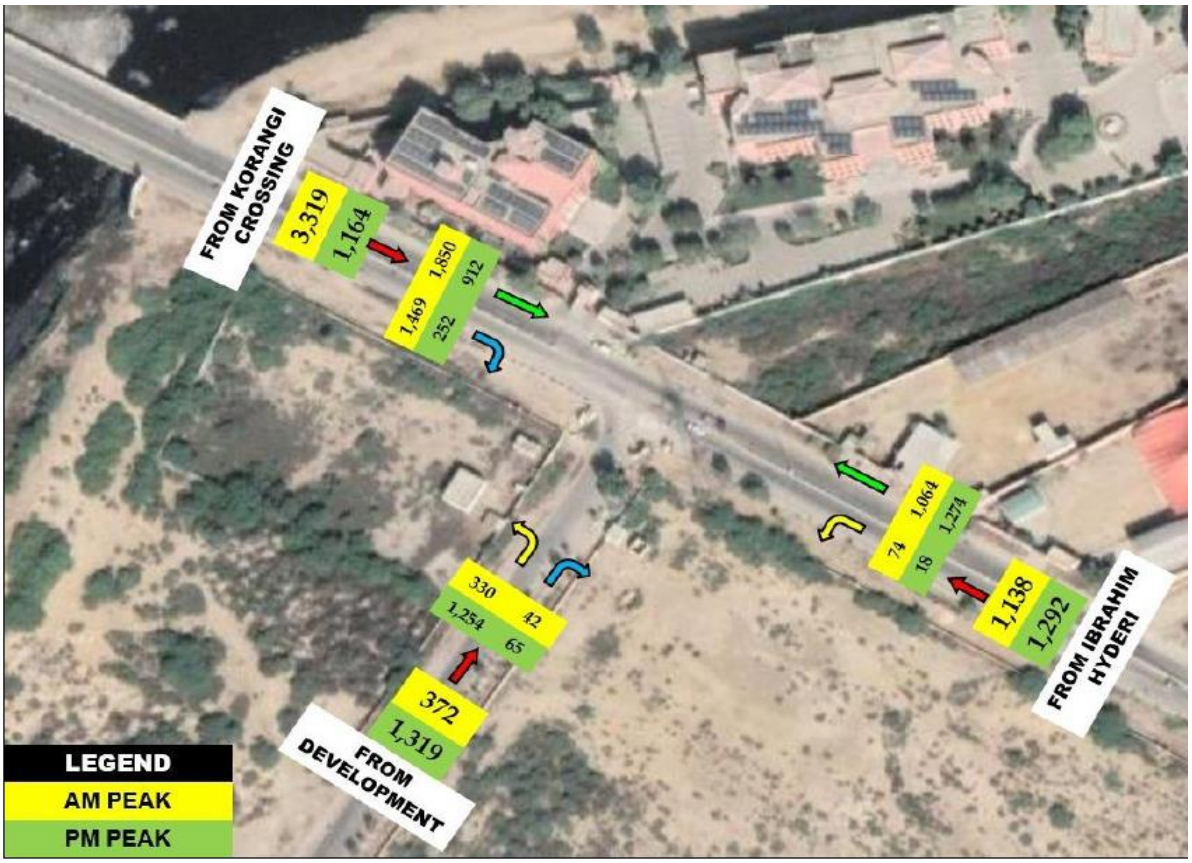


Figure 6.3 - Turning Movemenet Count Survey Data on Junction 1

Expected Junctions after the development of Project

Junctions 2,3 & 4 do not exist today but after the development of the project these junctions will play a vital role in entering and exit of project's traffic. These junctions will connect all three entrances of the project with the 100 feet wide external road.

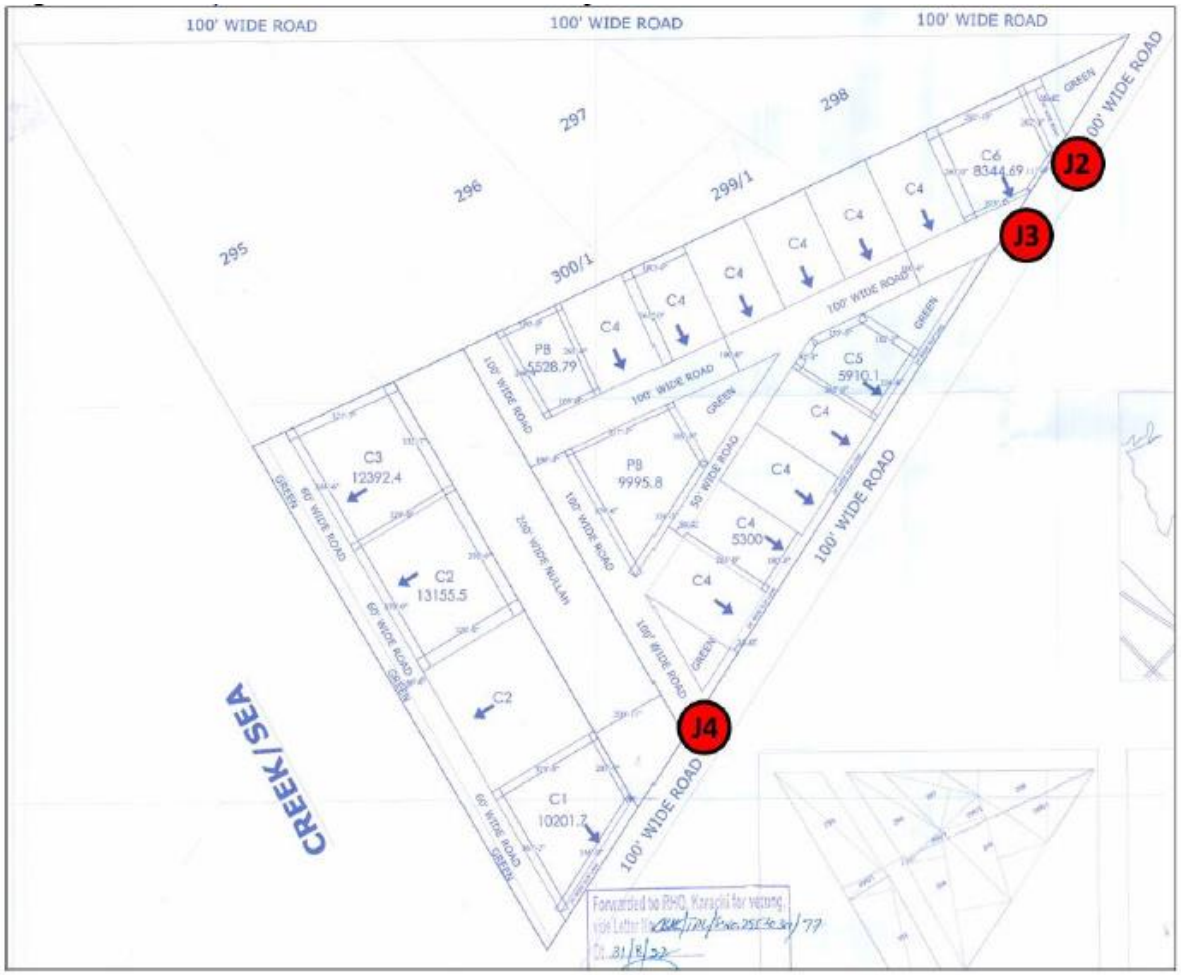


Figure 6.4 - Expected Junctions near Project

Mitigation Measures

The following mitigation measures will be adopted to remove the constraints to smooth flow of traffic:

- Heavy traffic during construction; phase will come to the project site during late night hours.

- Project vehicles shall not be fitted with pressure horns.
- Designated parking areas will be provided for different type of project vehicles within project site.
- Traffic management plan will be introduced to manage smooth flow of vehicular traffic and to avoid traffic jam and long queues. It will be implemented and monitored.
- Vehicles will be parked at designated parking areas during operational phase.
- Parking of vehicles alongside the road would be prohibited at all times.
- The internal analysis can only be performed in only with development scenarios therefore it has been performed for both future target years i.e., 2030 & 2040 in only with development scenarios.

Scenario No.	Scenario Name
Scenario 1	2030 - With Development
Scenario 2	2040 - With Development

From the results it is evident that in 2030 & 2040 in both without and with development scenarios delays are very high and are not in acceptable limits for urban areas and need to be mitigated. However, on other junctions' delays are very low and are under acceptable limits.

Analysis Results for External junctions for Morning Peak

Delay Results (Sec) - AM Peak											
S. No.	Junction	2023		2030				2040			
				Without Development		With Development		Without Development		With Development	
		Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS
1	Junction 1	17.45	C	24.58	C	89.70	F	130.93	F	228.51	F
2	Junction 2	-	-	-	-	9.00	A	-	-	13.91	B
3	Junction 3	-	-	-	-	2.59	A	-	-	18.92	C
4	Junction 4	-	-	-	-	2.18	A	-	-	6.30	A

Analysis Results for External Junctions for Evening Peak

Delay Results (Sec) - PM Peak											
S. No.	Junction	2023		2030				2040			
				Without Development		With Development		Without Development		With Development	
		Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS
1	Junction 1	22.43	C	29.71	D	32.81	D	47.17	E	130.86	F
2	Junction 2	-	-	-	-	10.85	B	-	-	12.14	B
3	Junction 3	-	-	-	-	0.06	A	-	-	18.07	C
4	Junction 4	-	-	-	-	0.02	A	-	-	9.38	A

From the results it is evident that in 2030 & 2040 in both without and with development scenarios delays are very high and are not in acceptable limits for urban areas and need to be mitigated. However, on other junctions' delays are very low and are under acceptable limits.

The main reason behind the increase in delay in future scenarios is that in base case, this junction is un-signalized and only one lane in each direction is operational on Pakistan Refinery Road. In the above scenario, the delays are calculated by having the same configuration and without any improvement which is causing high delays.

To mitigate this, it is suggested to:

1. Signalize the Junction 1
2. Increase lanes on Pakistan refinery road from 1 to 3 as 100 feet right-of-way (ROW) is available on that road.

After taking these mitigation measures in the traffic model the results are significantly improved as shown in the Tables below.

Results for External junctions for Morning Peak after mitigations

Delay Results (Sec) - AM Peak											
S. No.	Junction	2023		2030				2040			
				Without Development		With Development		Without Development		With Development	
		Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS
1	Junction 1	17.45	C	40.25	D	43.90	D	59.84	E	64.15	E
2	Junction 2	-	-	-	-	9.00	A	-	-	13.91	B
3	Junction 3	-	-	-	-	2.59	A	-	-	18.92	C
4	Junction 4	-	-	-	-	2.18	A	-	-	6.30	A

Results for External Junctions for Evening Peak after mitigations

Delay Results (Sec) - PM Peak											
S. No.	Junction	2023		2030				2040			
				Without Development		With Development		Without Development		With Development	
		Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS
1	Junction 1	22.43	C	21.14	C	27.49	C	23.93	C	43.81	D
2	Junction 2	-	-	-	-	10.85	B	-	-	12.14	B
3	Junction 3	-	-	-	-	0.06	A	-	-	18.07	C
4	Junction 4	-	-	-	-	0.02	A	-	-	9.38	A

6.3.11 Wastewater Generation & Disposal

Construction Phase: Disposal of domestic effluent from the construction site has to be adequately managed so that the wastewater flows into the regular channel and does not contaminate the soil and groundwater of the site or its surrounding.

Mitigation Measures

The following mitigation measures will be adopted in the subsequent stages of construction:
Wastewater generated will be routed to the nearest drain / sewerage system through Septic tank.
Sewage will not be mixed with any other waste.

Operation Phase: The project on becoming functional will generate wastewater that will be mainly sewage. Small quantities of hazardous wastewater may be produced during the maintenance activities in the building (such as oily water etc.). RO reject water will also be produced.

The source of wastewater will include toilets, washrooms, laundry, kitchen and restaurant. The wastewater so produced will comply with the SEQS values provided that other hazardous wastes (i.e., paints, solvents etc.) are not mixed with it. The impact of disposal of such wastewater would not be significant since it is expected to comply with the Sindh Environmental Quality Standards (SEQS) for municipal effluent.

Waste water will be treated at source and the grey water will be separated from black and recycled into a separate channel for use in the washrooms. This is expected to substantially reduce the water footprint. The final discharge would be routed to the existing municipal drain/sewerage system.

Mitigation Measures

Following mitigation measures will be adopted for effective management of wastewater during the operation stage of project:

- It is recommended that a package-type sewage treatment plant is installed comprising of primary and secondary process to treat the sewage water to keep the discharge under SEQS limit. The treated water then can be used for irrigation/landscaping.
- Waste segregation measures would be employed to minimize entry of solid waste into the wastewater stream.
- Water conservation strategies will be employed to avoid wastage of water.
- In case RO plant is used as augmented source of water during operations, RO reject will either be disposed into allocated drain after dilution with raw water or with sewage discharge from outlet of septic tank/sewage treatment plant.

6.3.12 Solid Waste Generation and Management

Construction Phase: The construction phase of the project is expected to generate wastes including; packing waste; scrap, excess construction materials and debris, domestic wastes from construction camp, empty containers and drums, used lubricating oils and chemicals etc.

The impact of solid waste disposal would be significant if the waste management is not carried out appropriately. Also, if excessive wastes are generated, recyclable wastes are not recycled, wastes are scattered, handling of wastes will result in contamination, and wastes are improperly disposed of, the result would be serious degradation of the environment.

Waste generated as a result of construction activity will be inherently less reactive and chemically inert under normal conditions however, its handling and storage may pose adverse impacts of minor nature which could be controlled by employing the recommended mitigation measures in the ESMP.

Mitigation Measures

A waste management plan will be developed for the construction stage of the project. The following will be the key elements of the waste management system:

- Separate bins will be placed for different type of wastes - plastic, paper, metal, glass, wood, and cotton.
- Recyclable material will be separated at source. The recyclable waste will be used in house or sold to waste contractors for recycling.
- Non-hazardous non-recyclable wastes such as kitchen wastes will be disposed of in landfill site managed by municipal administration or approved waste manager/contractor.
- No wastes will he dumped at any location outside the site boundary.
- All hazardous waste will be separated from other wastes. Hazardous wastes will be stored in designated areas with restricted access and proper marking. Hazardous wastes will be disposed of through EPA approved waste manager/contractor.
- Surplus construction materials including partially filled chemical and paint containers will be returned to suppliers. Inert construction wastes will be disposed of onsite as fill material or sold as scrap to contractors.
- Records of all waste generated during the construction period will be maintained. Quantities of waste disposed, recycled, or reused will be logged on a Waste Tracking Register.
- Training will be provided to personnel for identification, segregation, and management of waste.

Operation Phase: Project will generate solid waste from residential units and commercial units of the project. In Karachi, the per capita waste generation has been estimated at 0.613 kg per day25 in the core areas like Defence Housing Authority and Clifton. Commercial and institutional waste fraction equal to 40% of the residential sector[26].

The solid waste will mainly include food waste, paper and packaging material, plastic bottles and glass. If not properly managed and disposed of, this can pose serious environmental threat of pollution not only to the occupants and visitors to the complex but also to the surroundings.

Solid waste management however remains an unresolved problem in Karachi. Several options have been proposed and also implemented but none of them could resolve the problem. The solution perhaps lies now in the attempts that the Sindh Solid Waste Management Board has launched on. The SSWMB has taken a holistic view of the situation and has integrated a number of options that may at least partly alleviate the heavy impact of indiscriminate disposal of waste which Karachi is faced with.

Mitigation Measures

The following measures would reduce the negative impacts of solid waste disposal:

- All solid waste shall be segregated into organic and recyclable waste at source and then collected, stored, and transported for ultimate safe disposal.
- Handling & disposal of solid waste shall be managed by a dedicated waste management contractor.
- The solid waste management plan shall be developed and implemented and facilities for collection, storage will be ensured.

6.3.13 Seismic Hazards

The area presents a moderate to high hazard potential for earthquake activity. The seismic zone map of Pakistan has divided the country into 4 seismic zones ranging in term of major, moderate, minor and negligible zones with respect to ground acceleration values. Under this zoning the project site lies in the moderate to high hazard zone with minor to moderate damaging impact.
The recently developed guidelines for earthquake design of buildings in Karachi have assigned an expected Peak Ground Acceleration'(PGA) value of 0.20g for larger buildings. This would place the project site within Uniform Building Code (UBC) Zone 2B. The expected intensity according to the Modified Mercallis Scale (MM) would be VIII and higher.

6.3.14 Energy Use

Electricity during construction phase will be produced from diesel generators, whereas during operation phase, power supply from KE shall be made available. A back-up diesel operated generator will also be installed in case of emergency or suspension of power supply from the mains. The power produced will be significant in terms of costs both environmental and economic. Since energy produced from non-renewable resource results in higher COx, SOx, and NOx emissions, it is important to ensure that energy is used prudently and best management practices are adopted in building design.

Mitigation Measures

- Gensets will be installed with stand-alone or isolated foundation with proper anti-vibration packing/pad, etc.;

[25] Data Collection for Preparation of National Study on Privatization of Solid Waste Management in Eight Selected Cities of Pakistan
[26] Study conducted by the consortium of National Consulting Engineers of Pakistan, Waste Management Pakistan (Pvt.) Ltd. and Sembwaste Pte. Ltd. in 2005

- Proponent shall necessarily install a source of standby power back up for the buildings and installation of genset by individuals will be prohibited.
- Proper maintenance as per following can reduce the pollution level and increase the Genset life.

6.3.15 Fire Hazards & Life Safety

Fire incidents in multistorey buildings have garnered significant attention in the fire safety over the years. The design of life safety systems is a multidisciplinary solution with the architect detailing the fire stairs, evacuation routes, areas of refuge as well as the fire rating of the shafts and internal fire separation within the building. The structural engineers will specify the fire-retardant materials that will protect the structure. They have designed the active systems in the building to provide a comprehensive fire detection and management system in line with the overall fire and life safety strategy.

Mitigation Measures

The following mitigation measures have been proposed:

- Portable Fire Extinguishers shall be strategically located next to the fire hose reels throughout the building to cover all the spaces.
- Two types of extinguishers shall be installed
- Dry Powder
- Carbon Dioxide
- Fire Hydrants shall be installed as per NFPA-14.
- These shall be provided with the quick – connect couplings compatible to Fire Brigade use.
- Fire Brigade inlet connection shall be provided at the Ground Level.
- These connections shall allow the Fire Brigades to their water supplies & pump into the Fire Suppression System.

Fire Detection

Smoke detectors are installed in all the apartments & lobbies.

Fire-rated Walls

The stairwell walls are designed to have a fire-rating of 2 hours Apartment party walls & internal walls have a fire-rating of 60 mins & 30 mins respectively.

Pressurized Stairs

The stairwells are closed and pressurized.

Automatic Fire Sprinkler

Automatic sprinkler system has been proposed for the entire building

Fire-hose Cabinets

Fire-hose cabinets are provided at regular intervals on all floors. Fire-fighting line supplies water from two main water-reservoirs in the complex. Each reservoirs has a reserve capacity of 100,000 gallons for fire-fighting

Fire Hydrants

Fire hydrants provided at regular intervals along the internal ring road. Pressure at the fire hydrant is at 16 bar, allows water to reach top of the towers.

Voice evacuation system

Corridors and lobbies will be equipped wth a so-phisticated evatuation system which will come into action in a case of emergency

6.3.16 Materials Selection

General specification/details have been worked out in respect of type of structures, concrete, and all other materials required for the project. The following measures will be adopted to ensure sustainable development of the Project:

Mitigation Measures

- The construction materials in use will conform strictly to the requirements of the project by critically following the ASTM standards. It has been observed that the fire is caused in Karachi by initiating ignition of the combustible plastic materials. Use of plastic materials should be reduced as far as possible and the architects will be mandated to certify that the fire-retardant properties are critically followed.
- The structures and materials will, in the subsequent construction stage, conform to recommended standards and follow standard practice of civil works.
- Materials including paving stones, crush, gravel and sand will be brought from commercial quarries located in Sindh province. Environmentally sound materials and goods will be selected, with priority being accorded to products meeting national and international standards.
- Traditionally well-tried materials and components will be selected and selection of construction materials would be based on sustainable source.
- The production, use and disposal of building materials during the construction stage will utilize considerable amount of energy and resources; all attempts will be made towards efficient consumption and minimization of wastage of water, energy and materials.
- Best practice of energy efficiency will be adopted in the building design. The Project would be constructed with high level of thermal insulation.
- The environmental impacts arising from selection of building materials and components would take account of the environmental issues during the materials selection process, and introduce Recycling strategies such as Reuse and Reduction of Wastewater.

6.3.17 Impacts on Ecology

The project lies adjacent to Gizri Creek. The Malir River is discharged directly into the Gizri Creek and the creek is influenced by Arabian sea through tidal variations. Malir river discharges its domestic and industrial waste into the creek as well and due to the connection with the sea, salinity of water is high. Mangrove trees are surviving and growing in the creek. Tall trees of Mangrove (about 6-7 ft.) are located close to the western boundary of the project site. The specie grown over the area is Avicennia marina.

6.3.17.1 Flora

Given that the mangroves have adapted to and continue to grow and thrive despite the dumping of wastewater in the creek, and given that no mangroves will be removed under the project, it is not envisaged that there will be major impacts on the mangroves present.

6.3.17.2 Avi-Fauna

The avi-fauna present within the mangrove species adjacent to the site may be impacted from project activities also, where the potential impacts are highlighted below:

- Construction activities during construction, and then the occupational activities during operation would contribute towards noise pollution that may disturb avifauna in the area
- Artificial lighting employed under the different phases of the project may disrupt bird's nocturnal behaviors, navigation, and breeding patterns

- The development of buildings in the area may change the micro-climate of the area including wind patterns, shade, and temperature, potentially making the habitat less suitable
- Disruption in movement patterns due to the presence of large buildings leading to collisions which may result in injury or death

Mitigation Measures

The mitigation measures proposed to address these impacts include:

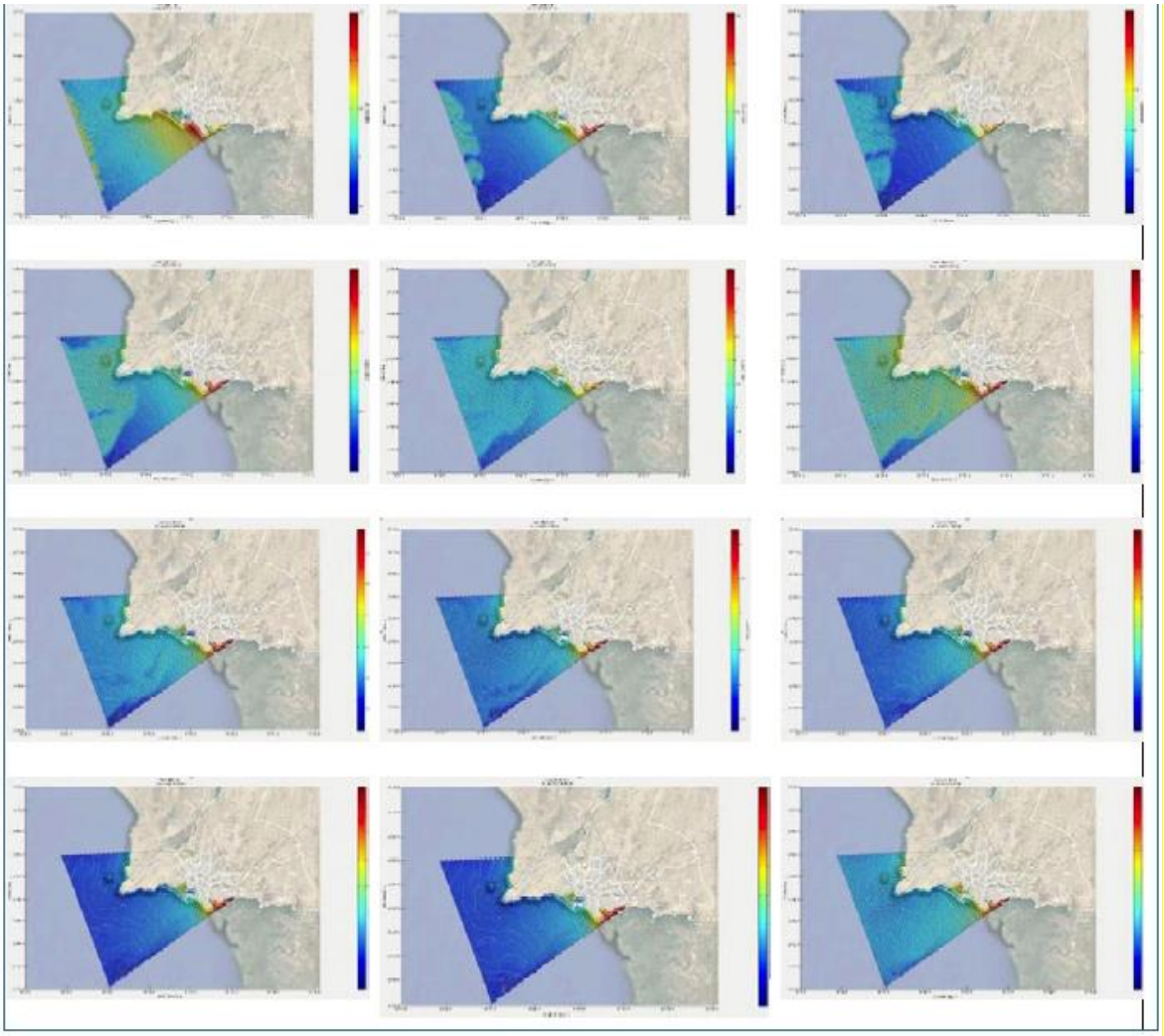
- Maintaining a buffer zone between the mangroves and the development to reduce direct impacts
- Install downward facing lights to avoid upward or outward glare
- Prevent runoff and pollution through proper drainage and containment systems
- Incorporate native plants into landscaping to provide alternate habitats and food sources
- Raise awareness about protecting mangroves and wildlife among workers and residents
- Using patterned or frosted glass to break reflections and make windows visible to birds or installing glass with ultraviolet patterns that birds can see but are less noticeable to humans
- Use matte or opaque materials on portions of the façade to reduce reflections and avoid potential collisions
- Use smart lighting systems which are timer controlled or motion sensitive
- Avoid placing vegetation directly behind large windows, as birds may mistake it for a clear flight path
- Position buildings to minimize interference with flight paths, especially near the creek area or corridors birds use to access mangroves.
- Conduct bird carcass monitoring at a specified frequency to ascertain the efficiency of measures installed and employed, to allow for the presence of a corrective mechanism that can address any further impacts that may arise.

6.3.18 Flood Risk

The project site is in the proximity of Gizri creek, whose tidal effects are dampened by the presence of mangroves along western boundary of proposed development. In the rainy season, creek receives heavy water flow from Malir River, with millions of gallons emptying eventually into the Arabian Sea. The project site is expected to be naturally protected from this seasonal rise in the flow of water through presence of mangroves. This is supplemented through a detailed study carried out by the proponent through the National Institute of Oceanography, where the detailed study is attached to this report as an annex.

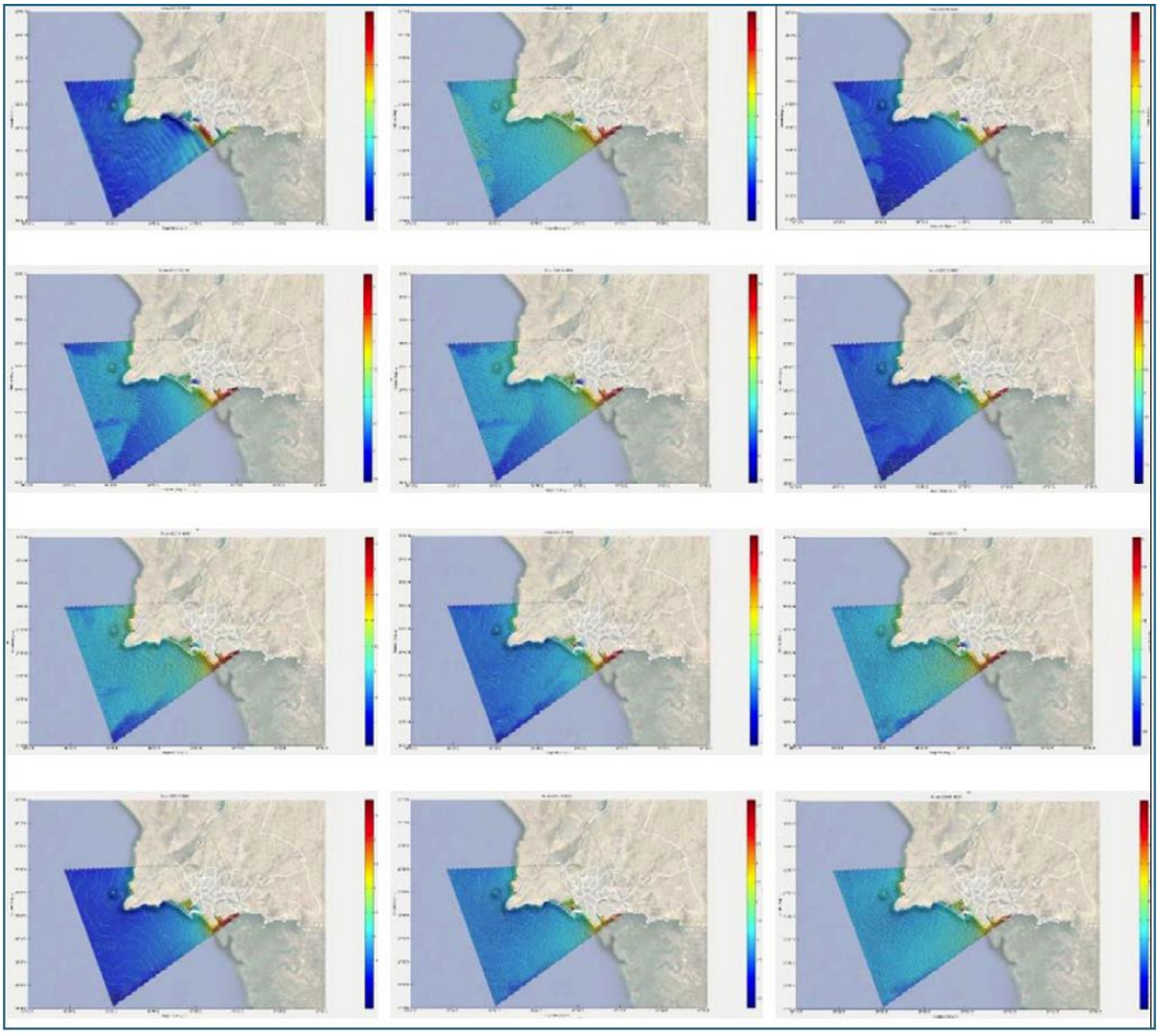
To analyze the anticipated level of damage (if any) from flowing events, scenario based numerical models were prepared to assess the extent of water inundation that could potentially cause harm to the creek areas. Various scenarios were analyzed and evaluated to determine which scenarios could cause damage and to the extent of this damage:

Numerical Model near Karachi Coast at 30-43 m/s wind speed



The modelling above highlights for wind speeds varying between 30-43 m/s, the water level reaches a maximum of 2.5 m.

Similarly, modelling was also carried out for the continued winds at the higher end of the spectrum, i.e., 43 m/s, where the results are provided below:



The modelling above highlights for continued wind speeds at the higher end of the spectrum at 43 m/s, the water level reaches a maximum of 3.5 m.

To properly address this impact, NMCS has incorporated the following measures:

- Development of the project at an elevation higher than the high flood line highlighted and obtained above through modelling conducted
- Development of a breakwater along the periphery of the development that would absorb shocks and dissipate energy from wave action, and simultaneously protecting the retaining wall of the development from any erosion or weakening.

Following the implementation of these measures, the flood risk impact will be medium to low, where to further reduce the severity of this impact, the following mitigation measures are also proposed:

Mitigation Measures

- Submersible pumps should be installed in the basements.
- Buildings at the proposed development have been designed to be elevated from the ground level. This includes moving key or essential equipment from low-lying elevations within a structure to areas that would not be subject to potential flooding.
- Adequate drain to cater the stormwater at the site will be constructed

- Measures for dry floodproofing may also be considered, such as;
- Applying a waterproof coating or membrane to the exterior walls of the buildings where required
- Installing watertight shields over doors, windows and other openings;
- Installing backflow valves in sanitary and storm sewer lines;
- Raising utility system components, machinery and other pieces of equipment above the flood level;
- Installing a sump pump and foundation drain system;
- Strengthening walls so that they can withstand the pressures of floodwaters and the impacts of flood borne debris.

6.3.19 Potential Impacts on Socio-Economic Environment

- Health, Safety and Environment (HSE) are major components of the Environmental and Social Management Plan (ESMP) of which monitoring of the environmental performance is an integral part. The proponent has to ensure strict adherence to the measures and guidelines stated in the ESMP and the contractor must be made to follow the Standard Operating Procedures for construction activities.
- It is not unusual to observe that construction workers are left on their own to protect themselves from imminent hazards. Accidents usually occur at unprotected sites and are incident on unprotected workers. HSE considerations require that precautions must be taken against even the most insignificant impacts.
- Major social concerns during the construction stage arise when: i) the stakeholders are not informed about the project or its schedule of operations; ii) the site is not appropriately cordoned off to restrain outsiders from entering the site; iii) construction crew invariably ignores or sidetracks the mandatory requirement of wearing PPE; iv) construction crew is not pre-trained to be aware of the likely hazards during various stages of the project; v) even if they are trained on awareness and provided the PPE the lukewarm attitude of the supervisors does not oversee the follow-up of HSE procedures/SOPs.
- Safety risk assumes substantial proportion in densified areas of urban centers. Under the circumstances there is need for strict compliance with the HSE procedures and accidents incident on non-observation of HSE procedures must be keenly monitored and recorded to ensure the safety of both workers and citizens. For this purpose, the contractor will be required to maintain a record of procedures on Health, Safety and Environmental Management Plan and Standards Operating Procedures in addition to the following:

Mitigation Measures

- Provide alternative traffic arrangement/detours, if necessary, so that traffic can be distributed and move on different roads; & ensure that public/residents association is informed about such traffic diversions;
- Provide information to the public through media –newspapers and local cable television (TV) services about the need and schedule of work, and alternative routes;
- Maintain transparency of the project, public information/caution boards must be provided at the work site – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work; traffic diversion details, if any; entry restriction information; competent official's name and contact information for public complaints.
- Restraining access to the public from the site by enclosing/barricading the construction area; providing warning boards and sign boards and positioning security guards throughout the day and night, 07/24;
- Ensuring provision of PPE (helmet, hand gloves, boots, masks, safety hoists when working at height, etc.) and making sure that all workers do wear them;

- List the code of conduct and standard operating procedures (SOPs) to be followed during different stages of construction;
- Employ an Environmental, Health and Safety (EHS) expert on site;
- Provide on-site Health and Safety Training for all site personnel;
- Report accidents to the authorities promptly, and maintain records on regular basis
- Temporary inconveniences due to construction works will be minimized through planning and coordination with community members and organizations e.g. Traffic Management Authorities.
- The proposed project will create employment during its construction and operation phase. During construction, over 150 people are expected to be employed. The Project will also create employment opportunities after completion. This also includes staff directly involved in the operation and management of the facilities that include the building management, the staff engaged by the residential flats, domestic servants, security personnel, and drivers.
- Most of the workforce shall comprise local people as part of project's Corporate Social Responsibility. The generation of employment is likely to be a major positive impact arising from the proposed development.

7 CUMULATIVE IMPACT ASSESSMENT

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones (IFC Good Practice Handbook).

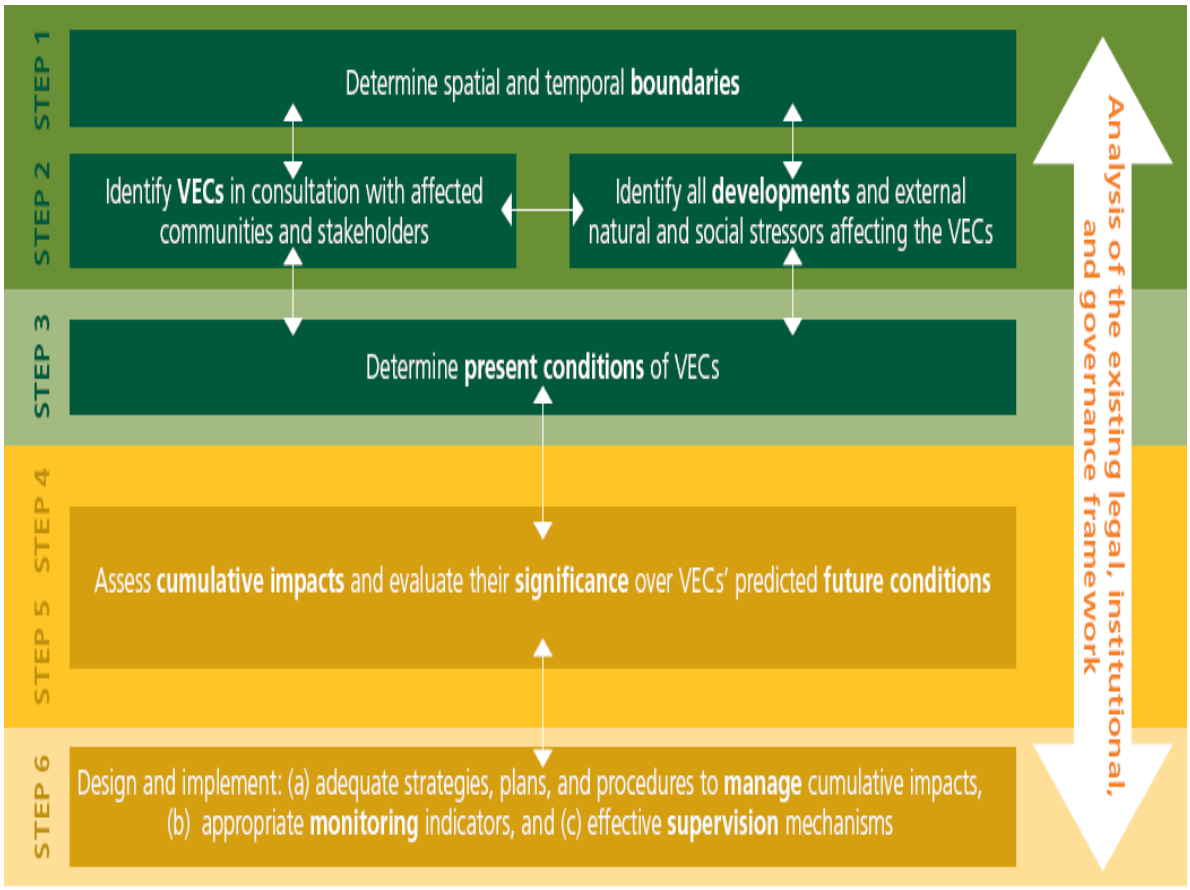


Figure 7.1 - Six Step Approach of Rapid Cumulative Impact Assessment
Source: IFC Good Practice Handbook

7.1 Assessment Scenario

In this section of the report, the spatial and temporal boundaries of the "The Mangrove Creekside Development" have been assessed.

Assessment of Temporal Boundaries

The Mangrove Creekside Development in construction and operation with the following 1000-meter radius of Area of Influence (AOI) projects that have the potential to affect Valued Environmental and Social Components (VECs). A list of all potential receptors in the area has been given below.

7.1.1 Temporal Boundary Overlapping Scenarios

There are two possible temporal boundary overlapping scenarios which can be explored:

1. Scenario A – "The Mangrove Creekside Development" in construction with Korangi Creek Industrial Park in construction.
2. Scenario A – "The Mangrove Creekside Development" in operation with Korangi Creek Industrial Park in full operation and Salim Habib University in operation.

Table 7.1 - Receptors nearby the Project

S. No	Name/Type of Receptor	Distance (m)
1	Korangi Creek Industrial Park	800
2	Salim Habib University	860

7.1.2 Assessment of Geographical Boundaries

There are not many developments exist at present in the project vicinity. The following figure shows the geographical locations of NMCS and other developments in 1000 radius of Area of Influence (AOI) projects.

Figure 7.2 - Nearby Developments

An estimation of the distances between the and the "The Mangrove Creekside Development" has been given above.

7.2 Identification of Valued Environmental and Social Components (VECs)

VECs are environmental and social attributes that are considered to be important in assessing risks. VECs may be directly or indirectly affected by a specific development, they often are also

affected by the cumulative effects of several developments. VECs are the ultimate recipient of impacts because they tend to be at the ends of ecological pathways.
The following VECs have been identified in this section:

- Air shed and its quality
- Noise
- Water shed and its quality
- Soil and its quality
- Sediment transport
- Community Health, Safety & Security
- Traffic congestion

The present conditions of the above VECs have been documented in Chapter 4 of this report.

7.3 Assessment of Cumulative Impacts on VECs during construction of "The Mangrove Creekside Urban Development".

7.3.1 Impacts on Air Quality

The major sources of air emissions from the proposed development construction phase will be the stack emissions from stand by diesel generators, construction vehicles and fugitive dust emissions from construction activity. The significant components of combustion emissions are NOx, SO2, CO, CO2 and fine particulate matter less than 10 microns (PM10) and dust from construction activity.

The cumulative effect of these emissions coupled with those from the construction of the Korangi Creek Industrial Park to be considered. Operations of Korangi Creek Industrial Park and others coupled with construction of proposed does have cumulative impact on air quality due to the generation of dust from construction activity and emissions from industrial units such as Thal Engineering. Temporary inconveniences due to construction works will be minimized through planning and coordination with community members and organizations.

7.3.1.1 Existing Controls

Construction impacts to air quality at proposed development site will be mitigated through construction management practices such as the implementation of suppression measures for fugitive dust and gaseous emissions. Mitigation of emissions from vehicles and other engine-driven construction equipment will include proper maintenance and controlling unnecessary idling of equipment.

7.3.1.2 Significance of Impacts

Emissions from construction of proposed development are expected to have limited overlapping with those emitted from the construction of Korangi Creek Industrial Park due to prevailing wind direction, and construction-related air quality impacts are expected to be temporary and localized. The cumulative air quality impacts from construction of proposed development Project concurrently with construction of Korangi Creek Industrial Park are considered to be minor. An evaluation of impacts is summarized in Table below.

Table 7.2 - Evaluation of Cumulative Impacts from Air Emissions

Impact	Emissions from construction of proposed development (NOx, SO2, CO, PM10) in combination with emissions of dust, vehicles and equipment associated with the construction of nearby developments

Impact Magnitude	Emissions from construction of proposed development would be small and localized to the construction areas.				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	Due to temporary inconveniences due to construction works, the receptor sensitivity will be medium.				
Impact Nature	Negative	Positive	Neutral		
	Impacts to air quality are considered to be negative impacts				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will only last for the duration of construction of TTZ				
Impact Extent	Local	Regional	Global		
	Impacts would be limited to the project sites.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as medium due to the medium receptor sensitivity.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a medium receptor sensitivity and medium impact severity results in an overall moderate significance.				

7.3.1.3 Additional Mitigation Measures, Management and Monitoring

No further controls are required except the in-place controls stated In the ESMP of the ESIA report.

7.3.1.4 Significance of Residual Impacts

Upon compliance with applicable standards in the EMP, if emissions are controlled to within applicable standards through the use of best practices and monitoring, residual impacts may be reduced to negligible.

7.3.2 Impacts from Noise Emissions

The main sources of noise generated from construction of proposed development, along with the construction of nearby developments, include the following:

Table 7.3 - 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
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

Clearing		Structure Construction	
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			

Noise will also be generated during construction works such as pile-driving, earthworks, etc. Acoustic effects in the barren land are expected to echo the noise, especially during activities with sharp bursts of noise such as those emitted during piling.

The SEQS stipulate that ambient noise levels should not exceed 65 dBA at day and 55 dBA in commercial area. Monitoring of Noise is conducted in the vicinity of project areas pre-construction and the overall results were found within the limits of SEQS except at some instances during daytime. Noise monitoring plan will be followed as per EMP.

The project located in Korangi Creek Cantonment, Karachi at the extreme southern end along Gizri Creek. In macroenvironment, Korangi Creek Industrial Park (KCIP) is located in the north of the project site and Pakistan refinery in the east. The project borders the Gizri Creek at its southwestern boundaries. During construction phase of proposed development and nearby development, the noise, albeit local, would likely exceed OSHA limits for construction site.

Nevertheless, noise impacts are expected to be associated more with construction rather than operation of the sites.

7.3.2.1 Existing Controls

During construction of Mangrove Creekside Development, periodic monitoring of noise at the nearest receptors will be carried out. If noise levels exceed guidelines, the equipment suppliers will be required to reduce noise at the source in order to meet ambient noise targets. Additionally, noise-producing equipment will be placed inside acoustic enclosures to reduce noise at the source. Other measures include:

- Selection of up to date and well-maintained plant with reduced noise levels.
- Providing residents with advance warning of construction activities.
- Use noise-abating devices wherever needed and practicable.
- Where possible, confining noisy work to normal working hours in the day.

7.3.2.2 Significance of Impacts

Significance of impacts is expected to be minor. An evaluation of impacts is summarized below.

7.3.2.3 Additional Mitigation Measures, Management and Monitoring

The Project ESMP will provide procedures for contractors to ensure minimization of noise and a monitoring program that maintains compliance with applicable standards.

7.3.2.4 Significance of Residual Impacts

Upon compliance with applicable standards presented in the ESMP, if noise levels are controlled to within applicable standards through the use of best practices and feedback monitoring, residual impacts may be reduced to negligible

Table 7.4 - Evaluation of Cumulative Impacts from Noise Emissions

Impact	Noise from Construction of proposed Site in combination with noise generated by the construction with other development.				
Impact Magnitude	The magnitude of noise emissions is higher for construction than for operation. However, noise impact will be limited within the boundaries of all sites.				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	Temporary inconveniences due to construction works, the receptor sensitivity will be medium.				
Impact Nature	Negative	Positive	Neutral		
	Impacts from noise emissions are considered to be negative impacts				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will only last for the duration of construction of proposed site, Korangi Creek Industrial Park development				
Impact Extent	Local	Regional	Global		
	Impacts would be limited around all project sites that are considered.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as medium due to the medium receptor sensitivity.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a low receptor sensitivity and slight impact severity results in an overall moderate significance.				

7.3.3 Impacts from Wastewater

The wastewater generally comprises of the liquid waste discharged by entities in the areas and can encompass a wide range of potential contaminants and concentrations. The composition of wastewater varies widely depending on the source of its generation. The wastewater expected to generate from the projects would have typical properties of a mix of domestic and industrial effluents but expected to be largely domestic in nature. A partial list of the ingredients contained in a typical wastewater is given below:

- Water (> 95%) which is often added during flushing to carry the waste down a drain.
- Pathogens such as bacteria, viruses, and parasitic worms.
- Non-pathogenic bacteria (> 100,000/ml for sewage)
- Organic particles such as faeces, hairs, food, vomit, paper fibres, plant material, humus, etc.
- Soluble organic material such as urea, fruit sugars,
- Soluble proteins, drugs, pharmaceuticals, etc.
- Inorganic particles such as sand, grit, metal particles, ceramics, etc.
- Soluble inorganic material such as ammonia, road-salt, sea-salt, cyanide, hydrogen sulphide, thiocyanates, thiosulphates, etc.
- Animals such as protozoa, insects, arthropods, small fish, etc.
- Macro-solids such as sanitary towels, nappies/diapers, condoms, needles, children's toys, dead pets, etc.
- Gases such as hydrogen sulphide, carbon dioxide, methane, etc.
- Considering that proposed development is establishing their own Sewage Treatment Plant, which will treat all wastewater, after which the treated water will be used for landscaping, and potentially diluting the RO reject, it will not contribute to any impacts regarding wastewater.

7.3.4 Impacts on Community Health, Safety & Security

Impacts to community health, safety and security during operation of all projects would be similar to those described in above section. The risk of accidents and injuries is associated with increase in traffic from the operation of commercial projects. Also, the long-term operation of the projects may attract newcomers seeking jobs and/or opportunities to provide goods and services. An assessment on the potential for population influx is needed to better understand the potential for impacts on disease transmission, psycho-social well-being, and public health infrastructure (including drinking water and sanitation services, health care services, etc.).

7.3.4.1 Existing Controls

Existing controls and mitigation measures for impacts to community health have been described in the relevant sections of ESIA. For Safety and Security of residents and visitors, all projects have their own security arrangements and emergency and disaster management plans.

7.3.4.2 Significance of Impacts

Significance of impacts is expected to be Low. An evaluation of impacts is summarized in the Table below:

Table 7.5 - Impacts to Community Health, Safety, & Security from Operations of Projects

Impact Magnitude	The magnitude of the impact encompasses all local people (residents and visitors)				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	The sensitivity of the local people to health, safety and security impacts is considered low due to availability of all resources in an area.				
Impact Nature	Negative Imp	Positive	Neutral		
	Impacts to community health and safety and security are considered to be positive impacts because of establishing new skyline and commercial areas impeding better security, health and safety.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts from concurrent projects are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts, particularly the provision of social services will last as long as the facilities remain in operation.				
Impact Extent	Local	Regional	Global		
	Impacts would be limited to the area around the project sites.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as low due to availability of resources in an area to tackle health, safety and security concerns.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a Low Receptor Sensitivity and Low Impact Severity results in an overall Minor significance				

7.3.4.3 Additional Mitigation Measures, Management and Monitoring

Additional measures are not required, other than those given in ESMP of the ESIA.

7.3.5 Impacts from Solid Waste

From the operation of “The Mangrove Creekside Development”, and nearby projects, waste generated by users, i.e., domestic wastes include food leftovers, vegetable peels, plastic, house

sweepings, clothes, and ash. Commercial waste generally comprises paper, cardboard and plastic wastes like batteries, bulbs, tube lights should also be generated.

7.3.5.1 Controls Adopted

Adequate provision should be made for storage of solid waste and for easy access to the dustbins. Three colors of bins: - dark grey for inert waste, green for wood and ply waste and blue for hazardous waste can be used. Local Authority, such as Cantonment Board Korangi Creek, will be responsible to transfer waste from secondary to tertiary / landfill site. Adequate provision should be made for storage of solid waste.

7.3.5.2 Significance of Impacts

The Significance of impacts is expected to be moderate. An evaluation of impacts is summarized in the Table below:

Table 7.6 - Impacts from Solid Waste from Operation of Projects

Impact Magnitude	The magnitude of the Impacts on the sustainability of associated sanitation and solid waste disposal systems and their interactions with other urban services.				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	Natural soil/ interactions with other urban services				
Impact Nature	Negative	Positive	Neutral		
	Impacts from solid waste are considered to be negative impacts				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts from concurrent projects are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will last as long as these facilities remain in operation.				
Impact Extent	Local	Regional	Global		
	Impacts would be considered local.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Medium. Large quantities of solid wastes will be generated due to the operation of commercial areas.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of Medium Receptor Sensitivity and Medium Impact Severity results in an overall Moderate significance.				

7.3.5.3 Additional Mitigation Measures, Management and Monitoring

Cantonment Board Korangi Creek (CBKC) is already managing the waste in the area. Compliance is made by CBKC to avoid throwing the waste on to the public streets. It is mandated by the projects proponents to adhere the CBKC requirements. If the waste is properly managed by the proponents inside their facilities and outside by CBKC, no further mitigation measures are required.

7.3.5.4 Significance of Residual Impacts

Depending on the measures taken by Cantonment Board Korangi Creek (CBKC) and project proponents, the impacts will be negligible.

7.3.6 Impacts from Generation of Traffic

In the vicinity of "The Mangrove Creekside Development", a few new development projects are expected to be constructed in near future. So, a study taking impacts of traffic of overall developments becomes critically important.

Traffic analysis has been conducted for the project, keeping in consideration the project location, its vicinity and developments in the area.

Road Network

The road network serving the project area includes Pakistan Refinery Road, Korangi Creek Industrial Park Road, Salim Habib University Road and Korangi Creek Road.

7.3.6.1 Controls Adopted

- Individual projects to adopt their own traffic management plans and manages the traffic inside their premises and adjoining roads.
- Adequate parking provisions as per local bylaws.
- Continuous engagement with traffic authorities for smooth flow of traffic around project vicinity.

7.3.6.2 Significance of Impacts

Significance of impacts is expected to be moderate. An evaluation of impacts is summarized in the table below.

Table 7.7 - Impact from generation of Traffic

Impact Magnitude	The magnitude of the impact encompasses the Korangi Creek Road, Korangi road, UMDC Road.				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	Traffic on Korangi Creek Road and adjoining roads				
Impact Nature	Negative	Positive	Neutral		
	Impacts from traffic are considered to be negative impacts				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts from concurrent projects are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will last as long as these projects remain in operation and as long as measures to accommodate the traffic will not be implemented.				
Impact Extent	Local	Regional	Global		
	Impacts would be considered local and localized to Civil Lines area.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Medium. Traffic congestion will affect in many ways contributing air pollution, noise, economic loss etc.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of Medium Receptor Sensitivity and Medium Impact Severity results in an overall Moderate significance.				

7.3.6.3 Additional Mitigation Measures, Management and Monitoring

Further development of the area through the deployment of traffic police, signaling, hard intervention in the form of infrastructure development and soft intervention in the form of traffic and parking management would decrease the chances of over speeding and accidents.

7.3.6.4 Significance of Residual Impacts

No such significant impacts foreseen.

7.4 Conclusion

This preliminary cumulative impact assessment for the “The Mangrove Creekside Development” was conducted to provide a desktop, high-level, qualitative assessment of the potential cumulative environmental and social impacts associated with the concurrent construction and operation of Korangi Creek Industrial Park and other developments.

Key operational activities of these projects were described. The environmental and social setting was assessed to identify sensitive and important environmental and social receptors which could be affected by the Project.

The preliminary assessment suggested the potential cumulative environmental and social impacts that may arise from the concurrent construction and operation of the projects listed above, and highlighted mitigation measures which, if implemented properly, would reduce the impacts from such activities.

8 ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN (ESMP)

8.1 Introduction

8.1.1 General

The Environmental and Social Impact Assessment (ESIA) for the proposed development activities of proposed Project has identified potential impacts that are likely to arise during the construction and operation phases. The ESIA has examined in detail both negative and positive impacts of each stage of the operation. Where adverse impacts have been identified, the ESIA has recommended mitigation measures; include management and monitoring practices, physical controls, or compensation in monetary terms. The mitigation measures proposed are based on a good understanding of the sensitivity and behavior of environmental receptors, past experience, case studies, legislative controls, guidelines, & expert advice.

For any residual impacts (impacts remaining after applying the recommended mitigation measures) or for impacts in which there has been a level of uncertainly in prediction, monitoring measures have been recommended. Advice on monitoring measures required was sought from experts involved in the ESIA and case studies of similar development activities at international level.

For the effective implementation and management of the mitigation measures and monitoring requirements an Environmental and Social Management Plan (ESMP) has been prepared in accordance with the guidelines and requirements of the Sindh Environmental Protection Agency (SEPA) and the Environmental and Social Performance Standards of the International Finance Corporation (IFC).

8.1.2 Objectives

The ESMP provides a delivery mechanism to address adverse impacts, to enhance project benefits and to introduce standards of good practice to be adopted for all project works.

The primary objectives of the ESMP are to:

- Outline mitigation measures recommended in the ESIA and define the responsibility and timing for the implementation of these measures;
- Develop a monitoring mechanism and identify parameters that can confirm the implementation of the mitigation of these measures;
- Define roles and responsibilities of the project proponent for the implementation of ESMP and identify areas where these roles and responsibilities can be shared with other stakeholders and
- Define the requirements necessary for documenting compliance with the ESMP and communicating it to all concerned regulatory agencies.

For each impact, or activity, which could give rise to an impact, the following information is presented:

- Mitigation measure that will be implemented;
- The person(s) responsible for ensuring full implementation of the mitigation measure;

- The parameters that will be monitored to ensure effective implementation of the mitigation measure;
- The timing for the implementation of the action, to ensure that the objectives of the mitigation are fully met.

8.1.3 Structure of the ESMP

The ESMP consists of the following section.

- Legislation and guidelines.
- Organizational structure and roles and responsibilities;
- Mitigation management's matrix
- Environmental monitoring programme
- Change management plan
- Training Programme

8.1.4 Legislation and Guidelines

The ESIA has discussed in detail all the legislation and guidelines (chapter 2) which has relevance to the project. Proponent shall ensure that the construction and operation of project is conducted in conformance to relevant legislations and guidelines and guidance is sought as and when required. Proponent shall also ensure that the key project management staff is aware of these legislations and guidelines. SEQS for municipal and industrial effluents, selected gaseous pollutants from industrial sources and motor vehicle exhaust and noise have also been mentioned.

8.2 Organizational Structure and Roles and Responsibilities

8.2.1 Organizational Structure

The proposed project includes the following main organization:

- NMCS as the project proponent and owners of the ESMP.
- The construction contractor as well as contractor required during the operational phase (e.g., waste contractor) as the executors of the ESMP.

These organizations will have the following roles and responsibilities during the project activities.

8.2.2 Roles and Responsibilities

A. General

Proponent: Proponent will be responsible for ensuring the implementation of the ESMP. A person holding a senior position will be responsible for the overall environmental performances during the proposed project. The person will be responsible for ensuring the implementation of the ESMP by Proponent and all project contractors. The proponent's Site Representative (SR) will be responsible of implementation of the ESMP and liaison with project contractor and stakeholders at site regarding environmental issues during the construction phase. Further the person holding a senior position in Proponent will also be responsible for monitoring ESMP's compliance and provided technical support in environmental issues.

Project Contractors: For the proposed project, Proponent will appoint construction contractor for different field operations. Various contractor will also be hired during the operation phase of the building (e.g. waste contractors) The contractors will be responsible for implementation of, or

adherence to, all provisions of the ESIA and the ESMP and with any environmental and other codes of conduct required by Proponent Overall responsibility of the contractor's environmental performances will rest with the person holding the highest management position within the contractor's organization reporting to their management. The contractor's site managers will be responsible for the effective implementation of the ESIA and the ESMP. The contractor's HSE officers will have functional responsibilities to ensure implementation of or adherence to the ESMP.

Planning and Design of the Operations

Details of project Activities: Details of the project activities are provided in section 3 of the ESIA report. Following approval of the ESIA, any changes to the proposed activities will be handled through the change Management Plan provided in this ESMP.

Approvals: Obtaining no objection Certificate (NOC)/Approval from SEPA will not relieve the proponent of other legal obligation and hence Proponent and project contractors will obtain all other relevant clearance and necessary approvals required by the Government of Sindh and Relevant departments prior to commencing the respective operations.

Contractual Provision: Adherence to the requirements of the ESIA and ESMP in terms of environmental mitigation will be required from all project contractors and thus ESMP will form part of their contractor with Proponent

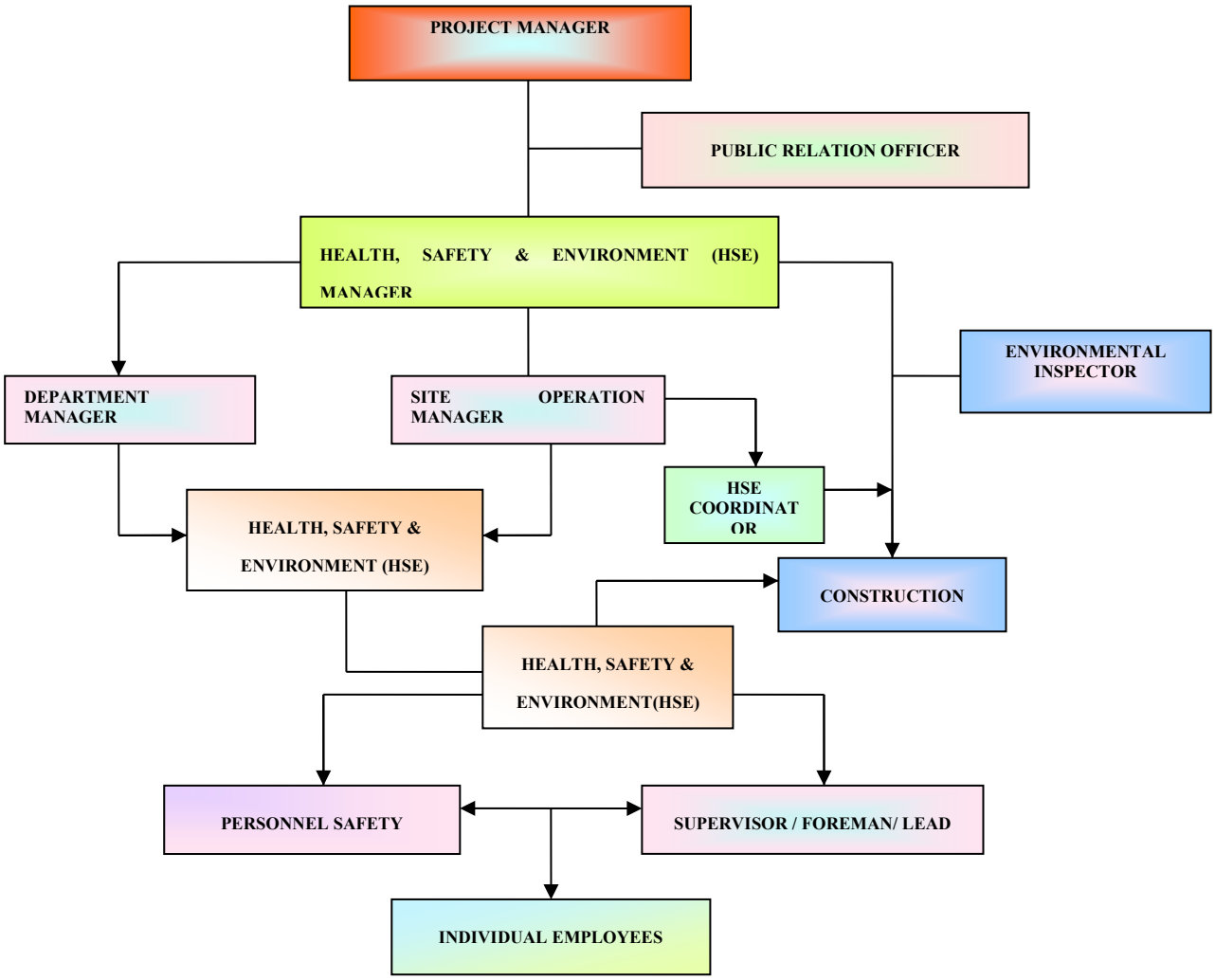
B. Implementation of the Operation

Co-ordination with Stakeholders: Proponent will ensure that co-ordination with the regulators and other stakeholders on environmental & social matters is maintained throughout construction & operation phase of the project.

Monitoring: Proponent and the contractors will ensure that monitoring of the project activities is carried out throughout the project. The Proponent site representative will monitor all project activities during the construction and operation phase. He will keep a record of all non-conformances observed and report these along with actions to Proponent management for further action. The site representative will also report any impacts anticipated along with his recommendation for further action.

Emergency Procedures: Proponent and the contractors will prepare contingency plans to deal with any emergency situation that may arise during the construction and operation e.g., major oil spills, medical evacuation & communicate these to the regulatory agencies if required by these agencies. Approvals: The project contractor will be responsible for obtaining all relevant approvals.

SUGGESTED ORGANOGRAM FOR ENVIRONMENTAL MANAGEMENT



Trainings: The project contractors will be responsible for the selection and training of their staff capable of completing the project activities properly and efficiently. The contractors will be responsible for providing training to their staff members according to the training programme. The training programme is discussed briefly in section below.

C. Communication and Documentation

Proponent and the contractor will ensure that the communication and documentation requirements specified in the ESMP are fulfilled during the construction and operation phase.

Change Management: The ESIA for the proposed operation recognizes that changes in the operation or the ESMP may be required during the project activities and therefore provides a Change Management Plan to manage such changes. Overall responsibility for the preparation of change management statements will be with Proponent's site representative.

Restoration: Proponent along with the construction contractor will be responsible for the final restoration of work areas.

8.3 Maintenance of the ESMP

The ESMP needs to be revised on timely basis to keep up-to-date as per the requirements comes up regularly. Therefore, outlining the responsibilities and activities associated with the maintenance of the ESMP is essential. The responsibilities of the Construction Contractor should be detailed and procedures for requesting ESMP revisions should also be outlined. ESMP revision procedures must include requirements for notification of the appropriate government and municipal agencies so that their role is also played in the overall management process.

8.4 Environmental Health and Safety Management System

Environmental, Health and Safety Management System is essential for the care of EHS issues which should outline mitigation measures and best management practices. This management system recommends carrying out a complete assessment, evaluating, monitoring, identifying and control all potential hazards and risks arise during the construction and operation phases of the proposed project. It needs to ensure that the Health and Safety Plan (HSP) along with the Health and Safety Rules is established and enforced. The Plan should outline roles, responsibilities and expected outcomes with respect to the environmental health and safety management of the construction & operation phase of the Project. These measures should be implemented to ensure that no significant adverse environmental, health and safety impacts are created by activities associated with the construction of the project.

Protection of the public and workforce health and safety during both construction and operations is the prime responsibility of proponent. Utilizing expert personnel and the Environment, Health and Safety Management System (EHSMS), the potential health and safety hazards and risks will be identified and assessed, then the subject of substantial planning, organization, procedures for various facility are developed.

8.4.1 Health and Safety during Construction Phase

Worker Health & Safety Management Plan will also be outlined to implement mitigation measures and best management practices. The plan should be implemented to ensure that no significant adverse worker's health and safety issues arise from activities associated with the construction of the project.

Potential hazards for workers in construction include:

- Falls (from heights);
- Trench collapse;
- Scaffold collapse;
- Electric shock and arc flash/arc blast;
- Failure to use proper personal protective equipment; and
- Repetitive motion injuries.

8.4.2 Health and Safety during Operation Phase

Since project consists of multi-storey buildings, occupational health & safety issues need to be addressed managed effectively to ensure safety of its occupants in particular and the neighborhood in general.

8.5 Emergency Response Plan

Emergency may be defined as a sudden event causing or has the potential to cause serious human injury and /or environmental degradation of large magnitude. The best "cure'' for an emergency is, of course, "prevention". The probable emergency situation can be:

- Serious fire or explosion
- Major gas leakage.
- Major Spillage
- Natural calamity such as heavy rain, flooding, dust storm or earthquake, cyclone, etc.
- Bomb threat or any sabotage / terrorist activity
- Any other incident involving all or large part of the premises and its workers.

Emergency Response Management is provided by a small team of senior managers (the "Control Committee") who in turn will direct all response activities through the Emergency Response Unit.

8.5.1 Objectives

The main objective of this plan is to establish the general guidelines for the actions to be taken in the event of fires, explosion, emergencies, accidents, disasters and sabotage, aimed at minimizing their effects and consequences, in order to protect:

- The lives of own or third-party personnel present in the building's facilities.
- The lives of the occupants of the Project
- The lives of the nearby residents & communities coming into the direct influence of the building's area.
- The lives of the ecological systems located in the surroundings of the Project.

8.5.2 Emergency Response Manuals

Based on the Risk Assessment the proponent should prepare written emergency preparedness and response plans/procedures for the building to cover emergency situations that could occur. It may be required that Emergency Response Manuals will be developed for various situations arising.

8.6 Standard Operating Procedures (During Construction phase)

8.6.1 Wastewater/ Storm Water Management

1. Purpose of Wastewater/storm water Management

The purpose of the adopted procedure is to provide guidelines and simplify the process of categorizing, quantifying, managing, and disposing of wastewater wherever and whenever arising during the project's construction phase. Wastewater management is a critical component of operating policies. Wastewater management includes the proper disposal/recycling and reuse of the wastewater generated during construction and operation phase.

2. Scope

Wastewater as part of construction operation will be managed as per this procedure. An integrated wastewater management system for project is essential to reduce wastewater.

Substitute techniques must be investigated, including source reduction, recycling and reuse wherever possible with a view towards maximizing the benefits and minimizing the cost of each method of wastewater management.

3. Procedure

Main concern to manage the wastewater is listed below:

- Eliminate wastewater production wherever possible.
- Minimize wastewater production.
- Recycle or Reuse
- Wastewater disposal in an environmentally safe manner through adequately designed facility
- Proper drainage of Storm water

a) Wastewater Minimization: Generation of wastewater will be minimized through the following steps taken by working personnel at the facility:
   a. Through efficient use of raw water (minimizing the wastewater).
   b. Reuse of wastewater after treatment.
b) Storage and Handling: Wastewater shall be stored/retained in specifically designed facility or storage tanks till proper treatment at sewage treatment plant is sought and subsequently disposed off.
c) Segregation: Wastewater used in construction will be segregated from wastewater originating from latrines used by construction staff.
d) Recycling: Reuse of wastewater is a best way to reduce the quantity of the wastewater that requires subsequent treatment and disposal. Construction wastewater may be reused in construction activity because it is generally Non-hazardous.
e) Treatment: Wastewater originates from latrines used by construction staff requires treatment through retention in septic tanks before disposal.
f) Disposal: Proper disposal should be done following the treatment through discharge into water bodies or sewerage system where available.

4. Wastewater Management Options

- All storm water run-off from construction sites will be inspected for the sediment load and may be directed to sedimentation basins to remove suspended solids (e.g., silt);
- Sewage may be collected and temporarily stored in tank(s) until it is transported to a designated wastewater treatment facility;
- Standard mobile sewage tankers may be engaged to collect and transport sewage from portable latrines and temporary storage tanks;
- Direct discharge will only be considered as a contingency option.

8.6.2 Solid Waste Management Plan

1. Purpose

The purpose of this procedure is to provide guidelines and simplify the process of categorizing, managing and disposing of solid wastes. Waste management includes the proper handling, collection, storage, manifesting, transportation, and disposal/recycling of the solid waste generated. The procedure is designed to assist in the management's wide effort to provide protection to the environment and to comply with company's corporate requirement, environmental laws and regulations regarding proper waste management.

2. Scope

The waste management plan has been developed to ensure that the Management of solid waste generated as a result of the construction is consistent, efficient, and in conformance with the laws and regulations.

With respect to monitoring, the waste management sets out the following objective:

To monitor and inspect waste management-related facilities and activities directly resulting from executing the scope of the contract in order to ensure compliance with the WMP. Guidelines for proper handling, categorization, recording, minimization, recycling and disposal of all types of waste associated with company operations and projects are part of this procedure.

3. Definitions

a) Waste: Any material, for which no further use is intended, is considered a waste. It can be solid, semi-solid or liquid. Additionally, abandoned materials and materials intended to be recycled are considered wastes. It is very important to understand this concept, because even though something is going to be recycled, it must be managed as a waste until it is actually recycled.
b) Hazardous Waste: Waste is categorized as a hazardous waste if it has one or more of the following properties:
    a. Ignitability (flash point less than 60oC);
    b. Corrosivity (pH less than or equal to 2.0, or greater than or equal to 12.5);
    c. Reactivity (inherently unstable under ordinary conditions or when exposed to water);
    d. Irritability (when in contact with body causes inflammation)
    e. Toxicity (may cause risk of injury to health of organisms or the environment.)
c) Non-hazardous Waste: The wastes are categorized as non-hazardous wastes, if they do not possess any of the hazardous characteristics as defined above. However, non-hazardous waste may still present hazards to employees who handle them. All recommended safety and handling practices must be followed.

4. Procedure

Priorities to manage the waste are listed below:

a) Eliminate waste production whenever and wherever possible. Use the material only for its intended purpose on site
b) Minimize waste production
c) Reuse
d) Dispose of waste through properly designed waste disposal facility.

e) Waste Minimization: To minimize waste, the following steps shall be taken by all personnel working on sites (during construction phase):
    a. Only the needed number of materials shall be ordered. Before purchasing hazardous material, all alternatives for non-hazardous material should be explored.
    b. Prior consideration shall be given to the sizes of containers available when ordering products that could potentially generate waste. The intent is to avoid unused products and/or their containers from becoming wastes that require special handling.
f) Waste Categorization: All wastes generated at facilities shall be categorized in two major categories (i.e. Hazardous wastes and Non-hazardous wastes) as per the definitions in section above. Each category has different types of requirements for handling, storage and disposal.

g) Labelling
   a. Name of the waste (e.g., waste oil, solvents, paints).
   b. Waste category (e.g., toxic, ignitable).
   c. Facility name and address (disposal site, etc.).
   d. Date of waste accumulation: (date when waste was placed in drum).
   e. Wastes are segregated and located in designated areas to optimize control; storage areas.

h) Segregation: The scheme of segregation is as follow:
   a. All hazardous waste if found shall be segregated from other types of hazardous wastes as well as non-hazardous wastes at the point of generation of waste.
   b. Food waste shall be collected in separate containers.
   c. All containers must be clearly labeled. The label must clearly mention the name or type of waste. Also, if the waste is hazardous, it should be clearly labeled on the container along with its hazardous characteristics (e.g. flammable, toxic, radioactive, etc.). This is important to workers and to emergency response teams, who need to know what they are dealing with. Missing or unreadable labels must be replaced.

i) Storage and Handling
   a. Waste shall be temporarily stored at waste storage facility that will be sent for recycling or off-site disposal shall be temporarily stored at designated site(s) within the building premises.
   b. The oily sludge, contaminated soil shall be stored in containers
   c. All other wastes awaiting disposal shall be kept in closed containers/boxes separately. Care must be taken to prevent wastes giving rise to secondary environmental problems, such as odors or soil and groundwater contamination through rainwater leaching.
   d. All stored wastes must be clearly labeled with type of waste and warning signs.
   e. Daily estimates of hazardous and non-hazardous waste and volumes generated on site.
   f. Waste segregation, waste storage containers, general housekeeping and the provision of adequate resources will be monitored.
   g. All workers handling wastes shall use proper PPE.

j) Reuse - Construction waste can be reused in other construction projects & excavated material can be reused in backfilling.

k) Disposal
   a. Disposal becomes the only available alternatives, if reuse and recycling options are exhausted. A material should be classified as a waste for disposal only if no other useful purpose can be identified and if the material cannot be beneficially reused or recycled. The choice of a suitable disposal option for any waste depends on both environmental and economic considerations. The final disposal can only be off-site disposal facilities due to limited space available.
   b. It requires properly designed and well-operated commercial waste disposal facilities such as sanitary landfill. All such facilities should be explored and evaluated for possible future use.

5. Recording & Reporting

The management has to record the information about source, composition, quantity, and final disposal of the waste. This information is needed for regulatory compliance, risk assessment and setting reduction targets and objectives as well as corporate statistics. The routine track of waste shall be recorded.

8.6.3 Air and Noise Emissions

1. Purpose

The purpose of this guideline is:

- To monitor contents of polluting substances in the atmospheric air;
- To control observance of approved limiting permissible emissions at man-made sources;
- To monitor natural sources and a number of man-made sources of emission at work sites at the construction phase;
- To identify sources of noise emissions and control noise pollution;
- To monitor noise emissions.

2. Scope

Scope of work includes:

- Evaluation of present ambient air quality and noise level at existing area.
- Evaluation of impact of traffic movement at the proposed site and noise level.
- Evaluation of impacts on roads and in the adjacent area due to construction.
- Evaluation of impacts of air emissions and noise from various stationary sources.
- Recommendations for mitigation techniques to redress the expected impacts both for design phase.

3. Definitions

Air pollution may be referred to as contamination of pollutants dispersed in air affecting ambient air quality that may be deleterious to life and property.
In common use the word noise means unwanted sound or noise pollution. Excessive noise permanently damages hearing, but a continuous low-level sound can be dangerous too.

4. Procedure

Air emissions (continuous or non-continuous) from facilities such as power generators are comprising of principal gases (greenhouse gases) which typically include carbon monoxide (CO), carbon dioxide (CO2), water vapors and other gases such as nitrogen oxides (NOx), and, in case of sour gases, sulphur dioxide (SO2). Air quality impacts should be estimated by the use of baseline air quality assessments and atmospheric dispersion models to establish potential ground level ambient air concentrations during facility design and operations planning. These studies should ensure that no adverse impacts to human health and the environment result. All reasonable attempts should be made to maximize energy efficiency and design facilities to minimize energy use. The overall objective should be to reduce air emissions and evaluate cost-effective options for reducing emissions that are technically feasible.

Also, vehicular emissions and noise due to traffic movement in and around the complex facility may of concern to be mitigated and monitored. Atmospheric conditions that may affect noise levels include humidity, wind direction, and wind speed. Vegetation, such as trees, and walls can reduce noise levels. Installation of acoustic insulating barriers can be implemented, where necessary.

5. Noise and Air Emissions Management Options

Noise and air emissions monitoring includes;

- Monitoring of air and noise emissions.
- Pollution control technology assessment,
- Emission inventory development,

- Development of parametric monitoring, periodic monitoring, and compliance assurance monitoring.

6. Air and Noise Quality Monitoring

Refer attached Environmental Monitoring Plan for details of air and noise quality monitoring at the project site during construction phase.

Performance Indicator: Monitoring results of ambient air shall show the concentration of pollutant in ambient air.

Record and Comments: Record would be kept with the laboratory report attached. A layout of record keeping format for monitoring results is attached in the annexure at the end of this ESMP.

8.7 Standard Operating Procedures (During Operational Phase)

8.7.1 Wastewater Management

1. Purpose of Wastewater Management

The purpose of this procedure is to provide guidelines and simplify the process of categorizing, managing, and disposing of wastewater wherever and whenever arising during the project's operational phase. Wastewater management includes the proper disposal/recycling and reuse of the wastewater generated during operation phase.

2. Scope

Wastewater generation as part of operational activity will be managed as per this procedure. An effective wastewater management system for Project is essential to reduce wastewater. Substitute techniques must be investigated, including source reduction, recycling and reuse wherever possible with a view towards maximizing the benefits and minimizing the cost of each method of wastewater management.

3. Definitions

a) Wastewater: All water arising after use/consumption from the Project which can encompass a wide range of potential contaminants and concentrations.
b) Hazardous Wastewater:
    a. All wastewater comes in the category of hazardous wastewater. If it has one or more of the following properties:
    b. Oily water
    c. Toxicity (wastewater containing laboratory testing chemicals, antibiotics etc.)
    d. Concentration of contaminants too high above safe acceptable limits
c) Non-hazardous Wastewater: All wastewaters are categorized as non-hazardous wastes, if they do not possess any of the hazardous contaminant mainly comprising of consumed water arising from washing area and sanitary wastewater.

4. Procedure

Main concern to manage the wastewater is listed below:

- Eliminate wastewater production wherever possible.
- Minimize wastewater production.
- Recycle or Reuse

- Wastewater disposal in an environmentally safe manner through adequately designed facility

Wastewater Minimization: Generation of wastewater will be minimized through the following steps taken by working personnel at the facility:

Through efficient use of raw water (minimizing the wastewater).

Storage and Handling: Wastewater shall be stored/retained in specifically designed facility or storage tanks till appropriate treatment is sought and subsequently disposed of.

Segregation: Hazardous wastewater shall be segregated from Non-hazardous wastewater.

Recycling: Recycling of Non-hazardous wastewater is a best way to reduce the quantity of the total wastewater that requires subsequent treatment and disposal. Non-hazardous wastewater may be used in the cooling plants and for horticulture purposes.

Treatment

- Treatment of wastewater through retention in septic tanks before disposal.
- Some of the wastewater may be reused as mentioned in recycling of wastewater. The treated water should comply with Sindh Environmental Quality Standards (SEQS).

Disposal
Proper disposal should be done following the treatment through discharge into water bodies or sewerage system where available.

5. Drinking Water Quality and Wastewater Monitoring Plan

Refer attached Environmental Monitoring Plan for details of drinking water quality and wastewater monitoring plan.

Performance Indicator

Monitoring results of water quality shall show the extent of contamination in the drinking water and shall regulate and maintain the quality of potable water for establishing its suitability for human consumption as per WHO guidelines for drinking water quality.

Monitoring results of wastewater quality shall show the concentration of pollutants in the sewage water and potential for contamination of ground water if not disposed of properly.

Record and Comments

Record of analysis reports shall be maintained.

8.7.2 Solid Waste Management Plan

1. Purpose

The purpose of this procedure is to provide guidelines and simplify the process of categorizing, managing, and disposing of solid wastes. Waste management is a critical component of management's operating policies. Waste management includes the proper handling, collection, storage, manifesting, transportation, and disposal / recycling of the solid waste generated.

2. Scope

The waste management plan has been developed to ensure that the Management of solid waste generated as a result of operation is consistent, efficient, and in conformance with the laws and regulations.

3. Definitions

d) Waste: Any material, for which no further use is intended, is considered a waste. It can be solid, semi-solid or liquid. Additionally, abandoned materials and materials intended to be recycled are considered wastes. It is very important to understand this concept, because even though something is going to be recycled, it must be managed as a waste until it is actually recycled.
e) Hazardous Waste: Waste is categorized as a hazardous waste if it has one or more of the following properties:
    a. Ignitability (flash point less than 60oC);
    b. Corrosivity (pH less than or equal to 2.0, or greater than or equal to 12.5);
    c. Reactivity (inherently unstable under ordinary conditions or when exposed to water);
    d. Irritability (when in contact with body causes inflammation)
    e. Toxicity (may cause risk of injury to health of organisms or the environment.)
f) Non-hazardous Waste: The wastes are categorized as non-hazardous wastes, if they do not possess any of the hazardous characteristics as defined above. However, non-hazardous waste may still present hazards to employees who handle them. All recommended safety and handling practices must be followed.

4. Procedure

Priorities to manage the waste are listed below:

l) Eliminate waste production whenever and wherever possible. Use the material only for its intended purpose on site
m) Minimize waste production
n) Reuse
o) Dispose of waste through properly designed waste disposal facility.

p) Waste Minimization: To minimize waste, the following steps shall be taken by all personnel working on sites (during construction phase):
    a. Only the needed number of materials shall be ordered. Before purchasing hazardous material, all alternatives for non-hazardous material should be explored.
    b. Prior consideration shall be given to the sizes of containers available when ordering products that could potentially generate waste. The intent is to avoid unused products and/or their containers from becoming wastes that require special handling.
q) Waste Categorization: All wastes generated at facilities shall be categorized in two major categories (i.e. Hazardous wastes and Non-hazardous wastes) as per the definitions in section above. Each category has different types of requirements for handling, storage and disposal.
r) Labelling
    a. Name of the waste (e.g., waste oil, solvents, paints).
    b. Waste category (e.g., toxic, ignitable).
    c. Facility name and address (disposal site, etc.).
    d. Date of waste accumulation: (date when waste was placed in drum).
    e. Wastes are segregated and located in designated areas to optimize control; storage areas.

s) Segregation: The scheme of segregation is as follow:
   a. All hazardous waste if found shall be segregated from other types of hazardous wastes as well as non-hazardous wastes at the point of generation of waste.
   b. Food waste shall be collected in separate containers.
   c. All containers must be clearly labeled. The label must clearly mention the name or type of waste. Also, if the waste is hazardous, it should be clearly labeled on the container along with its hazardous characteristics (e.g. flammable, toxic, radioactive, etc.). This is important to workers and to emergency response teams, who need to know what they are dealing with. Missing or unreadable labels must be replaced.

t) Storage and Handling
   a. Waste shall be temporarily stored at waste storage facility that will be sent for recycling or off-site disposal shall be temporarily stored at designated site(s) within the building premises.
   b. The oily sludge, contaminated soil shall be stored in containers
   c. All other wastes awaiting disposal shall be kept in closed containers/boxes separately. Care must be taken to prevent wastes giving rise to secondary environmental problems, such as odors or soil and groundwater contamination through rainwater leaching.
   d. All stored wastes must be clearly labeled with type of waste and warning signs.
   e. Daily estimates of hazardous and non-hazardous waste and volumes generated on site.
   f. Waste segregation, waste storage containers, general housekeeping and the provision of adequate resources will be monitored.
   g. All workers handling wastes shall use proper PPE.

u) Reuse - Construction waste can be reused in other construction projects & excavated material can be reused in backfilling.

v) Disposal
   a. Disposal becomes the only available alternatives, if reuse and recycling options are exhausted. A material should be classified as a waste for disposal only if no other useful purpose can be identified and if the material cannot be beneficially reused or recycled. The choice of a suitable disposal option for any waste depends on both environmental and economic considerations. The final disposal can only be off-site disposal facilities due to limited space available.
   b. It requires properly designed and well-operated commercial waste disposal facilities such as sanitary landfill. All such facilities should be explored and evaluated for possible future use.

5. Recording & Reporting

The management has to record the information about source, composition, quantity, and final disposal of the waste. This information is needed for regulatory compliance, risk assessment and setting reduction targets and objectives as well as corporate statistics. The routine track of waste shall be recorded.

8.7.3 Air and Noise Emissions

1. **Purpose**

The purpose of this guideline is:

- To monitor contents of polluting substances in the atmospheric air;
- To control observance of approved limiting permissible emissions at man-made sources;
- To monitor natural sources and a number of man-made sources of emission at work sites at the construction phase;

- To identify sources of noise emissions and control noise pollution;
- To monitor noise emissions.

2. Scope

Scope of work includes:

- Evaluation of present ambient air quality and noise level at existing area.
- Evaluation of impact of traffic movement at the proposed site and noise level.
- Evaluation of impacts on roads and in the adjacent area due to construction.
- Evaluation of impacts of air emissions and noise from various stationary sources.
- Recommendations for mitigation techniques to redress the expected impacts both for design phase.

3. Definitions

Air pollution may be referred to as contamination of pollutants dispersed in air affecting ambient air quality that may be deleterious to life and property.
In common use the word noise means unwanted sound or noise pollution. Excessive noise permanently damages hearing, but a continuous low-level sound can be dangerous too.

4. Procedure

Air emissions (continuous or non-continuous) from facilities such as power generators are comprising of principal gases (greenhouse gases) which typically include carbon monoxide (CO), carbon dioxide (CO2), water vapors and other gases such as nitrogen oxides (NOx), and, in case of sour gases, sulphur dioxide (SO2). Air quality impacts should be estimated by the use of baseline air quality assessments and atmospheric dispersion models to establish potential ground level ambient air concentrations during facility design and operations planning. These studies should ensure that no adverse impacts to human health and the environment result. All reasonable attempts should be made to maximize energy efficiency and design facilities to minimize energy use. The overall objective should be to reduce air emissions and evaluate cost-effective options for reducing emissions that are technically feasible.

Also, vehicular emissions and noise due to traffic movement in and around the complex facility may of concern to be mitigated and monitored. Atmospheric conditions that may affect noise levels include humidity, wind direction, and wind speed. Vegetation, such as trees, and walls can reduce noise levels. Installation of acoustic insulating barriers can be implemented, where necessary.

5. Noise and Air Emissions Management Options

Noise and air emissions monitoring includes;

- Monitoring of air and noise emissions.
- Pollution control technology assessment,
- Emission inventory development,
- Development of parametric monitoring, periodic monitoring, and compliance assurance monitoring.

6. Air and Noise Quality Monitoring

Refer attached Environmental Monitoring Plan for details of air and noise quality monitoring at the project site during construction phase.

Performance Indicator: Monitoring results of ambient air shall show the concentration of pollutant in ambient air.

Record and Comments: Record would be kept with the laboratory report attached. A layout of record keeping format for monitoring results is attached in the annexure at the end of this ESMP.

8.8 Environmental Compliance Reporting, Documentation and Trainings

The management will be responsible for the regular audit and review of the environmental management and monitoring plan. This will include both on-site auditing and review of performance reports. Additional onsite inspections and investigations will be undertaken in the event of significant environmental incidents. These will be undertaken in conjunction with the IMC.

The management will participate in the audits and inspections and investigations. The management will also be responsible for regular review of the environmental performance of the site and site personnel, and for the reporting on the implementation of commitments made in the ESMP.

In particular, there will be:

- Periodic audit reports.
- A review and improvement of the ESMP

Management recognizes that periodic external compliance audits and inspections will be made through a third-party consultant (IMC) to monitor, assess and validate the level of performance and compliance pursuant to the commitments made in the accepted Environmental Management Plan. The monitoring reports shall also be submitted to Sindh Environmental Protection Agency (SEPA) on regular intervals.

Training: It an important step for the implementation of the ESMP. All the employees will require to be trained to work appropriately on ESMP. EHS Manager will organize trainings in consultation with HSE Officer. It will make sure that employees understand the Environment, Health and Safety issues. Trainings should be arranged on regular basis with notification that it should be attended all respective employees.

HSE Officer will determine the training requirements during both phases. Induction will be the basis of all training courses for contractor & subcontractor during construction phase.
Trainings identified in ESMP are given below:

- Site induction course
- Training for emergency response and preparedness
- Training for familiarization with site environmental controls

Specific environmental training for relevant employees e.g. daily checks to maintain controls, waste minimization, etc.

8.9 Mitigation Management Matrix

The Mitigation Management Matrix will be used as a management & monitoring tool for implementation of the mitigation measures required by the ESIA. Mitigation management matrix for construction and operation is provided in the tables below. The matrix lists down the following:

- The mitigation measure recommended in the ESIA.
- 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;
- The timing at which the mitigation or monitoring has to be carried out.

It is highlighted that although responsibilities for executing and monitoring mitigation measures have been delegated to different persons, Proponent will hold the primary and overall responsibility for ensuring full implementation of the ESMP.

8.10 Environmental Monitoring Programme

The objective of the environmental monitoring during the construction & operation phase will be as follows:

- To check compliance of the contractors with the ESMP by monitoring activities of the project on a daily basis. This will be called compliance monitoring.
- To monitor impacts of the operation in which there has been a level of uncertainty in prediction such as impacts of noise, water abstraction etc. and to recommend mitigation measures if the impacts are assessed to be in excess of or different from those assessed in the ESIA. The aim will be attained through effects monitoring.
- To achieve these objectives, the following monitoring programme will be implemented.

8.10.1 Compliance Monitoring

Compliance monitoring will be carried out to ensure compliance with the requirements of the ESIA and to document and report all non-compliances. The mitigation management matrix provided in the ESMP will be used as a management and monitoring tool. The contractor's HSE Officer will be responsible for monitoring the compliance of their organization with the relevant ESMP requirements. Proponent's site representative will monitor the contractor's compliance and will also ensure that during construction each activity system and plan is in place for effective compliance monitoring. The site representative will make regular checks on the contractor's works; keep records of all non-compliances observed during the execution of the project activities; & the details of all remedial actions taken to mitigate the project impacts.

8.10.2 Effects Monitoring

The effects monitoring requirements have been detailed in Table 7.2. An independent monitoring consultant (IMC) will be responsible to carry out the required effects monitoring during the construction and operation phase.

8.10.3 Environmental Reporting

Final Monitoring Report (Construction Phase)

After completion of construction phase, a final monitoring report will be prepared by Proponent's site representative. The report will include the following:

- Introduction.
- Details of the Project Activities.
- Natural Resource used during the Project.
- List of non-compliances recorded.
- Effects of the Project on Communities and Physical Resources.

- Photographic Records
- Approvals provided during the project
- Change managements statements
- Trainings
- Conclusions

Annual Environmental Monitoring Reports (Operation Phase)

The project proponent shall prepare annual environmental monitoring reports describing the conduct of the operation phase for project along with details of the effects monitoring conducted annually during the operation phase of the project. The report shall be submitted to the SEPA.

8.11 Change Management Plan

The ESIA for the proposed project recognizes that changes in the operation or the ESMP may be required during the construction and operation and therefore provides a Change Management Plan to manage such changes. The management of changes is discussed under two separate headings, Additions to the ESMP and Changes to the Operation and the ESMP.

8.11.1 Changes to the ESMP

The ESIA and the ESMP have been developed based on the best possible information available at the time of the ESIA study. However, it is possible that during the conduct of the proposed operation additional mitigation measures based on the findings of environmental monitoring during the operation may have to be included in the ESMP. In such cases following actions will be taken:

- A meeting will be held between Proponent and the concerned project contractors. During the meeting, the proposed addition to the ESMP will be discussed and agreed upon by all parties.
- Based on the discussion during the meeting, a change report will be produced collectively, which will include the additional ESMP clause and the reasons for the addition.
- The report will be signed by all parties and will be filled at the site office: A copy of the report will be sent to Proponent and contractor head offices.
- All relevant project personnel will be informed of the addition.

8.11.2 Changes to the Operation

The change management system recognizes three orders of changes:

First Order
A first order change is one that leads to a significant departure from the project described or the impacts assessed in the ESIA and consequently require a reassessment of the environmental impacts associated with the change. Example of first order change includes change in location of proposed project. Action required in this case will be that the environmental impacts of the proposed change will be reassessed by Proponent and sent to the SEPA for approval.

Second Order
A second order change is one that does not result in the change in project description or impacts that are significantly different from those detailed in the ESIA. Example of second order changes includes extension in the site area. Action required for such changes will be that Proponent will reassess the impact of the activity on the environment & specify additional mitigation measures if required and report the changes to SEPA.

Third Order

A third order change is one that does not result in impacts above those already assessed in the ESIA, rather these may be made site to minimize the impact of an activity such as:

- Increase in project workforce;
- Change in layout plan.

The only action required for such changes will be to record the change in the Change Record Register.

8.12 Training Programme

Environmental training will form part of the environmental management system. The training will be directed towards all personnel for general environmental awareness.

8.12.1 Objectives

The key objective of training programme is to ensure that the requirements of the ESMP are clearly understood and followed throughout the project. The trainings to the staff will help in communicating environmental related restrictions specified in the ESIA and ESMP.

8.12.2 Roles and Responsibilities

The contractors will be primarily responsible for providing environmental training to all project personnel on potential environmental issues of the project. The contractors will be responsible to arrange trainings and ensure the presence of targeted staff.

8.12.3 Training Programme

The environmental awareness, ESIA and ESMP training will be carried out during the project activities.

Training log

A training log will be maintained by tine contractors. The training log will include:

- Topic
- Date, time and location
- Trainer
- Participants

Training Needs Assessment

In addition to the training specified in the training log special/additional trainings will be provided during the project activity. The criteria to assess the need of training will be based on the following:

- When a specified percentage of staff is newly inducted in the project
- When any non-compliance is repeatedly reported refresher training will be provided regarding that issue.
- When any incident/accident of minor or major nature occurs. Arrival of new contractor/sub-contractor.
- Start of any new process/activity.

Training Material

The contractors will develop & prepare training material regarding environmental awareness, sensitivity of the area, ESIA, ESMP and restrictions to be followed during the project. Separate training material will be prepared for each targeted staff.

8.13 Positive Social Impacts of Project

Most of the project's socioeconomic impacts will be beneficial. The beneficial impacts described briefly hereunder are:

The proposed project will create employment during its construction and operation phases. During construction, about 200-250 people are expected to be employed.

The project will create employment opportunities after completion. This also includes staff directly involved in the operation and management of the facilities, NMCS's management, the staff engaged by the residential flats and retail owners, domestic servants, security personnel, and drivers. Most of the workforce will comprise local people as part of the project's corporate social responsibility. The generation of employment is likely to have a major positive impact on the proposed development.

The below table presents mitigation measures of each adverse socio-economic effects and monitoring parameters with responsibilities defined separately for each aspect.

Table 8.1 - Social Mitigation & Monitoring Plan

S#	Socio-economic Effect	Mitigation Measure(s)	Mitigation Responsibility	Monitoring Parameters	Monitoring Frequency	Cost and Source of Funds
01	Restriction of access and impediment of locals to resources	It will be ensured that the construction site is appropriately cordoned off with hard barricade. Fencing and cordoning off will be ensured. Provide alternative traffic arrangement, if necessary.	CC	Check traffic management plan and construction sites, check consultation records	Weekly	Cost of hard barricade will be included in Contractual Cost borne by Contractor and will be assessed after finalization of construction plan
		Extensive consultation with stakeholders should be carried out before the commencement of project activities and their feedback, concerns and input should be taken into account in the project planning and execution. Leaflets traffic flow will be disseminated to local community representatives.	CC, ESMP Consultant		Before the start of interventions and during	Nil
02	Impacts on Women, Children, and Vulnerable Groups	In awareness raising, women should be targeted. Ensure participation of women in project activities through consultations, to ensure planned investments take the well-being of such groups into consideration.	ESMP Consultant reporting to Proponent	Consultation records, awareness raising records	Monthly	Nil
03	Project development not informed by concerns/views, participation of women and other groups.	Identify all direct and indirect stakeholders Hold meetings with all community groups, wherever possible, using women to encourage participation of women in all stages of the project. Identify the communication mechanisms most commonly used by local women and ensure these are used to impact and receive information throughout the project.	ESMP Consultant reporting to Proponent	Consultation records, awareness raising records	Monthly	Nil
04	Labor Issues	Preference will be given to labor from locally skilled and unskilled workers of the area.	CC	Occupational health and safety of	Daily	Nil

		No bonded and child labor will be allowed at site. All workers must have CNICs; Major labor laws will be followed e.g., Minimum Wage, Hours of work, Overtime Payment; harassment of women in the workplace. Also, laborers will be trained on appropriate interaction with local people especially women;		labor including PPE, consultation records		
		Prepare Labor Health and Safety Management plan defining the roles and responsibility of personnel who implement the plan	CC	Review and check the adequacy of the plan	Before the commencement of civil works	Nil
		Ensure that Job Hazard Analysis (JHA) is performed prior to commencing jobs and sign off by CC	CC	Review and check JHA and sign off	Before the commencement of job	Nil
		Allocate ESS staff as per site-specific plans made by the CC	CC	Check CC staffing details	Before the commencement of civil works	Nil
		WB Group's Environment, Health and Safety (EHS) Guidelines will be implemented	CC	Audit WB EHS guidelines provisions	Monthly	Nil
		Only labor trained to use construction equipment and machinery at site should be allowed to operate	CC	Check Training Certificate	At the time of induction	
		The ESMP Consultant will include appropriate clauses to protect environment and public health. The present ESMP including GRM will be included in the bidding document.	ESMP Consultant	Appropriate clauses in the bidding documents will be checked by supervision/ monitoring consultant	At the finalization of Contractor(s)	Nil
		Avoid stagnation of water and initiate drainage/cleanup of stagnant water.	CC	Supervision consultant will check signs of	Fortnightly	Nil

				water accumulation at construction site		
		Ensure the provision of appropriately stocked first-aid equipment at work sites;	CC	Supervision/ monitoring consultant will check First aid measures at construction site	After every accident, incident or a near miss	Included in Contractual Cost borne by Contractor
		Ensure the provision of appropriate personal protective equipment (PPE) to minimize risks, such as but not limited to appropriate apron/coverall, boots and impervious gloves; eye protection, electric shock protection and safety helmets;	CC	Supervision/ monitoring Consultant will check provision of PPE for construction workers	Daily	Included in Contractual Cost borne by Contractor
		Provide training for workers for the use of PPE;	CC	Check training records	Monthly	Biannually, 4-day workshop @ Rs.15,000 per workshop inc. expenses
		Include procedures for documenting and reporting accidents, diseases, and incidents.	CC	Check procedures	Monthly	Nil
		Water should be sprinkled daily or whenever there is dust problem on all exposed surfaces to suppress emission of dust. Wiping and sweeping should be adopted as a continuous activity to keep the surface area of the site clean.	CC	Monitor Dust emissions (SPM) Monitoring conducted as per SEQS.	Daily, if required	Water sprinkling cost is included in Contractual Cost borne by Contractor and will be assessed after finalization sub-project plans

Table 8.2 - Environmental & Social Management Plan

S.#	Impact and Mitigation Measures	Responsibilities	Monitoring	Timing
1	Land Use and Soils			
1.1	The construction activities will be planned in a way to minimize disturbance to soil	Proponent, CC	Monitoring compliance	During construction phase
1.2	To the extent possible, equipment and materials would be staged in areas that have already been disturbed	Proponent, CC	Monitoring compliance	During construction phase
1.3	Movement of construction equipment will primarily be restricted to work areas only to avoid unnecessary disturbance to soil	CC	Monitoring compliance	During construction phase
1.4	Routes of water tankers, dumper trucks and other project vehicles will be monitored for any signs of soil disturbance & road damage	CC	Monitoring compliance	During construction phase
1.5	Area showing signs of unstabilised soil conditions will be compacted and watered	Proponent, CC	Monitoring compliance	During construction phase
1.6	The assessment of settlement within affected zone due to dewatering will be conducted prior to dewatering	CC	Monitoring compliance	During construction phase
1.7	The affected zone of settlement, if identified will be monitored regularly during dewatering activity	Proponent, CC	Monitoring compliance	During construction phase
1.8	Proper drainage will be provided to construction camp, construction site, especially near excavations and around proposed facility	CC	Monitoring compliance	During construction phase
1.9	Vehicle speed will be regulated and monitored to avoid excessive dust emissions	CC	Monitoring compliance	During construction phase
1.10	Periodic trainings will be provided to drivers on mitigation measures related to off-road travel and speed limits	Proponent, CC	Check training records	During construction phase
1.11	The Project will have a storm water collection system so that the storm water effluent has minimal sediment load	Proponent, CC	Monitoring compliance	During design and construction phase
2	Air Quality			
2.1	Dust Emissions			
2.1.1	Water will be sprinkled daily or when there is an obvious dust problem on all exposed surfaces to suppress emission of dust. Frequency of Sprinklings will be kept such that the dust remains under control, particularly when wind is blowing towards the receptors	CC	Monitoring compliance	During construction phase

2.1.2	Dust emissions from soil piles and aggregate storage stockpiles will be reduced by appropriate measures. These may include: Keeping the material moist by sprinkling of water at appropriate frequency Erecting windshield walls on three sides of the piles such that the wall project 0.5m above the pile, or Covering the pile, for example with tarpaulin or thick plastic sheets, to prevent emissions. Locating stock piles out of the wind direction	CC	Monitoring compliance	During construction phase
2.1.3	All roads within the proposed Project will be paved as early as possible after the commencement of construction work. Until the roads are paved, they will be sprinkled regularly to prevent dust emission. Other temporary tracks within the site boundary will be compacted and sprinkled with water during the construction works.	Proponent, CC	Monitoring compliance	During construction phase
2.1.4	Project traffic will maintain a maximum speed limit of 20km/hr. on all unpaved areas within the project site.	Proponent, CC	Check speed of vehicles	During construction phase
2.1.5	Construction materials that are susceptible to dust formation will be transported only in covered trucks.	CC	Monitoring compliance	During construction phase
2.1.6	The exposure of construction workers to dust will be minimized by provision of dust masks.	CC	Check for dust masks	During construction phase
2.2	Vehicle Equipment and Exhaust			
2.2.1	All vehicles, generators and other equipment used during the construction will be properly tuned and maintained in good working condition in order to minimize emission of pollutants.	Proponent, CC	Maintenance records of vehicles and equipment	During construction phase
2.2.2	The exhaust of the standby generators during operation phase will be vented through vertical stacks to minimize exposure at ground level	CC	Monitor compliance	During construction phase
2.3	Generator Emissions			
2.3.1	The option of using natural gas as fuel in the back-up generators should be explored.	Proponent, Generator Vendor	Monitor compliance	During design phase
2.3.2	The generator will be properly tuned and maintained in good working condition in order to minimize exhaust emissions	Proponent	Check maintenance records	During operation phase

2.3.3	The diesel generator should be used for the required duration with the power switched back to the main power supply as quickly as possible.	Proponent	Monitoring compliance	During operation phase
2.3.4	NOx emission reduction techniques should be employed on a regular basis	Proponent	Monitor NOx emissions	During operation phase
3	Construction Noise			
3.1	Reduce equipment noise at source by proper design, maintenance and repair of construction machinery and equipment	Proponent, CC	Check maintenance records	During construction phase
3.2	Minimize noise from vehicles and power generators by use of proper silencers and mufflers.	Proponent, CC	Monitor compliance	During construction phase
3.3	Use noise-abating devices wherever needed and practicable.	Proponent, CC	Monitor compliance	During construction phase
4	Water Sourcing			
4.1	A complete record of water consumption during construction and operation phase will be maintained	Proponent, CC	Check water consumption records	During construction and operation phase
4.2	If a new water well is to be installed, it will be designed to abstract water preferably from deep aquifer not being used by local communities	Proponent, CC	Monitor compliance	During construction phase
4.3	Water conservation program will be initiated to prevent wastage of water.	Proponent, CC	Monitor compliance	During construction and operation phase
4.4	The water supply lines will be checked and repaired for leaks in order to reduce wastage of water.	Proponent, Maintenance Contractor	Check maintenance records	During operation phase
4.5	Recycle grey water for use for toilet flushing	Proponent	Monitor compliance	During operation phase
4.6	Ensure that water efficient sanitary fittings are used throughout the development e.g. low flush toilets, water efficient shower heads, and aerators on faucets.	Proponent	Monitor compliance	During construction and operation phase
5	Soil Contamination			

5.1	Fuels, lubricants, and chemical will be stored in covered bounded areas, underlain with impervious lining.	Proponent, CC	Monitor compliance	During construction phase
5.2	Maintenance of vehicles and equipment will only be carried out designated areas. The area will be provided with hard surface or tarpaulin will be spread on the ground to prevent potential contamination of soil.	Proponent, CC	Monitor compliance	During construction phase
5.3	Vehicles will only be washed at designated areas.	CC	Vehicle Inspection record	During construction phase
5.4	Regular inspections will be carried out to detect leakage in construction vehicles and equipment.	Proponent, CC	Check inspection / maintenance records	During construction phase
5.5	Appropriate arrangements, including shovels, plastic bags and absorbent materials, will be available near fuel and oil storage areas	CC	Monitor compliance	During construction phase
5.6	Contaminated soil will be removed and properly disposed after treatment such as incineration etc.	Proponent, CC	Monitor compliance	During construction phase
6	Traffic			
6.1	Heavy traffic during construction phase will come to the project site during late night hours.	Proponent, CC	Traffic situation, counts/records	During construction phase
6.2	Project vehicles shall not be fitted with pressure horns	CC	Monitor compliance	During construction phase
6.3	During construction, speed of vehicles within project premises shall be regulated.	Proponent, CC	Monitor compliance	During construction phase
6.4	Designated parking areas will be provided for different type of project vehicles within and around the project site	Proponent, CC	Monitor compliance	During construction phase
6.5	Prepare, implement and monitor the traffic management plan	Proponent	Monitor compliance	During construction and operation phase
6.7	Vehicles to use designated parking areas during operational phase.	Proponent	Monitor compliance	During operation phase
6.8	Parking of vehicles alongside the road should be prohibited at all time.	Proponent	Monitor compliance	During construction and operation phase
7	Wastewater Generation			
7.1	Wastewater Generation During Construction			

7.1.1	Wastewater generated at the campsites will be stored temporarily in septic systems comprising of septic tanks from where it will be routed to a nearest drain/sewerage system.	Proponent, CC	Monitor compliance	During construction phase
7.2	Wastewater Generation During Operation			
7.2.1	The grey water will be recycled to be re-used again in toilets and kitchens etc.	Proponent	Monitor compliance	During operation phase
7.2.2	Black water will be routed to septic tank for retention and primary treatment and will be discharged into a nearby out fall sewer via trunk sewer	Proponent, CC	Monitor compliance	During design, construction & operation phase
7.2.3	Waste segregation measures would be employed to minimize entry of solid waste into the wastewater stream	Proponent	Monitor compliance	During operation phase
7.2.4	Water conservation strategies will be employed to avoid wastage of water	Proponent	Monitor compliance	During operation phase
8	Solid Waste Generation and Management			
8.1	Solid Waste Generation and Management During Construction			
8.1.1	Separate bins will be placed for different types of wastes- plastics, paper, metal, glass, wood, and cotton.	Proponent, CC	Monitor compliance	During construction phase
8.1.2	Recyclable material will be separated at source. The recyclable waste will be sold to waste contractors for recycling	Proponent, CC	Monitor compliance	During construction phase
8.1.3	Non-hazardous non-recyclable wastes such as construction camp kitchen wastes will be disposed off in landfill site through municipal administration or approved waste contractor.	Proponent, CC	Monitor compliance	During construction phase
8.1.4	No waste will be dumped at any location outside the proposed site boundary.	Proponent, CC	Monitor compliance	During construction phase
8.1.5	All hazardous waste will be separated from other wastes. Hazardous wastes will be stored in designated areas with restricted access and proper marking. Hazardous wastes will be disposed off through approved waste contractors.	Proponent, CC	Check hazardous waste disposal records	During construction phase
8.1.6	Surplus construction materials including partially filled chemical and paint containers will be returned to suppliers. Inert construction wastes will be disposed off onsite as fill material or sold as scrap to contractors.	Proponent, CC	Check waste records	During construction phase

8.1.7	Records of all waste generated during the construction period will be maintained. Quantities of waste disposed, recycled, or reused will be logged on a Waste Tracking Register	Proponent, CC	Check waste record register	During construction phase
8.1.8	Training will be provided to personnel for identification, segregation, and management of waste	Proponent, CC	Check training records	During construction phase
8.2	Solid Waste Generation and Management During Operation			
8.2.1	Waste generation will be minimized by adopting waste management strategy of reduce, reuse and recycle	Proponent	Monitor compliance	During operation phase
8.2.2	A waste management plan will be prepared, implemented and monitored for the safe collection, storage and treatment/disposal of the building waste	Proponent	Monitor compliance	During operation phase
8.2.3	Records of all waste generated will be maintained. Quantities of waste disposed, recycled, or reused will be logged on a Waste Tracking Register	Proponent	Check waste tracking register	During operation phase
8.2.4	Training will be provided to personnel for identification, segregation, and management of waste	Proponent	Check training records	During operation phase
8.2.5	All inert and non-hazardous construction wastes will be disposed to the existing tipping sites within or outside of the city limits	Proponent, Waste Contractor	Monitor compliance	During operation phase
8.2.6	Hazardous wastes will be disposed through waste management contractors who will identify suitable disposal options for these wastes such as recycling, metal recovery, incineration or bioremediation etc.	Proponent, Waste Contractor	Monitor compliance	During operation phase
8.2.7	Various waste containers for waste collection should be placed at appropriate locations in the building	Proponent	Monitor compliance	During operation phase
8.2.8	Waste storage areas should be located within the facility and sized to the quantities of waste generated, with the following design considerations: Hard, impermeable floor with drainage, and designed for cleaning/disinfection with available water supply, Secured by locks with restricted access designed for access and regular cleaning by authorized cleaning staff and vehicles Protected from sun, and inaccessible to animals/Rodents Equipped with appropriate lighting and ventilation Segregated from food supplies and preparation areas Equipped with supplies of protected clothing, and spare bags/containers	Proponent, CC	Monitor compliance	During operation phase

9	Seismicity			
9.1	No specific mitigation measures other than to construct the facility in accordance with UBC Zone 2B	Proponent, Structure Design Consultant, CC	Monitor compliance	During project design phase
10	Sustainability			
10.1	Best practice of energy efficiency will be incorporated in the building design	Proponent, CC	Monitor compliance	During project design phase
10.2	Buildings to be constructed with high levels of thermal insulation	Proponent, CC	Monitor compliance	During project design phase
10.3	Ensure that HVAC system, refrigeration equipment and fire suppression equipment do not contain HCFC's or Halons	Proponent, CC	Monitor compliance	During project design phase
11	Socio-Economic Impacts			
11.1	Deliveries should be programmed to arrive and routed to minimize disturbance to residential areas, hospitals and offices.	Proponent, CC	Monitor compliance	During construction phase
11.2	Designated parking areas will be provided for different type of project vehicles within and around project site	Proponent, CC	Monitor compliance	During construction & operation phase
11.3	Areas earmarked for amenity and commercial infrastructure will not be used for other purposes after construction	Proponent	Monitor compliance	During construction & operation phase
11.4	Employment preference will be given to residents of the project area	Proponent, CC	Monitor compliance	During construction & operation phase
11.5	Local contractors will be given preference for hiring equipment and machinery during operation	Proponent, CC	Monitor compliance	During construction & operation phase
11.6	Ensure maximum quantity of water to be treated and reused in order to lessen its burden on the existing sewerage system.	Proponent	Monitor compliance	During design, construction & operation phase
11.7	Locals, surrounding business and city government are kept on the same page during all stages of the development of the project.	Proponent	Monitor compliance	During construction phase
11.8	A complaint register will be maintained on site during construction to record complaints of the nearby residents.	Proponent	Provision of complaint register	During construction phase
12	Flood Hazard			

12.1	Submersible pumps will be installed in the single basement.	Proponent, CC	Monitor compliance	Construction and operation phases
12.2	Buildings at the proposed development have been designed to be elevated from the ground level. This includes moving key or essential equipment from low-lying elevations within a structure to areas that would not be subject to potential flooding.	Proponent, CC	Monitor compliance	Construction phase
12.3	Adequate drain to cater the stormwater at the site will be constructed	CC	Monitor compliance	Construction phase
12.4	Measures for dry floodproofing may also be considered, such as; o Applying a waterproof coating or membrane to the exterior walls of the buildings where required o Installing watertight shields over doors, windows and other openings; o Installing backflow valves in sanitary and storm sewer lines; o Raising utility system components, machinery and other pieces of equipment above the flood level; o Installing a sump pump and foundation drain system; o Strengthening walls so that they can withstand the pressures of floodwaters and the impacts of flood borne debris.	Proponent, CC	Monitor compliance	Construction and operation phases
Legend: CC: Construction Contractor				

Table 8.3 - Environmental Monitoring Plan

Ambient Air Quality Sampling Plan					
Phase	Parameters	Locations	Frequency	Duration	Standards
Construction	SOx, NOx, CO, O3, PM2.5, PM10 Lead, SPM	Upwind and downwind locations with reference of project site	Quarterly	24hrs	SEQS/WB
Operation	SOx, NOx, CO, O3, PM2.5, PM10 Lead, SPM	Upwind and downwind locations with reference of project site	Quarterly	24hrs	SEQS/WB
Drinking Water Quality Sampling Plan					

Phase	Parameters	Locations	Frequency	Duration	Standards
Construction	Parameters as per SEQS	Drinking Water outlet/water cooler	Monthly	Grab sampling	SEQS/WHO
Operation	Parameters as per SEQS	Drinking Water outlet/water cooler	Monthly	Grab sampling	SEQS/WHO
Wastewater Quality Sampling Plan					
Phase	Parameters	Locations	Frequency	Duration	Standards
Construction	Parameters as per SEQS and Quantity of Wastewater	Camp site discharge points into drains	Quarterly	Grab sampling	SEQS/WB
Operation	Parameters as per SEQS and Quantity of Wastewater/Brine water	Septic tank, ETP and RO reject	Quarterly	Grab sampling	SEQS/WB
Noise Level Sampling Plan					
Phase	Parameters	Locations	Frequency	Duration	Standards
Construction	Decibels [dB(A)Scale]	At the interface of project site & community 7 m from the equipment at construction site At the interface of project site & facing road	Monthly	Specific intervals	SEQS/WB for Noise
Operation	Decibels [dB(A)Scale]	At the interface of project site & community 7 m from the equipment at construction site At the interface of project site & facing road	Quarterly	Specific intervals	SEQS/WB for Noise
		Gaseous Emissions			
Phase	Parameters	Locations	Frequency	Duration	Standards
All Phases	Parameters as per SEQS	Equipment exhaust, Generators' stacks	Quarterly	Instantaneous	SEQS/WB
Water Saving					
Stages	Parameters	Locations	Frequency	Duration	Standards

Construction	Water Consumption (in gallons)	Indoor water use Outdoor water use	Annually	Periodic	Best Practices
Operation	Water Consumption (in gallons)	Indoor water use Outdoor water use	Annually	Periodic	Best Practices
Water Recycling					
Construction	Water Recycling (in gallons)	Indoor water use Outdoor water use	Annually	Periodic	Best Practices
Operation	Water Recycling (in gallons)	Indoor water use Outdoor water use	Annually	Periodic	Best Practices
Occupational Health & Safety					
All Phases	Noise level monitoring and Occupational Health Surveillance Provision of proper lighting in all areas Provision of PPEs, coveralls and Indoor air quality testing. General Site Hazards and Work related injury	construction site and operational site of the building	Annually	Periodic	Occupational Health and safety Local and international standards
Waste Management					
All Phases	Quantity of Waste, Segregation, Storage Record Keeping, Disposal mechanism waste composition; recyclables and non-recyclables, hazardous waste	Activity Area	Annually	Periodic	Best Practices
Stakeholder Engagement					
All Phases	Grievance Redress Mechanism, Labor	nearby communities, PM, affected parties, interested groups, public at	Quarterly	Periodic	Best Practices

	Management Plan, and Stakeholder Engagement Plan	large, vulnerable groups, Government entities			
Emergency Response Plan					
All Phases	Flood risk, Fire, Earthquake, wind storm etc.	Inspection of site /building, firefighting equipment, drainage system	Annually	Periodic	Best Practices and NFPA (National Fire Protection Associates) standard and local jurisdiction requirements of Building Code of Pakistan – Fire Safety Provisions.

Table 9.4: ESMP Implementation Cost

Activity	Cost (Rupees PKR)	Remarks
Training Program	500, 000	refer section 8.11
Environmental Monitoring		
Ambient Air	740,000	Estimate Cost for 1-year monitoring
Drinking Water Quality	580,000	Estimate Cost for 1-year monitoring
Wastewater	600,000	Estimate Cost for 1-year monitoring
Noise Levels	144,000	Estimate Cost for 1-year monitoring
Solid Waste	150,000	Estimate Cost for 1-year monitoring
Gaseous Emissions	540,000	Estimate Cost for 1-year monitoring
Mitigation Measures (Construction)	3,000,000	Initial estimates

Mitigation Measures (Operation)	600,000	Initial estimates
Reporting	500,000	Initial estimates
Sub total	7,354,000	-
Contingencies (5% of ESMP cost)	3,677,000	-
Grand Total	11,031,000 Eleven Million Thirty-One Thousand	Cost for 1-year

Table 9.5: Sample Forms for Ambient Air Quality Monitoring Record

Items		Measured Value (Mean)	Measured Value (Max.)	SEQS	Remarks (Measurement Point, Frequency, Method, etc.)	Comments*
SO2	Annual Average			80 µg/m³		
	24 hours			120 µg/m³		
NO2	Annual Average			40 µg/m³		
	24 hours			80 µg/m³		
NO	Annual Average			40 µg/m³		
	24 hours			40 µg/m³		
CO	8 hours			5.0 mg/m³		
	1 hour			10 mg/m³		
Lead Pb	Annual Average			1.0 µg/m³		
	24 hours			1.5 µg/m³		
O3	1 hour			130 µg/m³		
Suspended	Annual Average			360 µg/m³		
SPM	Annual Average			360 µg/m³		
	24 hours			500 µg/m³		
Respirable particulate matter PM10	Annual Average			120 µg/m³		
	24 hours			150 µg/m³		
Respirable particulate matter PM2.5	Annual Average			40 µg/m³		
	24 hours			75 µg/m³		

* (H=High, L=Low)

Table 9.6: Stack Emissions

CO, SOx, NOx, Smoke							
Location	S. No.	Parameters	Date	Time (Hrs: Min)	Result (mg/Nm3)	SEQS (mg/Nm3)	Comments*
	1	CO				800	
	2	SOx				1700	
	3	NOx				600	
	4	Smoke				40% or 2 Ringlemann Scale or equivalent smoke number	
	5	PM10				500	

* (H=High, L=Low)

Table 9.7: Sample Forms for Waste Water Quality Monitoring Record					
Item	Unit	Measured Value (Mean)	Measured Value (Max.)	SEQS	Remarks (Measurement Point, Frequency, Method, etc.)
pH	pH			6-10	
TSS(Total Suspended Solids)	mg/L			150	
TDS(Total Dissolved Solids)	mg/L			3500	
BOD5	mg/L			80	
COD	mg/L			150	
Oil and Grease	mg/L			10	
Phenols	mg/L			0.1	
Chloride	mg/L			1000	
Cyanide	mg/L			2	
Sulphate	mg/L			600	
Sulphide	mg/L			1.0	
Ammonia	mg/L			40	
Fluoride	mg/L			10	
Pesticides	mg/L			0.15	
Cadmium	mg/L			0.1	
Chromium	mg/L			1.0	
Copper	mg/L			1.0	
Lead	mg/L			0.5	
Mercury	mg/L			0.01	
Selenium	mg/L			0.5	

Nickel	mg/L			1.0	
Total Toxic metals	mg/L			2.0	
Zinc	mg/L			5.0	
Arsenic	mg/L			1.0	
Barium	mg/L			1.5	
Iron	mg/L			8.0	
Silver	mg/L			1.0	
Manganese	mg/L			1.5	
Boron	mg/L			6.0	
Chlorine	mg/L			1.0	
An-ionic detergents	mg/L			20	
Temperature	0C			400≤ 30	

Table 9.8: Sample Form for Noise Quality Monitoring Record

Location	S. No.	Date	Time (Hrs: Min)	Analysis Result [dB(A)Scale	SEQS [dB(A)Scale]*	Comments**
	1				55 (Day) / 45 (Night)	
	2				55 (Day) / 45 (Night)	
	3				55 (Day) / 45 (Night)	
	4				55 (Day) / 45 (Night)	
	5				55 (Day) / 45 (Night)	
	6				55 (Day) / 45 (Night)	
	7				55 (Day) / 45 (Night)	
	8				55 (Day) / 45 (Night)	

** (H=High, L=Low)

Table 9.9: Sample Form for Drinking Water Quality Monitoring Record

Location	Date	Parameters	Sindh Standards (mg/l)	Analysis Result (mg/l)	Comments*
		Color	< 15 TCU		
		Taste	Non-objectionable/ Acceptable		
		Odor	Non-objectionable/Acceptable		
		Turbidity	< 5 NTU		

		Total Hardness as CaCO3	< 500 mg/l		
		TDS	<1000		
		pH	6.5-8.5		
		Aluminum (Al) mg/l	≤ 0.2		
		Antimony (Sb)	≤ 0.005		
		Arsenic (As)	≤ 0.05		
		Barium (Ba)	0.7		
		Boron (B)	0.3		
		Cadmium (Cd)	0.01		
		Chloride (Cl-)	< 250		
		Chromium (Cr)	≤ 0.05		
		Copper (Cu)	2		
		Phenolic compounds	<0.0002		
		Cyanide (CN)-	≤ 0.05		
		Fluoride (F)	≤ 1.5		
		Lead (Pb)	≤ 0.05		
		Manganese (Mn)	≤ 0.5		
		Mercury (Hg)	≤ 0.001		
		Nickel (Ni)	≤ 0.02		
		Nitrate (NO3)-	≤ 50		
		Nitrite (NO2)-	≤ 3		
		Selenium (Se)	≤ 0.01		
		Residual Chlorine	0.2-0.5 At consumer end 0.5-1.5 at source		
		Zinc (Zn)	5.0		
		All water intended for drinking (E.Coli or Thermo tolerant Coliform bacteria)	0.0 cfu/ 100 ml		
		Treated water entering the distribution system (Ecoli or thermo tolerant coliform and total coliform bacteria)	0.0 cfu/ 100 ml		
		Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform bacteria)	0.0 cfu/ 100 ml		

(cfu=Coliform Unit), * (H=High, L=Low)

Table 8.4 Sample Form for Solid Waste Monitoring Record

(Domestic / residential / commercial solid wastes)

Location: _____, Date: _____, Source: _____ (domestic/commercial)

Total Quantity (kg)	Components	Weight (as discarded)	% by weight (as discarded)	Recyclables	Non-recyclables	Organic waste
	Food/kitchen waste					
	Plastics					
	Metals					
	Paper					
	Textile/Rugs					
	Cardboard					
	Glass					
	Rubber					
	Other					
Total						

Generation Rate:

For domestic or residential units Total waste generated = _____ kg/capita/day
No of persons in units

For commercial units Total waste generated = _____ kg per unit area
Total floor area of unit

Summary:

Total Waste Generated (as collected) = _____ kg
Recyclable waste quantity = _____ kg
Non-Recyclable waste quantity = _____ kg
Organic waste quantity = _____ kg
%age of Recyclables = _____ %
%age of Non-recyclables = _____ %
%age of Organic waste = _____ %
Total waste sends for recycling = _____ kg
Total waste sends for landfill = _____ kg
Comments:

9 CONCLUSION

This ESIA study has been prepared for the proposed “The Mangrove Creekside Development” to investigate its potential environmental and social impacts arising during pre-construction, construction and operation phases of the project. The development of the proposed project aims for sustainability focused development comprising residential area, commercial and retail spaces and technology zone.

Primary and secondary baseline data has been collected and used to assess the environmental impacts of the Project. Detailed baseline monitoring, consisting of monitoring of ambient air quality and noise levels, has been conducted. This ESIA report highlights all potential environmental impacts associated with the Project and recommends mitigation measures. Any environmental impact associated with the project needs to be properly mitigated, through measures described in this report. Consultations have been conducted with the key stakeholders in the project area consisting of commercial entities, residential buildings and industrial units and other entities.

The majority of the environmental impacts are associated with the construction phase of the project such as deterioration of air quality, high noise levels, occupational health & safety and traffic management. There is no resettlement involved.

An Environmental and Social Management Plan (ESMP) has been prepared and will be implemented during the project construction and operation phases. The ESMP identifies the potential environmental impacts arising from the project along with a set of the mitigation measures to reduce the impacts to acceptable levels, while include the institutional arrangements for implementing the ESMP to ensure its effectiveness and a monitoring plan to ensure effectiveness of implementation of mitigation measures.

The overall conclusion of the ESIA study is that, provided that the mitigation and enhancement measures are implemented in full, there should be no significant persistent negative environmental impacts, emanating from the location, design, construction and operation of the project. There should in fact be positive benefits through nurturing the scientific research towards generating economic value. The project is expected to stimulate overall economic growth with entrepreneurship and technology-based exports, thereby potentially generating new skilled-job opportunities over medium and long term. There are two recommendations that need to be followed to ensure that the environmental impacts of the project are successfully mitigated;

- All mitigation measures proposed in this ESIA report are implemented as described in the document;
- The Environmental & Social Management Plan including Environmental Monitoring Plan is implemented in letter and spirit.

*Annex*ure

Annex – I:

Approved Master Plan

Cleared as per RHQ letter
No. 15/104/TDKR/KORANGI CREEK/04/4750
Dated: 12/10/2022

DIRECTOR
Military Lands & Cantonments
Karachi Region, Karachi Cantt.
12/10/2022

APPROVED
Vide C.B Resolution No. 19
dated 30/06/2022
down in ... additions laid
No.CBKC/NMCS/survey no. 295 to 301/511, 24/10/22

Cantonment Executive Officer
Korangi Creek

100' WIDE ROAD
100' WIDE ROAD
100' WIDE ROAD
100' WIDE ROAD

295
296
297
298
299/1
300/1
301

C6 8344.69
C5 5910.1
C4 5300
C4
C3 12392.4
C2 13155.5
C2
C1 10201.7
PB 5528.79
PB 9995.8
PB

GREEN
50' WIDE ROAD
60' WIDE ROAD
200' WIDE NULLAH
CREEK/SEA

Arrow indicates front elevation(orientation) of plots.

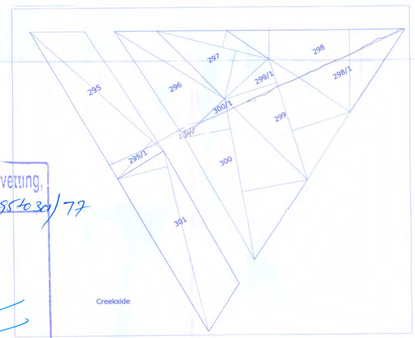
Survey Draughtsman
Cantt Board Korangi Creek

Cantt Executive Officer
Cantonment Board
Korangi Creek

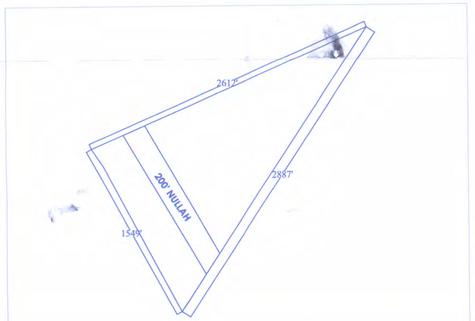
Forwarded to RHQ, Karachi for vetting,
vide Letter No. CBKC/TPL/S.No.295 to 301/77
Dt. 31/8/22

Cantonment Executive Officer,
Korangi Creek

KEY PLAN



SURVEY PLAN



SITE PLAN

SCHEDULE OF AREA

TOTAL PLOT AREA	=	40 ACRE
OR	=	193,600 SQ.YD
OR	=	17,424,00 SQ.FTS

SCHEDULE OF PLOTS

TYPE	PLOT DESIGNATION	PLOT SIZE	PLOT SIZE (SQFT)	TOTAL PLOTS	AREA IN SQFT	AREA IN SQYD	PERCENTAGES
COM-RES	C1	AS PER PLAN	91,815.3	1	91,815.3	10,201.7	
COM-RES	C2	370'X320'	118,400	2	236,800	26,311.1	
COM-RES	C3	AS PER PLAN	111,531.6	1	111,531.6	12,392.4	
COM-RES	C4	180'X265'	47,700	10	477,000	53,000	
COM-RES	C5	AS PER PLAN	53,190.9	1	53,190.9	5910.1	
COM-RES	C6	AS PER PLAN	75102.2	1	75102.2	8344.69	
TOTAL				16	1,045,440	116,160	60 %
PUBLIC USE	PB				137,021.4	15,224.6	7.86 %
GREEN					141,987.6	15,776.4	8.14 %
ROADS					417,951	46,439	24 %
GRAND TOTAL					1,742,400	193,600	100 %

TITLE

PROPOSE LAYOUT PLAN ON LAND MEASURING 40-00 ACRES PLOT OF SURVEY NOS: 295/1(33 GHUNTAS),296/1(1 GHUNTA),298/1(4 ACRES 14 GHUNTAS),299(8 ACRES 28 GHUNTAS),300(13ACRES 26 GHUNTAS) AND 301(12 ACRES 18 GHUNTAS),SITUATED AT DEH DIH,TAPPO IBRAHIM HYDERI,TALUKA KORANGI CREEK KARACHI EAST

LESSEE :

National Management &Consultancy
Services Private Limited
Subsidiary of TPL Properties Ltd.
20th Floor,Sky Tower-East Wing,Dolmen City,HC-3,
Block 4,Abdul Sattar Edhi Avenue,
Clifton,Karachi

THROUGH DIRECTOR

TOWN PLANNER

ATIF-UR-REHMAN
B-CRP (Town Planning)
Member Of PCATP Reg.P-0725
S.B.C.A Licence TP 07-41

ARCHITECT

ARCHITECT FIZA AFZAL
B.ARCH, M.P.C.A.T.P
SBCA Licensce No. AL-01-5421A

SCALE	NORTH
1:2000	
ISSUE DATE	REVISION NO.
26-08-2022	REV-1

Annex – II:

NOCs & Approvals

HEADQUARTERS
Civil Aviation Authority
Jinnah International Airport
Karachi-75200
Tele: 9221 - 99242794
Fax: 9221 – 34604977

HQCAA/6427/2/4/16/ADS/DAAR (P/C) /572

Dated: 17 August 2010

ISSUANCE OF NOC FOR HEIGHT

1. Reference is made to your letter No. CAA-NOC-07-10-001 dated 3rd July 2010 / CAA/002 dated 13th August 2010 on the subject.

2. Civil Aviation Authority has no objection to the construction of multi storey building 'ENCLAVE' maximum 350 feet (three hundred fifty feet) from Ground Level (which includes over head water tank, antenna, Neon sign board etc. on roof top) or 381.16 ft (three hundred eighty one decimal sixteen feet) above mean sea level , at (2448 N 6706 E) Plot # . Survey No. 295-301, Deh Dih, Korangi Creek, Karachi with the following terms and conditions:-

a) Height of the building should not be more than 350 feet (three hundred fifty feet) from ground level. Obstruction light must be provided on top of the building, in accordance with the specification contained in Para 6.3 of Chapter 6 of ICAO Annex-14 (copy enclosed).

b) The refuse shall not be kept open but always be stored in covered containers to ensure that birds are not attracted.

c) Civil Aviation Authority shall not accept liability for any loss(s)/damage(s) /inconvenience suffered due to noise or other aviation related activities or any other claim by other Organizations/person(s).

d) Civil Aviation Authority reserves the right to cancel the said NOC if the terms & conditions are not complied with. This Noc is valid for one year from the date of issue if, the work is not commenced within this period.

e) This NOC is only relates to the clearance / permissible height at proposed location and does not absolve the holder for fulfilling requirement of other concerned departments / organizaiton / agencies etc.

f) NOC from Director Air Traffic Services, Air Headquarters PAF, Islamabad must also be obtained before the start of work.

g) Completion of work is also required to be notified to HQCAA for the issuance of notices to the Aviators.

3. This is issued with the approval of Director of Airspace & Aerodrome Regulations (DAAR).

(9)

CONFIDENTIAL

AHQ/1532/2/ATS

12 October, 2022

Omer Masoom Wazir
(Cantonment Executive Officer)
Military Lands & Cantonment Department
Cantonment Board Korangi Creek, Karachi
Tel: 021-35090301

NOC FOR HEIGHT CLEARANCE UNDER ICAO OBSTACLE LIMITATION SURFACES (OLS)

1. Reference letter No CBKC/NMCS/42 dated 18 July, 2022 and CBKC/Survey No 295 to 301/371 dated 16 September,2022.

2. It is apprised that the undermentioned site has been evaluated as per ICAO Obstacle Limitation Surfaces (OLS) criteria wrt PAF Base, Faisal: -

Site Name / Location	Site Coordinates	Approved Height (AGL)	Remarks
Survey No 295 To 301, NACLASS 24, Deh Tappo, Ibrahim Haidery, Karachi	24°47'49.62"N 67°06'31.40"E 24°47'26.06"N 67°06'15.04"E 24°47'29.04"N 67°06'17.14"E 24°47'30.96"N 67°06'18.44"E 24°47'37.93"N 67°06'06.47"E 24°47'39.95"N 67°06'10.55"E 24°47'40.98"N 67°06'12.38"E	350 feet	CLEAR

3. The site mentioned in Para 2 above is "CLEAR" and be provided with NOC for construction of building / infrastructure.

4. It is highlighted that the height clearance is subject to following terms and conditions: -

(a) Height of the building / infrastructure including signboards, water tanks, antenna etc. shall not exceed the height allowed in Para 2.

(b) No variation in the site and height of building is allowed.

(c) Garbage / refuse shall be kept in covered containers and disposed of properly to eliminate fire / bird hazards.

(d) Obstruction lights shall be installed as per ICAO / PCAA specified criteria.

(e) AHQ will not accept any liability for any loss, damage or inconvenience suffered due to noise or other effects of aviation related activities or any other claim.

GOVERNMENT OF PAKISTAN
Ministry of Defence
Survey of Pakistan
Directorate of Printing & Geodesy
Tele: 051-9290207

No. 871 /42-A-3 (DGIC) Karachi
Dated:- 08 -09 -2022.

To,

Mr. Danish Qazi,
Chief Executive Officer,
National Management & Consultancy Services (Pvt) Ltd,
Address: 20th Floor, Sky Tower, East Wing,
Dolmen City, HC-3, Block-4, Abdul Sattar Edhi Avenue,
Clifton, Karachi.
CNIC # 42201-5209277-3,
Contact No. 0300-8241394, 021-37130227.

Sub: **PROVISION OF SITE CO-ORDINATES IN WGS-84:**

Ref:
i) Your letter No. Nil, dated 05-08-2022.
ii) GIC Karachi letter No. 904-T/42-A-2, dated 24-08-2022.
iii) No. 6 G.U letter No. 2587/42-A-3/Verify, dated 08-09-2022.

With reference to your letter cited above at Sl. (i) Following WGS-84, co-ordinates and heights of under mentioned site are sent herewith for further necessary action at your end, please.

Company/Station Name	Point ID	Latitude	Longitude	M.S.L.
SURVEY NO.295 TO 301 ADMEASURING 40 ACRES, NACLASS 24 DEH TAPPO IBRAHIM HAIDERY, KARACHI	DQ.01	24°47'49.62"	67°06'31.40"	2.79
	DQ.02	24°47'26.06"	67°06'15.04"	2.54
	DQ.03	24°47'29.04"	67°06'17.14"	3.02
	DQ.04	24°47'30.96"	67°06'18.44"	3.26
	DQ.05	24°47'37.93"	67°06'06.47"	3.24
	DQ.06	24°47'39.95"	67°06'10.55"	2.51
	DQ.07	24°47'40.98"	67°06'12.38"	2.51

Nisar

(NISAR ALI HUSSAIN)
DEPUTY DIRECTOR
PRINTING & GEODESY
SURVEY OF PAKISTAN
RAWALPINDI

Copy for information & necessary action.

(i) The Director Geo Information Center, Survey of Pakistan, Karachi.
(ii) Additional Director, Aerodrome Standards Branch, Headquarters Pakistan Civil Aviation Authority **(PCAA)**, Inspectorate Building, Jinnah International Airport, Karachi.
(iii) Assistant Director, Navigation, Directorate of Air Traffic Services**(ATS)**, Air Headquarters, Islamabad.
(iv) Sindh Building Control Authority**(SBCA)**, Civic Centre Annexe, University Road, Gulshan-e-Iqbal, Karachi -5.

(10)

(f) Any other condition imposed by the Govt of Pakistan shall also be adhered to

5. This NOC is only related to the clearance / permissible height at proposed location in Para 2 and does not absolve the holder for fulfilling requirement of other concerned departments. Moreover, any omission due to submission of incorrect data or marginal error **shall not entitle** the holder for any claim whatsoever in future. **In addition, at any stage if, any dispute of land on the said survey numbers arises with PAF, this NOC shall be cancelled immediately.** Please ensure that terms and conditions of the NOC are strictly adhered to.

(RUBINA KHAN)
Group Captain
Director Air Traffic Services
Air Headquarters Islamabad
Tel 051-950 2351

Copy to: -

1. PAF Base, Faisal **(Base Commander)** :for info, please
2. PAF Base, Faisal (OC ATC Sqn)

3 **Director Airspace & Aerodrome Regulation (DAAR)**
HQ Civil Aviation Authority
Karachi

Annex – III:
Topographic Survey Report

The Mangrove –Creekside Urban Development

Final Report

Submitted by EA Consulting Pvt. Ltd.

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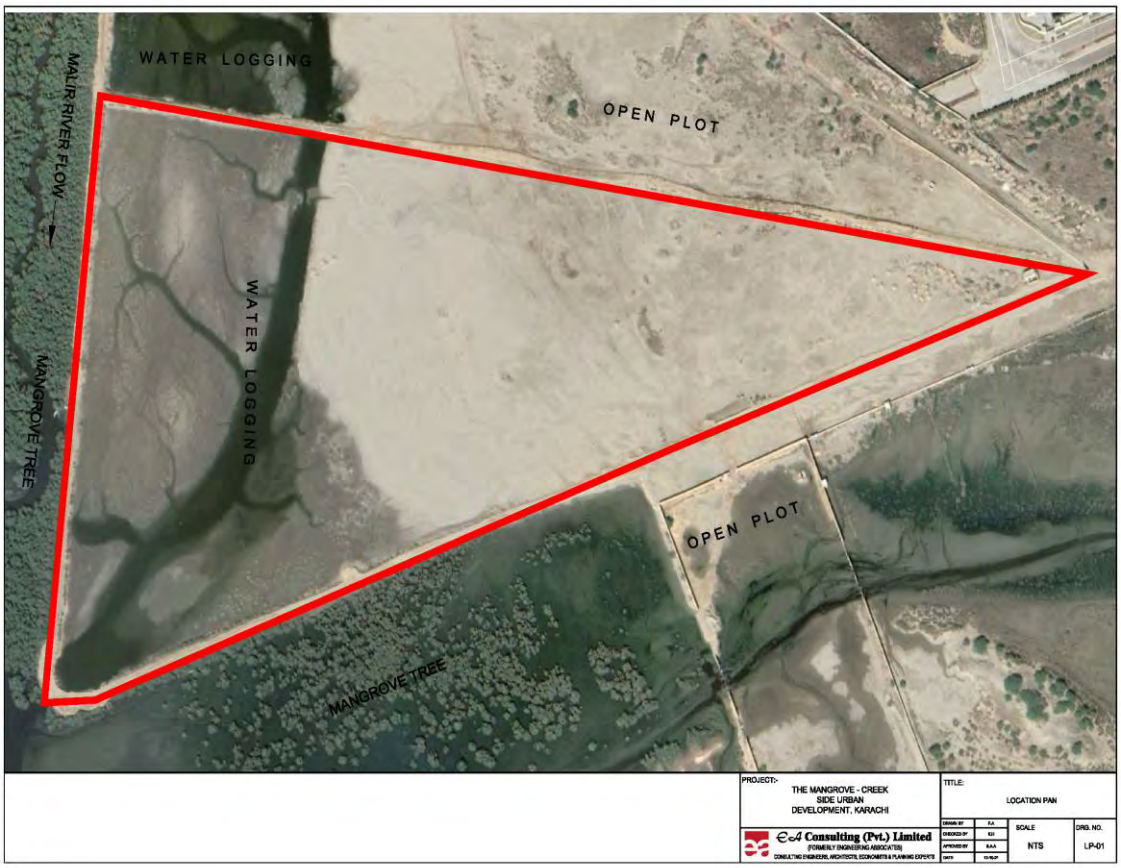
1.0 INTRODUCTION

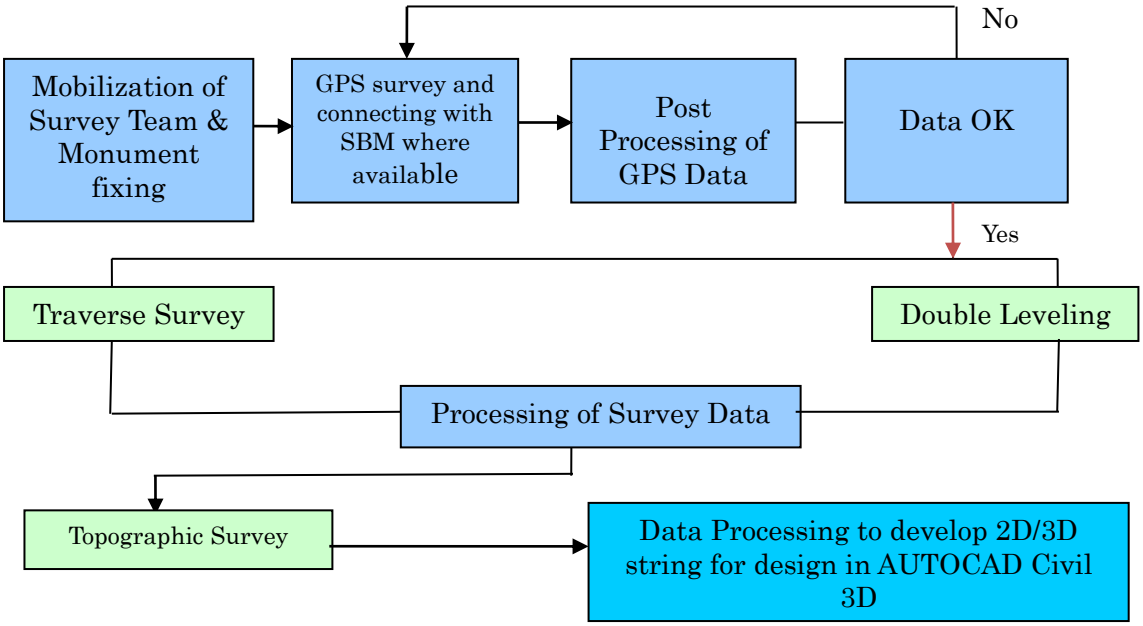
TPL Properties vide their Letter No: TPLO-Mngrv-2021-0001 dated September 21, 2021, have appointed EA Consulting Pvt. Ltd. for carrying out topographic survey of their property in Korangi which has been earmarked for development. Location of the said property in shown in Figure 1-1.



This report is in compliance of this requirement and present the topographic survey carried out at the said property.

2.0 FLOW CHART OF TOPOGRAPHIC SURVEY

Detailed topographic survey is conducted using contemporary tools and techniques to enable engineers in carrying out detailed engineering design of Project in accordance with the requirements identified in the Terms of Reference. The following flow-chart briefly describes the procedures of different components of this topographic survey.



2.1 Mobilization of Survey Teams

After reviewing project requirements vis-à-vis topographic survey, following field teams were mobilized with their equipment

(i) Monument Fixing Team
(ii) GPS Survey Team
(iii) Traverse Survey Team
(iv) Control Leveling Team
(v) Topographic & X-Sec Survey Teams

2.2 Adopted Methodology

Pegging & Monument Fixing

Route Reccee and Pegging was completed by the Survey Team Leader himself, the senior most surveyor. The aim of this activity is to establish control points at suitable

and safe places within the survey area by driving wooden pegs or by embedding concrete pillars at each selected place.
Every effort was made to select locations, which were safe from conservation point of view and free of any obstruction to facilitate uninterrupted GPS signals and observation.

Primary Control by GPS for X, Y, Z

A) General

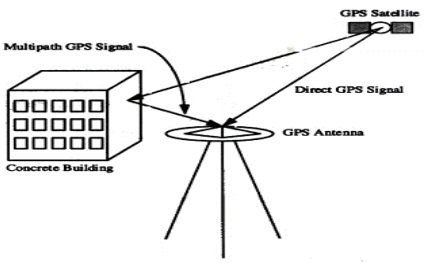
The GPS system was originally designed for military use only, providing sea, air and ground forces of the United States and NATO with an all-weather, high-precision, worldwide real-time positioning system. Though initially designed as a military system, it became freely available for international civil use. The system has a complete set of at least 24 satellites orbiting the earth in a carefully designed pattern. The initial design was for a 24 satellite constellation, each orbiting at an altitude of approximately 20,200 km above the earth, in one of six orbital planes. Each satellite broadcasts a unique "bar code", known as Pseudo Random Noise (PRN) code, which enables GPS receivers to identify the satellites from where the signals came, and makes positioning possible.

A master control station updates the information (message) component of the GPS signal with satellite ephemeris data and other announcements to the users. This information is then decoded by the receiver and used in the positioning process.

The User Segment is the most important segment of the system and is comprised of all users making observations with GPS receivers. The civilian GPS user community has increased dramatically in recent years, due to the emergence of low cost, portable GPS receivers and the ever-expanding areas of applications in which GPS has been found to be very useful. Some of these applications are: surveying, mapping, navigation and vehicle tracking

B) GPS Limitations

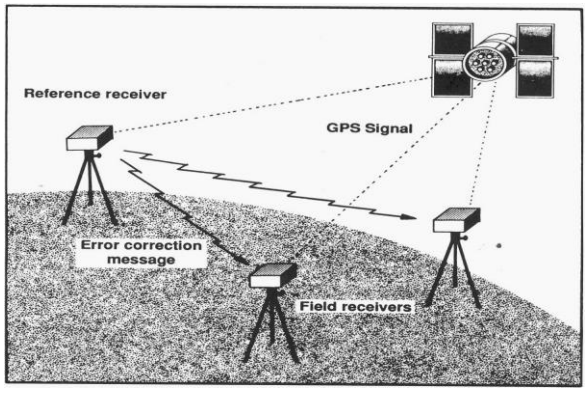
Though GPS can provide a worldwide 3-D position, 24 hours a day, in any type of weather, the system does have some limitations. First, there must be a (relatively) clear "line of sight" between the receiver's antenna and several orbiting satellites. Buildings, trees, mountains, steep cliffs, overpasses, and other obstructions that block the line of sight between the satellite and the observer (GPS antenna) make it impossible to work with GPS. Anything shielding the antenna from a satellite can potentially weaken the satellite's signal to such a degree that it becomes too difficult to make reliable positioning. Any obstruction that can block or interfere with a radio signal can effectively block or interfere with GPS signals.



Bouncing of the signal off nearby objects may present another problem, that of distinguishing between the signals coming directly from the satellite and the "echo" signal that reaches the receiver indirectly. This phenomenon is referred to as ***multi-path***. Multi-path refers to the existence of signals reflected from objects

in the vicinity of a receiver's antenna that corrupt the direct line-of-sight signals from the GPS satellites, thus degrading the accuracy of both code-based and carrier phase–based measurements. Particularly difficult is close-in multi-path in which the reflected secondary signals arrive only slightly later (within about 100 nanoseconds) than does the direct-path signal, having been reflected from objects only a short distance from the receiver antenna. In areas that possess these types of characteristics, longer observational times or traditional surveying techniques must be used instead of GPS positioning or to complement the GPS positioning. The receiver must receive signals from at least four satellites to be able to make reliable position measurements. In addition, these satellites must be in a favorable geometrical arrangement. The four satellites used by the receiver for positioning must be fairly spread apart. In areas with a relatively open view of the sky, this will almost always be the case because of the way these satellites were placed in orbit.

C) GPS Point Positioning



The position of a point is determined by measure distances or pseudo ranges from the receiver to at least four satellites. The GPS receiver "knows" where each of the satellites is at the instant in which the distance was measured. These distances will intersect only at one point, the position of the GPS receiver (antenna). The receiver "knows" the position of the satellites, because this information comes from the broadcast ephemeris that is downloaded when the GPS receiver is turned on. The GPS receiver performs the necessary mathematical calculations, then displays and/or stores the position, along with any other descriptive information entered by the operator from the keyboard.

D) Advantages of GPS

The most advantageous aspects of GPS are its accuracy, precision, and efficiency, particularly in survey tasks that span a large area. Traditional terrestrial survey activities that would have normally taken months to complete, now take only a few days utilizing GPS. Real-time applications of GPS enable surveyors to perform quick data collection. GPS is used exclusively to density control networks.

E) GPS Observations

GPS observations using "Trimble GPS 4000 SSI Dual Frequency Instrument" will be carried out using a pair of receivers, the "BASE" and the "Rover". The Base will be placed at known point and the Rover at the stations whose coordinates to be determined. Static mode of survey will be adopted with small baseline and longer observation time. All coordinates will be observed in UTM Coordinate System.

F) Post Processing of GPS Data

Positioning information provided by GPS contain errors. The errors due to atmospheric effects and orbital perpetrations can be corrected by means of a technique called "Differential Correction".

During the post processing, the correct coordinates of the unknown points are obtained with reference to the correct coordinates of the known points.

For this Project, coordinates and levels of Survey of Pakistan Bench Marks (SBM) in the vicinity of project roads were explored, however, SoP SBMs could not be found. As such, coordinates/levels observed from GPS were used as reference coordinates for processing of GPS survey data.

At the end of each day the Post Processing of GPS observations in UTM was carried out using the Post Processing software to remove any possible error.

Coordinates obtained through GPS observation were then used for generating coordinates for Traverse Stations i.e. secondary control.

2.3 Secondary Horizontal Control by Traverse for X, Y

Secondary Horizontal Control was established by Traverse Method using the Primary GPS Survey Control Points. These traverse control points were used by topographic survey teams and cross-section survey teams within the project area. These points were established at suitable places within project area by using small size pillars or by driving wooden pegs or by marking the station number by paint on permanent structures. Total Station is set at known point (in terms of Easting, Northing & Elevation), Tri-Bridge Target is set on the second known point, which is in direct visual contact from the first point. Values of E, N & H of first and second known points are feed in the Total station, and Total Station reads the second point where the tri-bridge is set. In this way, total station is oriented in terms of bearing, distance and elevation to the survey control established during the GPS survey. The Prism target is then fixed to third location, and Total Station observed angle and distance to this point. When, third point is still there with its prism fixed, the total station is moved to fourth point, re-read the third point for orientation, and fifth point is established using prism target, and so on, until the next GPS known point is reached, where the traverse surveyor closes his observation and checks his work. At the end of Traverse Survey, coordinates of all the unknown points are calculated using angle and distance, observed during the field work. The coordinates of Secondary Control (Traverse) points were ultimately used for Topographic Survey,

The following precautions were taken in traverse observations to achieve the accuracy required for such work.

- Total Station with the least count of 1" (one second of arc) was used for all angular and linear measurements.

- Each traverse angle was observed on two zeroes taking measurements on both left and right faces. The agreement between the two values of the same traverse angle were not allowed to exceed 10". Observations were repeated where the discordance exceeded the given limit. The means of 2 sets (4 measures) of traverse angles were used for computing bearings.

- Total Station were used for all linear measurements. Having an accuracy of around 3mm plus 3 parts per million of distance which can yield high accuracy up to 1 in 25,000.

- Reciprocal linear measurements were made for each traverse leg, thus measuring each distance twice in fore and back directions. The agreement between the two measurements was ensured to be of the order of 1 in 10,000. The means of the two measurements was accepted for the computation of traverse line.

2.4 Secondary Vertical Control by Double Leveling Technique for "Z"

Vertical Control were established using Double Leveling method with precautionary measures as provided hereunder:

- Nikon Titling Leveling Instruments Model AC-2S of magnifications 30X was used for control leveling.
- The longest permissible shot was limited to 100 meters provided the staff graduations could clearly be visible. The shots were further reduced to 50 meters and even shorter for accurate reading and to minimize the effect of shimmering created by high temperature.
- Two surveyors observed the leveling line in fore and back directions connecting all the traverse stations of the main traverse line en-route and establishing their own Temporary Bench Marks - TBMs on permanent structures or by marking the station number by paint on road side structures at suitable interval.
- The permissible discordance between "Fore" and "Back" leveling at any Benchmark was kept $\pm$ 0.009 meter (9 mm)
- The accuracy of leveling line is kept 15mm $\sqrt{K}$, where K is the length of line in kilometers.

Horizontal and Vertical Control Point data are mentioned in Topographic Survey Plan which is attached with this report as ***Annexure-A***

3.0 DETAILED TOPOGRAPHIC SURVEY

The purpose of topographic survey is to collect all topographical (natural and man-made) information of the area of interest to facilitate detailed designing.

The topographic survey was carried out by Total Station to depict all manmade and natural features existing inside the survey corridor. Nikon Total Stations Set NPL-332 with built-in electronic Data Collector and Trimble GPS were used for collecting topographic details.

A total station surveying instrument is the central component in modern "field–to–flash" surveying system. Total Station integrates an electronic digital theodolite, an electronic distance measuring instrument (EDM) and a computer in a single functional unit. The electronic digital theodolite automatically measures and displays horizontal and vertical angles. Total Station instruments simultaneously measures distance, as well as directions, and transmit the results automatically to a built-in computer. The horizontal and vertical angles and slope distance can be displayed, upon keyboard commands. Horizontal and vertical distance components are instantaneously computed and displayed. If coordinates of the occupied station and a reference azimuth are input into the system, coordinates of the sighted point are immediately obtained.

To synchronize the work of each party a list of features codes was prepared in advance which covers all the anticipated topographic features that could be encountered during the survey work. The final list of feature codes was feed into the Total Station instrument prior to field work to facilitate the surveyors with the facility

of on-line coding.

The method of surveying details through data collector is similar to conventional Plane Table Survey method but the major difference is its capacity of developing topo drawings on any desired scale with three dimensional outputs of every feature / points along with on-screen plotting of them, for minimizing error, which in the case of PT Survey is not possible.

Topographic survey within the survey area was conducted and all features and ground details; falling within the survey area were recorded. Every care was taken to pick the following details:

- Representative Ground Level
- Sudden Change of ground elevations
- Existing road, including carriageway, shoulders, toe of embankment
- Existing Draining Structures
- Existing nala boundaries, top width and ground features
- Boundaries of Ditches, Eroded Banks
- The outer limits of village boundaries, buildings, huts, hedges, walls
- Location of isolated building/yards
- Roads intersecting the project road, their junction details
- Railway line, if present
- Boundaries of agriculture farms, orchards, graveyards and other land uses

During topographic survey, all existing features, such as roads, tracks, railway lines, houses, huts, graves, trees, underground (if markers are visible) and overhead utilities, water courses, drains, top and bottom levels of cliff, etc. and all other features present within the survey strip area were picked. Spot levels at regular interval were observed to depict the relief of the area.

The instrument, Total Station or GPS, was setup on a control point and its coordinates were fed into recorder. After stationing, the surveyors started taking details of ground by using the feature code database, which had already been saved in the hard drive of data collector.

The Surveyors deployed on detailed survey with Total Stations/GPS, down loads the raw survey data from their electronic data collector to computers as soon as a survey job was completed. This data was then communicated through e-mail to Head Office where team of experienced engineers downloaded it to mapping software for processing and production of drawings. SDR Mapping and Design (Ver. 6.5) and Civil-3D software are used for the processing of the raw survey data.

4.0 POST PROCESSING OF FIELD DATA, DRAFTING AND PLOTTING

SDR Mapping and Design (Ver. 6.5) and Civil-3D software acts as an interface to transform the Total Station/GPS Data and develop topographic feature Maps and Digital Terrain Model (DTM) using raw elevations. The processed data is converted to ASCII format which is used to develop DXF Format files. These DXF files are imported to AutoCAD software to develop Digital 3-Dimensional Survey Drawing. These AutoCAD drawings are further refined by draftsmen using specific layers, line type, line thicknesses, and text height. A detailed line work and insertion of appropriate symbols is also carried out at this stage to make the survey drawings more legible and

easy to read for design engineers. Additional software are used to develop Digital Terrain Model (DTM) using the spot elevation and cross-section data collected during the field survey. This DTM eventually produces contours on any desired contour intervals.

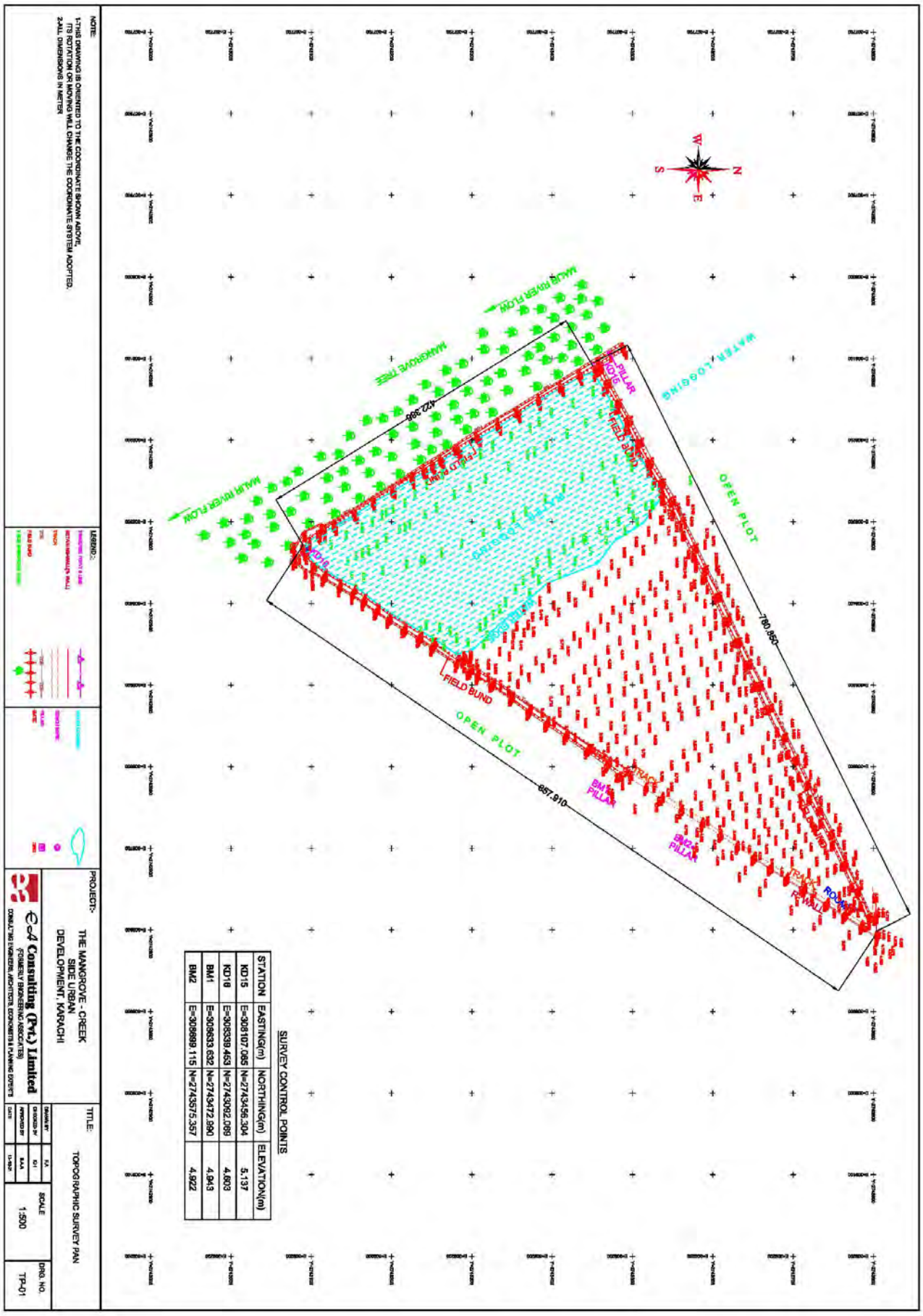
As soon as these survey drawings were printed on appropriate scale, these were sent back to survey teams for field verification. At that stage surveyors visually verify all the survey drawings. All omissions, errors, or missing information were recorded either on drawing manually or, if required digitally, and this data once again was sent back to office for updating the survey drawings.

5.0 PICTORIAL OF SURVEY WORKS

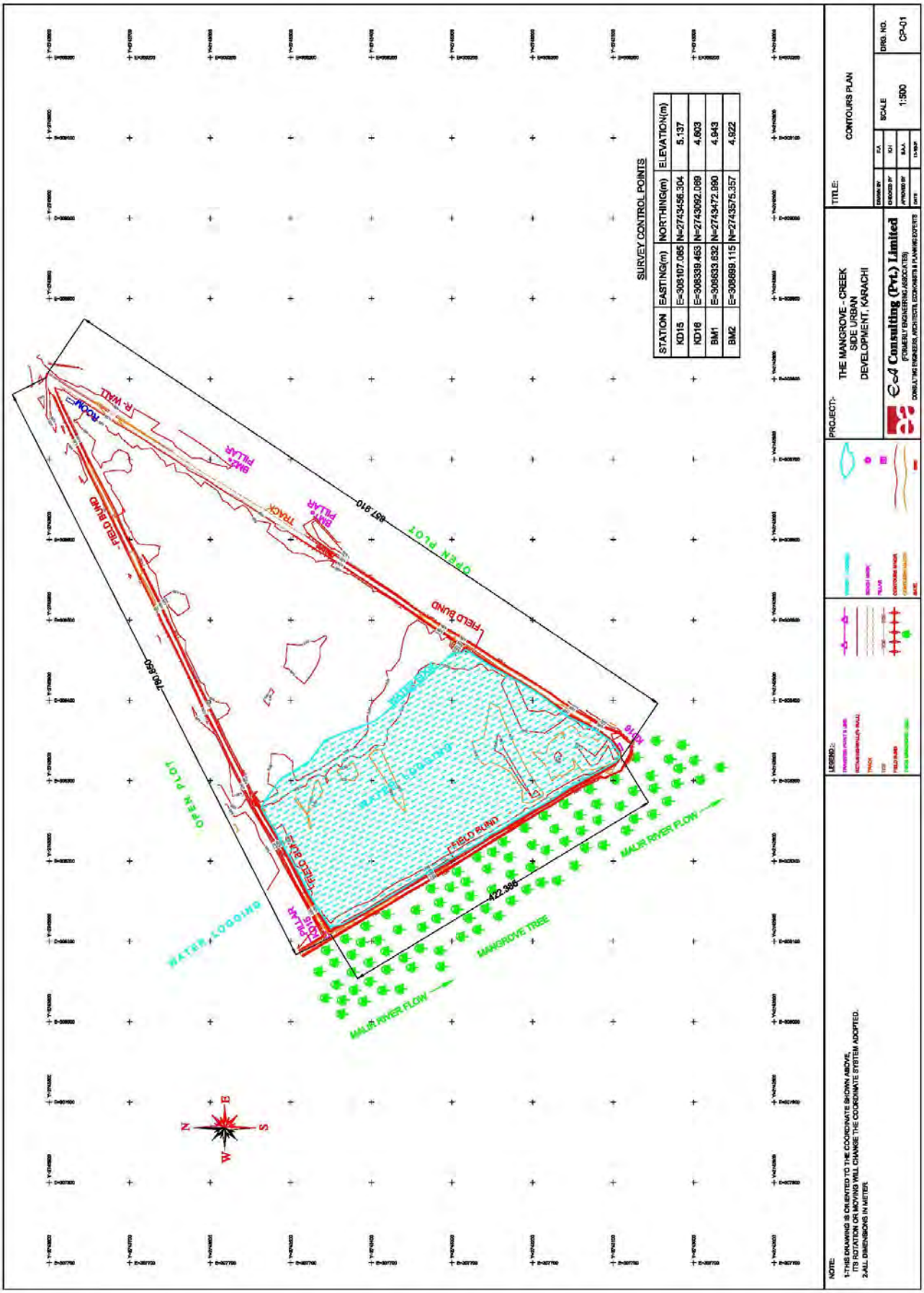
Some selected photographs of different survey activities are given as follows:

Annexure-A

TOPOGRAPHIC SURVEY PLAN


NOTE:
1-THIS DRAWING IS ORIENTED TO THE COORDINATE SHOWN ABOVE, ITS ROTATION OR MOVING WILL CHANGE THE COORDINATE SYSTEM ADOPTED.
2-ALL DIMENSIONS IN METER.
LEGEND:
PROJECT:-
THE MANGROVE - CREEK SIDE URBAN DEVELOPMENT, KARACHI
TITLE:
TOPOGRAPHIC SURVEY PAN
EA Consulting (Pvt.) Limited
(FORMERLY EKISTICS ASSOCIATES)
CONSULTING ENGINEERS, ARCHITECTS, ECONOMISTS & PLANNING EXPERTS
DRAWN BY
CHECKED BY
APPROVED BY
DATE
SCALE
1:500
DRG. NO.
TP-01
SURVEY CONTROL POINTS
STATION | EASTING(m) | NORTHING(m) | ELEVATION(m)
KD15 | E=308107.085 | N=2743456.304 | 5.137
KD16 | E=308339.453 | N=2743092.089 | 4.803
BM1 | E=308633.632 | N=2743472.990 | 4.943
BM2 | E=308699.115 | N=2743575.357 | 4.922
MANGROVE TREE
MAJR RIVER FLOW
MAJR RIVER FLOW
WATER LOGGING
OPEN PLOT
OPEN PLOT
FIELD BUND
FIELD BUND
FIELD BUND
KD15
KD16
BM1 PILLAR
BM2 PILLAR
780.850
422.396
657.910
N
S
E
W

With Contours



Annex – IV:
Geotechnical Investigation Report

SOIL TESTING SERVICES

KGI – 2009 – 898

GEOTECHNICAL INVESTIGATION FOR 32 ACRES LAND OUT OF SURVEY NOS, 295 TO 301, DEH DIH, TAPO IBRAHIM HAIDERY, KORANGI CREEK, KARACHI

Client: Block by Block

December 2009

SOIL TESTING SERVICES

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Appendix A **Borehole Logs**
Appendix B **Laboratory Test Results**
Appendix C **Pile Capacity Calculations**

1. INTRODUCTION

M/s. Block by Block is planning to develop 32 acres land out of survey nos. 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek, Karachi. In order to proceed with the construction of this branch Block by Block wanted to determine the geotechnical parameters of the subsurface deposits. 'Block by Block' hired the services of M/s. Soil Testing Services (STS) to conduct geotechnical investigation at the proposed location of the exploration rig.

The geotechnical field investigation and laboratory testing was conducted by STS in November – December 2009. Scope of work included drilling of five boreholes up to 20m deep, one borehole up to 30m deep and four boreholes up to 15m deep, carrying out field tests, including standard penetration test, collection of soil and samples, laboratory testing and preparation of report including recommendations for foundation design.

The report consists of seven chapters with *Chapter 2* describing the site's existing condition, *Chapter 3* discusses the on site testing and drilling activities, *Chapter 4* describes the performance of laboratory tests, *Chapter 5* describes the subsurface deposits in detail, *Chapter 6* includes the recommendation for foundation design and *Chapter 7* contains a summary of conclusions regarding the ground conditions, with respect to geotechnical engineering for this project.

2. THE SITE

The site is located off the Korangi Creek Road in the Ibrahim Haidery area of Karachi. Major landmarks in the proximity of the site include the College of Business Management (CBM) and National Refinery Limited (NRL).

2.1 CURRENT CONDITIONS

A significant area of the site is covered with soft sand layer. This makes movement of trucks a problem and the area needs to be ploughed by a tractor to make the land suitable for movement of machinery.

3. DRILLING, FIELD TESTING & SAMPLING

The field testing program consisted of drilling works, in-situ testing including Standard Penetration Tests (SPT) and collection of soil and water samples. The following sections describe these activities in further detail.

3.1 DRILLING METHOD

The boreholes were drilled by rotary wash boring method. Clay and sand was encountered up to the maximum explored depth of 30m. Tricone and clay bits were used to drill the 4-inch borehole. The dates and duration of the drilling is given in Table 3.1

Table 3.1 Milestone dates and duration of boreholes

BH No.	Start Date	Finish Date	Duration (days)
01	19.11.2009	19.11.2009	01
02	21.11.2009	21.11.2009	01
03	23.11.2009	23.11.2009	01
04	24.11.2009	24.11.2009	01
05	25.11.2009	25.11.2009	01
06	25.11.2009	25.11.2009	01
07	26.11.2009	26.11.2009	01
08	26.11.2009	26.11.2009	01
09	25.11.2009	25.11.2009	01
10	24.11.2009	24.11.2009	01

3.2 FIELD TESTING AND SAMPLING

The standard penetration tests (SPT) were carried out at 1.5m interval till 30m depth. The standard penetration test was carried out by “Donut” type sliding hammer. Split-spoon sampler was used in cohesive and fine granular soils to conduct SPT.

4. LABORATORY TESTING

Laboratory testing was carried out on the retrieved split-spoon samples and water sample. The following section enlists and gives details of relevant tests carried out on select samples as required for determining the subsurface conditions and correlating with the information obtained from field testing and sampling.

4.1 CHEMICAL TESTS

Sulphate in groundwater or soil can attack concrete placed in the ground or on surface. A reaction takes place between the sulphate and the aluminate compounds present in the cement, causing crystallisation of complex compounds. The expansion, which accompanies crystallisation, induces stresses in the concrete, which results in mechanical disintegration.

In moist conditions, such as exposure to seawater, the presence of chloride ion, Cl^-, presents a serious possibility of the corrosion of the reinforcement. The presence of $Ca(OH)_2$ provides a strong alkaline environment in which a thin film of iron oxide is formed on the metal surface which protects it against corrosion. However, if the concrete is permeable to the extent that the soluble chlorides can reach up to the reinforcing steel, then in the presence of water and oxygen, the corrosion of the reinforcement will take place. Rust occupies more volume than the original steel, and hence the ensuing expansion of concrete, results in cracking and spalling.

Due to adverse effect of sulphates and chlorides on the quality of concrete it is essential to conduct chemical tests on soil and groundwater. This helps in quantifying the expected exposure of concrete to these chemicals and in devising precautionary measures to ensure integrity of concrete.

The following chemical tests were carried out on soil and groundwater samples:

- Total dissolved solids
- Chloride content
- Sulphate content
- pH

Chemical tests were carried out in accordance with BS 1377-3. Chemical characteristics of groundwater indicate very high composition of chloride and sulphate salts. The severe

exposure to these harmful salts will effect the selection of cement for underground concreting and is discussed in *Chapter 6*.

Table 4.1: ACI standards for concrete for sulphate exposure

Sulphate Exposure	Water Soluble Sulphates in Soil (%)	Sulphate in Water (mg/L)	Cement Type
Negligible	0.00-0.10	0- 150	OPC
Moderate	0.10-0.20	150- 1500	Type II
Severe	0.20-2.00	1500-10000	Type V
Very Severe	Over 2.00	Over 10000	TypeV plus pozzolan

4.2 GRAIN SIZE ANALYSIS

The purpose of grain size analysis is to determine the sizes of the assemblage of particles that make up the soil. The grain size analysis is conducted in two parts: for particles above the "# 200 US sieve", sieve analysis is carried out by passing the selected soil sample from various sieves. For particles finer than the "# 200 US sieve", hydrometer analysis is carried out. The combined process of determination of the size of particles is termed as the grain size analysis.

The samples were prepared in accordance with ASTM D 420 and the grain size analysis was carried out in accordance ASTM D 422.

4.3 LIQUID AND PLASTIC LIMITS

The liquid and plastic limits of soil are parameters that define the state of the soil at different water content levels. The liquid limit is the water content above which the soil goes from solid phase to liquid phase and the plastic limit indicates the water content below which the soil mass makes the transition from a plastic, remouldable solid to a brittle mass which can not be remoulded any more. The difference in the water contents at Liquid and Plastic limits is termed as the plasticity index and it is a measure of the plasticity of the soil under consideration. The samples used for determining the limits are finer than the "#40 US sieve".

The limits were determined in accordance with the ASTM D 4318.

4.4 DIRECT SHEAR TEST

The direct shear test involves, placing a test sample in a rectangular box having two portions, the top portion can move while the lower portion is fixed. The sample is consolidated under a normal load. Also, double drainage is ensured by placing porous stones on the top and bottom of the sample. Hence, the test may be carried out under drained conditions. The shear strength of a remoulded sample is measured by applying a horizontal force which pushes the top part of rectangular box, the sample is sheared to failure and the normal and shear stresses at the point of failure are noted down. The shear box test (or the direct shear test) suffers from various limitations the most prominent of which is the forced failure plane formed due the configuration of the apparatus; this might result in concealing the actual plane of failure. As, the tests are carried out on disturbed samples and since only the stresses at the point of failure are determined the test results can not be reliably used in describing the strength characteristics of the ground. The ASTM D 3080 was followed for the performance of the direct shear test.

5. GROUND CONDITIONS

The subsurface deposits up to the explored depth consist of the following units:

- Silty fine to medium grained sand
- Silty Clay

Following sub-sections describe the strength characteristics of these geological units along with the groundwater conditions at the site.

5.1 SILTY FINE SAND

These soil deposits are found from a depth of 0-18 meters below the existing ground level at the locations of the boreholes, except boreholes 5, 6, 7 and 9. The sand deposits vary from medium dense to very dense state of compactness. Direct shear tests conducted on the remoulded samples indicate high shearing resistance varying from 25 degrees to 38 degrees.

5.2 SILTY CLAY

The silty clay layer is encountered at two different depth horizons in all the boreholes. In *BH 1* hard silty clay was found from 25-30 m below the existing ground level. In boreholes 5, 6, 7 and 9 silty clay has been encountered from existing ground level to about 3m below existing ground level. The clay encountered in the boreholes can be classified as soft to stiff, based on the SPT data. The clay can be classified in the *"CL-ML"* group of Unified Classification System.

5.3 GROUNDWATER CONDITIONS

Groundwater was encountered in all the boreholes drilled at the site. The depth of water table in the boreholes was determined to be around 1.6m below present ground level. The groundwater encountered at very shallow depth indicates presence of perched water table in the sediment layers.

6. ENGINEERING DESIGN CONSIDERATIONS

The proposed development includes construction of multi-storey buildings. The expected loads coming from the building will be borne by the soil. The subsurface deposits encountered and the expected loads coming from the structure indicate that the structure should be supported on pile foundations to avoid excessive settlement and shear failure.

6.1 RAFT FOUNDATION

As the subsurface characteristics vary throughout the site, a general bearing capacity can be given for the entire area by assuming the existence of weakest soil conditions. The foundation of the proposed structures can be supported on raft foundation. *Table 6.1* gives the bearing capacity at different embedment depths.

Table 6.1 Bearing Capacity Values – Raft Foundation

Depth (m)	Net Allowable Bearing Pressure (kPa)	Gross Allowable Bearing Pressure (kPa)
1.50	60	85
3.00	75	125

6.2 DEEP FOUNDATIONS

Deep foundations will have to be provided to support structural load coming from the structure. The pile capacities have been calculated after determination of soil characteristics from SPT data. The axial pile capacities are given in *Table 6.2*.

Table 6.2 Axial Pile Capacities

Diameter (mm)	Length of pile below existing ground level (meters)	Tension (kN)	Compression (kN)
560	15	131	538
	20	222	752
600	15	141	607
	20	238	846
760	15	178	927
	20	302	1278

6.2.1 PILE CONSTRUCTION

Total pile capacity has been derived from combination of end bearing and skin friction components. It is, therefore, essential to adopt appropriate construction methodology to satisfy following requirements:

1. Disturbance to sub-surface along shaft and pile tip shall be avoided during the course of drilling.

2. The bottom of pile shall be cleaned of all loose materials which may accumulate during the course of drilling.

Pile concreting shall be undertaken only when above conditions are fulfilled.

It is understood that subsurface materials will be carefully examined during pilling and it shall be ensured that all piles are placed in proper stratum. This exercise will serve as safeguard against variations in quality and level of occurrence of rock or dense stratum. Necessary embedment in appropriate stratum shall be ensured for all piles.

6.2.2 CONFIRMATORY TESTING

- Pile capacity values have been computed by static formulae which suffer from limitations. As such, all these values are tentative and therefore need verification through full scale load tests.
- Pile capacity values shall be suitably adjusted, if warranted, by results of load tests.
- Pile integrity test shall also be performed to check continuity of concrete below ground surface.
- This report will be valid only if requirement of confirmatory testing is fulfilled.

6.3 SOIL PROFILE TYPE (ACCORDING TO UBC-97)

Chapter 16, Division V, Section 1636 of UBC-97 deals with the determination of Soil Profile Types. Design practice involves using seismic parameters of zone 2b.

6.3.1 SEISMIC ZONE FACTOR

Table 16-I of UBC-97 defines the seismic zone factor to be used in choosing seismic coefficients for a location. The seismic zone factor **"Z"** will be taken as 0.20.

6.3.2 SOIL PROFILE TYPE

Table 16-J of UBC-97 defines the soil profile types to be used for determining seismic coefficients. Based on the field data obtained from sub-soil exploration, the soil profile will be taken as **"S_D"** i.e. stiff soil for design of structures.

6.3.3 SEISMIC COEFFICIENTS

Seismic zone factor **"Z"** and soil profile type corresponds to the seismic coefficients as under;

For S_D: C_a = 0.28 & C_V = 0.40

6.4 TYPE OF CEMENT

Tests on water sample obtained from the borehole indicate high chloride content and severe sulphate exposure. For the project site, the order of preference of type of cement for substructure on technical grounds should be as under:

1) High Slag Portland Cement (containing at least 65% blast furnace slag)
2) Type II cement
3) Type I cement (with C_3A between 5 and 8 percent)

In our opinion, High Slag Portland Cement is the preferred option. In any case requirements of ACI code with regards to water-cement ratio, strength of concrete and concrete cover for seawater exposure should be fulfilled.

7. CONCLUSIONS

Salient features of this report are summarised hereunder:

- Geotechnical investigation for mulit-storey building for For 32 Acres Land out Of Survey Nos, 295 To 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek, Karachi was carried out in November – December 2009.
- Ten boreholes were drilled by rotary drilling method. Depth of these boreholes is shown in respective bore logs.
- The soil conditions determined from the investigation consist of medium dense to dense silty fine sand and soft to hard silty clay deposits.
- Groundwater was encountered at a depth of 1.6m below existing ground level.
- High slag Portland cement is recommended for underground concrete works.
- Recommendations regarding engineering design are presented in *Chapter 6* of the report.

Appendix A

Borehole Logs

Soil Testing Services

SUBSURFACE EXPLORATION LOG

Start date: **November 19, 2009** End date: **November 19, 2009**		Casing diameter: **125 mm**	BOREHOLE No. **1**
Drilling Method: Equipment: **Rotary Wash** Driller: **Muhammad Munir**		Borehole Diameter: **100 mm**	Coordinates: - Ground level: **Equal to road level**

Date and time	Casing depth (m)	Depth to water (m)	Sample details: Depth (m)	Sample details: Type	Sample details: No.	Standard Penetration Test: Blows/N	Standard Penetration Test: Drive	Description of strata	Level below road level (m)	Layer thickness (m)	Legend
19.11.09 1:00 PM	(3.00)	W.T 1.5m	1					**Yellowish brown, loose, fine SAND with some clay**		(1.50)	
			2	SPT	1	18	450				
19.11.09 1:15 PM			3	SPT	2	19	450	**Greyish brown, medium dense, fine grain SAND**		(3.00)	
19.11.09 1:25 PM			4								
			5	SPT	3	23	450				
19.11.09 1:40 PM			6	SPT	4	43	450	**Yellowish brown, medium dense, medium to coarse SAND**		(3.00)	
19.11.09 1:58 PM			7								
			8	SPT	5	27	450				
19.11.09 2:13 PM			9	SPT	6	53	450				
19.11.09 2:32 PM			10	SPT	7	42	450				
19.11.09 2:49 PM			11	SPT	8	37	450	**Greyish brown, medium to dense, silty fine to coarse SAND**		(12.50)	
19.11.09 3:05 PM			12	SPT	9	54	450				
19.11.09 3:21 PM			13	SPT	10	56	450				
19.11.09 3:40 PM			14	SPT	11	46	450				
19.11.09 3:50 PM			15	SPT	12	40	450				
19.11.09 4:05 PM			16	SPT	13	58	450				
			17								
			18								
			19								
			20								

Remarks:

- SPT Standard Penetration Test
- SPT(C) Standard Penetration Test with Cone
- UDS Undisturbed Sample

Logged by: Niaz Muhammad Khan
Compiled by: Syed Irfan Shah
Checked by: Ali Zaidi

Project:
Soil Investigation for proposed school at survey nos, 295 to 301,
Deh Dih, Tapo Ibrahim Haidery, Korangi Creek,

Contract No. KGI-2009-898

Sheet No. 1 of 2

Soil Testing Services

SUBSURFACE EXPLORATION LOG

Start date: **November 19, 2009** End date: **November 19, 2009**		Casing diameter: **125 mm**	BOREHOLE No. **1**
Drilling Method: Equipment: **Rotary Wash** Driller: **Muhammad Munir**		Borehole Diameter: **100 mm**	Coordinates: - Ground level: **Equal to road level**

Date and time	Casing depth (m)	Depth to water (m)	Sample details: Depth (m)	Sample details: Type	Sample details: No.	Standard Penetration Test: Blows/N	Standard Penetration Test: Drive	Description of strata	Level below road level (m)	Layer thickness (m)	Legend
19.11.09 4:20 PM			22	SPT	14	40	450	**Greyish brown,dense, silty fine to coarse SAND**		(4.00)	
19.11.09 4:35 PM			23	SPT	15	43	450				
19.11.09 4:50 PM			25	SPT	16	45	450				
19.11.09 5:05 PM			26	SPT	17	46	450	**Brownish grey, hard, silty CLAY with some coarse grained sand**		(6.00)	
19.11.09 5:25 PM			28	SPT	18	38	450				
19.11.09 5:35 PM			29	SPT	19	46	450				
19.11.09 5:50 PM			30	R	1	13	Nil	**Bottom of BH-01 at 30-m**			

Remarks:

- SPT Standard Penetration Test
- SPT(C) Standard Penetration Test with Cone
- UDS Undisturbed Sample

Logged by: Niaz Muhammad Khan
Compiled by: Syed Irfan Shah
Checked by: Ali Zaidi

Project: Soil Investigation for proposed school at survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek,

Contract No. KGI-2009-898

Sheet No. 2 of 2

Soil Testing Services

SUBSURFACE EXPLORATION LOG

Start date: **November 21, 2009** End date: **November 21, 2009**		Casing diameter: **125 mm**	BOREHOLE No. **2**
Drilling Method: Equipment: **Rotary Wash** Driller: **Muhammad Munir**		Borehole Diameter: **100 mm**	Coordinates: - Ground level: **Equal to road level**

Date and time	Casing depth (m)	Depth to water (m)	Sample details: Depth (m)	Sample details: Type	Sample details: No.	Standard Penetration Test: Blows/N	Standard Penetration Test: Drive	Description of strata	Level below road level (m)	Layer thickness (m)	Legend
21.11.09 8:30 AM	(3.00)	W.T 1.6m	1					**Yellow, loose, fine SAND with some clay**		(1.50)	
			2	SPT	1	21	450				
21.11.09 8:50 AM			3	SPT	2	25	450				
			4					**Greyish brown, medium dense, fine grained SAND**		(6.00)	
21.11.09 9:05 AM			5	SPT	3	27	450				
21.11.09 9:25 AM			6	SPT	4	33	450				
			7								
21.11.09 9:42 AM			8	SPT	5	35	450				
21.11.09 10:00 AM			9	SPT	6	53	450				
			10								
21.11.09 10:20 AM			11	SPT	7	58	450				
21.11.09 10:40 AM			12	SPT	8	40	450	**Brown, dense to very dense, fine to medium grained SAND with some clay and coarse sand**		(12.50)	
21.11.09 11:00 AM			13	SPT	9	54	450				
			14								
21.11.09 11:21 AM			15	SPT	10	56	450				
21.11.09 11:47 AM			16	SPT	11	47	450				
			17								
21.11.09 12:00 PM			18	SPT	12	40	450				
21.11.09 12:20 PM			19								
			20	SPT	13	58	450	**Bottom of BH-02 at 20-m**			

Remarks:

- SPT Standard Penetration Test
- SPT(C) Standard Penetration Test with Cone
- UDS Undisturbed Sample

Logged by: Niaz Muhammad Khan
Compiled by: Syed Irfan Shah
Checked by: Ali Zaidi

Project:
Soil Investigation for proposed school at survey nos, 295 to 301,
Deh Dih, Tapo Ibrahim Haidery, Korangi Creek,

Contract No. KGI-2009-898
Sheet No. 1 of 1

Soil Testing Services

SUBSURFACE EXPLORATION LOG

Start date: **November 23, 2009** End date: **November 23, 2009**		Casing diameter: **125 mm**	BOREHOLE No. **3**
Drilling Method: Equipment: **Rotary Wash** Driller: **Muhammad Munir**		Borehole Diameter: **100 mm**	Coordinates: - Ground level: **Equal to road level**

Date and time	Casing depth (m)	Depth to water (m)	Sample details: Depth (m)	Sample details: Type	Sample details: No.	Standard Penetration Test: Blows/N	Standard Penetration Test: Drive	Description of strata	Level below road level (m)	Layer thickness (m)	Legend
23.11.09 11:00 AM	(3.00)	W.T 1.5m	1					**Yellow, very loose, fine SAND with some clay**		(1.50)	
			2	SPT	1	11	450				
23.11.09 11:15 AM			3	SPT	2	21	450	**Greyish brown, medium dense, fine grained SAND**		(6.00)	
23.11.09 11:27 AM			4	SPT	3	38	450				
23.11.09 11:34 AM			5	SPT	4	46	450				
23.11.09 11:45 AM			6	SPT	5	50	450				
23.11.09 11:55 AM			7	SPT	6	53	450	**Brown, dense to very dense, medium to fine grained SAND**		(7.50)	
23.11.09 12:07 PM			8	SPT	7	58	450				
23.11.09 12:20 PM			9	SPT	8	41	450				
23.11.09 12:32 PM			10	SPT	9	53	450				
23.11.09 12:45 PM			11	SPT	10	42	450	**Bottom of BH-03 at 15-m**			
			12								
			13								
			14								
			15								

Remarks:

- SPT Standard Penetration Test
- SPT(C) Standard Penetration Test with Cone
- UDS Undisturbed Sample

Logged by: Niaz Muhammad Khan
Compiled by: Syed Irfan Shah
Checked by: Ali Zaidi

Project: Soil Investigation for proposed school at survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek,

Contract No. KGI-2009-898

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Soil Testing Services

SUBSURFACE EXPLORATION LOG

Start date: **November 24, 2009** End date: **November 24, 2009**		Casing diameter: **125 mm**	BOREHOLE No. **4**
Drilling Method: Equipment: **Rotary Wash** Driller: **Muhammad Munir**		Borehole Diameter: **100 mm**	Coordinates: - Ground level: **Equal to road level**

Date and time	Casing depth (m)	Depth to water (m)	Sample details: Depth (m)	Type	No.	Standard Penetration Test: Blows/N	Drive	Description of strata	Level below road level (m)	Layer thickness (m)	Legend
24.11.09 9:00 AM	(3.00)	W.T 1.6m	1					**Yellow, very loose, fine grained SAND with some clay**		(1.50)	
			2	SPT	1	10	450				
24.11.09 9:20 AM			3	SPT	2	13	450	**Greyish brown, medium dense, fine grained SAND**		(7.50)	
24.11.09 9:35 AM			4	SPT	3	27	450				
24.11.09 9:50 AM			5	SPT	4	32	450				
24.11.09 10:02 AM			6	SPT	5	33	450				
24.11.09 12:20 AM			7	SPT	6	30	450				
24.11.09 10:37 AM			8	SPT	7	40	450				
24.11.09 10:50 AM			9	SPT	8	42	450				
24.11.09 11:05 AM			10	SPT	9	51	450	**Greyish brown, medium dense, fine to coarse SAND**		(11.00)	
24.11.09 11:23 AM			11	SPT	10	53	450				
24.11.09 11:40 AM			12	SPT	11	55	450				
24.11.09 12:00 PM			13	SPT	12	58	450				
24.11.09 12:18 PM			14	SPT	13	56	450				
			15					**Bottom of BH-04 at 20-m**			
			16								
			17								
			18								
			19								
			20								

Remarks:

- SPT Standard Penetration Test
- SPT(C) Standard Penetration Test with Cone
- UDS Undisturbed Sample

Logged by: Niaz Muhammad Khan
Compiled by: Syed Irfan Shah
Checked by: Ali Zaidi

Project:
Soil Investigation for proposed school at survey nos, 295 to 301,
Deh Dih, Tapo Ibrahim Haidery, Korangi Creek,

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Soil Testing Services

SUBSURFACE EXPLORATION LOG

Start date: **November 25, 2009** End date: **November 25, 2009**		Casing diameter: **125 mm**	BOREHOLE No. **5**
Drilling Method: Equipment: **Rotary Wash** Driller: **Muhammad Munir**		Borehole Diameter: **100 mm**	Coordinates: - Ground level: **Equal to road level**

Date and time	Casing depth (m)	Depth to water (m)	Sample details: Depth (m)	Sample details: Type	Sample details: No.	Standard Penetration Test: Blows/N	Standard Penetration Test: Drive	Description of strata	Level below road level (m)	Layer thickness (m)	Legend
25.11.09 9:00 AM	(3.00)	W.T 1.5m	1					**Greyish brown, stiff, silty CLAY**		(3.00)	
			2	SPT	1	13	450				
25.11.09 9:20 AM			3	SPT	2	15	450				
			4					**Grey, medium dense, fine grained SAND**		(3.00)	
25.11.09 9:37 AM			5	SPT	3	10	450				
25.11.09 9:50 AM			6	SPT	4	12	450				
			7					**Greyish brown, medium to very dense, silty fine to medium SAND**		(9.00)	
25.11.09 10:05 AM			8	SPT	5	17	450				
25.11.09 10:20 AM			9	SPT	6	21	450				
			10								
25.11.09 10:35 AM			11	SPT	7	32	450				
25.11.09 10:57 AM			12	SPT	8	35	450				
			13								
25.11.09 11:15 AM			14	SPT	9	39	450				
25.11.09 11:37 AM			15	SPT	10	53	450	**Bottom of BH-05 at 15-m**			

Remarks:

- SPT Standard Penetration Test
- SPT(C) Standard Penetration Test with Cone
- UDS Undisturbed Sample

Logged by: Niaz Muhammad Khan
Compiled by: Syed Irfan Shah
Checked by: Ali Zaidi

Project: Soil Investigation for proposed school at survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek,

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Soil Testing Services

SUBSURFACE EXPLORATION LOG

Start date: November 25, 2009 End date: November 25, 2009		Casing diameter: 125 mm	BOREHOLE No. 6
Drilling Method: Equipment: Rotary Wash Driller: Muhammad Munir		Borehole Diameter: 100 mm	Coordinates: - Ground level: Equal to road level

Date and time	Casing depth (m)	Depth to water (m)	Sample details: Depth (m)	Type	No.	Standard Penetration Test: Blows/N	Drive	Description of strata	Level below road level (m)	Layer thickness (m)	Legend
25.11.09 12:10 PM	(3.00)	W.T 1.5m	1								
			2	SPT	1	8	450	**Greyish brown, soft to medium stiff, silty CLAY/clayey SILT**		(4.50)	
25.11.09 12:25 PM			3	SPT	2	4	450				
			4								
25.11.09 12:38 PM			5	SPT	3	14	450	**Greyish brown, medium dense, fine grained SAND**		(1.50)	
25.11.09 12:52 PM			6								
			7	SPT	4	26	450				
25.11.09 1:10 PM			8	SPT	5	19	450				
25.11.09 1:25 PM			9	SPT	6	20	450				
			10								
25.11.09 1:40 PM			11	SPT	7	22	450				
25.11.09 1:58 PM			12	SPT	8	34	450				
			13					**Greyish brown, medium to very dense, silty fine to medium SAND**		(14.00)	
25.11.09 2:00 PM			14	SPT	9	31	450				
25.11.09 2:20 PM			15	SPT	10	40	450				
			16								
25.11.09 2:38 PM			17	SPT	11	45	450				
25.11.09 2:55 PM			18	SPT	12	58	450				
			19								
25.11.09 3:17 PM			20	SPT	13	50	450	**Bottom of BH-06 at 20-m**			

Remarks:

- SPT Standard Penetration Test
- SPT(C) Standard Penetration Test with Cone
- UDS Undisturbed Sample

Logged by: Niaz Muhammad Khan
Compiled by: Syed Irfan Shah
Checked by: Ali Zaidi

Project: Soil Investigation for proposed school at survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek,

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Soil Testing Services

SUBSURFACE EXPLORATION LOG

Start date: **November 26, 2009** End date: **November 26, 2009**		Casing diameter: **125 mm**	BOREHOLE No. **7**
Drilling Method: Equipment: **Rotary Wash** Driller: **Muhammad Munir**		Borehole Diameter: **100 mm**	Coordinates: - Ground level: **Equal to road level**

Date and time	Casing depth (m)	Depth to water (m)	Sample details: Depth (m)	Sample details: Type	Sample details: No.	Standard Penetration Test: Blows/N	Standard Penetration Test: Drive	Description of strata	Level below road level (m)	Layer thickness (m)	Legend
26.11.09 9:00 AM	(3.00)	W.T 1.6m	1					**Yellow, medium stiiff CLAY**		(1.50)	
			2	SPT	1	9	450				
26.11.09 9:20 AM			3	SPT	2	26	450				
			4					**Greyish brown, medium dense, fine grained SAND**			
26.11.09 9:40 AM			5	SPT	3	30	450			(6.00)	
26.11.09 10:05 AM			6	SPT	4	27	450				
			7								
26.11.09 10:25 AM			8	SPT	5	31	450				
			9								
26.11.09 10:40 AM			10	SPT	6	35	450				
26.11.09 10:55 AM			11	SPT	7	37	450				
			12								
26.11.09 11:10 AM			13	SPT	8	42	450	**Greyish brown, medium to very dense, silty fine to medium SAND**		(12.50)	
26.11.09 11:30 AM			14	SPT	9	45	450				
			15								
26.11.09 11:45 AM			16	SPT	10	58	450				
26.11.09 12:00 PM			17	SPT	11	49	450				
			18								
26.11.09 12:15 PM			19	SPT	12	50	450				
26.11.09 12:38 PM			20	SPT	13	53	450	**Bottom of BH-07 at 20-m**			

Remarks:

- SPT Standard Penetration Test
- SPT(C) Standard Penetration Test with Cone
- UDS Undisturbed Sample

Logged by: Niaz Muhammad Khan
Compiled by: Syed Irfan Shah
Checked by: Ali Zaidi

Project:
Soil Investigation for proposed school at survey nos, 295 to 301,
Deh Dih, Tapo Ibrahim Haidery, Korangi Creek,

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Soil Testing Services

SUBSURFACE EXPLORATION LOG

Start date: **November 26, 2009** End date: **November 26, 2009**		Casing diameter: **125 mm**	BOREHOLE No. **8**
Drilling Method: Equipment: **Rotary Wash** Driller: **Zafar Iqbal**		Borehole Diameter: **100 mm**	Coordinates: - Ground level: **Equal to road level**

Date and time	Casing depth (m)	Depth to water (m)	Sample details: Depth (m)	Sample details: Type	Sample details: No.	Standard Penetration Test: Blows/N	Standard Penetration Test: Drive	Description of strata	Level below road level (m)	Layer thickness (m)	Legend
26.11.09 9:00 AM	(3.00)	W.T 1.5m	1								
			2	SPT	1	5	450				
26.11.09 9:18 AM			3								
			4	SPT	2	4	450	**Greyish brown, loose, fine SAND with some clay**		(7.00)	
26.11.09 9:35 AM			5	SPT	3	6	450				
26.11.09 9:50 AM			6								
			7	SPT	4	5	450				
26.11.09 10:10 AM			8	SPT	5	15	450				
26.11.09 10:30 AM			9								
			10	SPT	6	16	450	**Greyish brown, medium to dense, fine to medium SAND**		(8.00)	
26.11.09 10:45 AM			11	SPT	7	22	450				
26.11.09 11:05 AM			12	SPT	8	24	450				
26.11.09 11:20 AM			13	SPT	9	33	450				
			14								
26.11.09 12:00 PM			15	SPT	10	37	450	**Bottom of BH-08 at 15-m**			

Remarks:

- SPT Standard Penetration Test
- SPT(C) Standard Penetration Test with Cone
- UDS Undisturbed Sample

Logged by: Niaz Muhammad Khan
Compiled by: Syed Irfan Shah
Checked by: Ali Zaidi

Project: Soil Investigation for proposed school at survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek,

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Soil Testing Services

SUBSURFACE EXPLORATION LOG

Start date: November 25, 2009 End date: November 25, 2009		Casing diameter: 125 mm	BOREHOLE No. 9
Drilling Method: Equipment: Rotary Wash Driller: Muhammad Munir		Borehole Diameter: 100 mm	Coordinates: - Ground level: Equal to road level

Date and time	Casing depth (m)	Depth to water (m)	Sample details: Depth (m)	Type	No.	Standard Penetration Test: Blows/N	Drive	Description of strata	Level below road level (m)	Layer thickness (m)	Legend
25.11.09 8:30 AM	(3.00)	W.T 1.5m	1								
			2	SPT	1	8	450				
25.11.09 8:55 AM			3	SPT	2	10	450				
25.11.09 9:15 AM			4	SPT	3	7	450	**Greyish brown, medium to very stiff, silty CLAY/clayey SILT**		(9.00)	
25.11.09 9:35 AM			5	SPT	4	6	450				
25.11.09 9:48 AM			6	SPT	5	17	450				
25.11.09 10:05 AM			7	SPT	6	18	450				
25.11.09 10:22 AM			8	SPT	7	22	450				
25.11.09 10:40 AM			9	SPT	8	40	450	**Greyish brown, medium to very dense, fine to medium grained SAND**		(6.00)	
25.11.09 11:02 AM			10	SPT	9	42	450				
25.11.09 11:23 AM			11	SPT	10	65	450				
			12					**Bottom of BH-09 at 15-m**			
			13								
			14								
			15								

Remarks:

- SPT Standard Penetration Test
- SPT(C) Standard Penetration Test with Cone
- UDS Undisturbed Sample

Logged by: Niaz Muhammad Khan
Compiled by: Syed Irfan Shah
Checked by: Ali Zaidi

Project: Soil Investigation for proposed school at survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek,

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Soil Testing Services

SUBSURFACE EXPLORATION LOG

Start date: **November 24, 2009** End date: **November 24, 2009**		Casing diameter: **125 mm**	BOREHOLE No. **10**
Drilling Method: Equipment: **Rotary Wash** Driller: **Zafar Iqbal**		Borehole Diameter: **100 mm**	Coordinates: - Ground level: **Equal to road level**

Date and time	Casing depth (m)	Depth to water (m)	Sample details: Depth (m)	Sample details: Type	Sample details: No.	Standard Penetration Test: Blows/N	Standard Penetration Test: Drive	Description of strata	Level below road level (m)	Layer thickness (m)	Legend
24.11.09 9:10 AM	(3.00)	W.T 1.6m	1								
			2	SPT	1	7	450				
24.11.09 9:30 AM			3	SPT	2	9	450				
24.11.09 9:45 AM			4	SPT	3	11	450				
24.11.09 10:00 AM			5	SPT	4	11	450	**Greyish brown, loose, loose to medium dense, fine SAND, some clay**		(13.50)	
24.11.09 10:15 AM			6	SPT	5	21	450				
24.11.09 10:30 AM			7	SPT	6	13	450				
24.11.09 10:45 AM			8	SPT	7	15	450				
24.11.09 11:00 AM			9	SPT	8	18	450				
24.11.09 11:20 AM			10	SPT	9	21	450				
24.11.09 11:45 AM			11	SPT	10	45	450				
24.11.09 12:00 PM			12	SPT	11	47	450	**Greyish brown, medium to dense, fine to medium grained SAND**		(6.50)	
24.11.09 12:20 PM			13	SPT	12	46	450				
24.11.09 12:40 PM			14	SPT	13	35	450				
			15					**Bottom of BH-10 at 20-m**			
			16								
			17								
			18								
			19								
			20								

Remarks:

- SPT Standard Penetration Test
- SPT(C) Standard Penetration Test with Cone
- UDS Undisturbed Sample

Logged by: Niaz Muhammad Khan
Compiled by: Syed Irfan Shah
Checked by: Ali Zaidi

Project:
Soil Investigation for proposed school at survey nos, 295 to 301,
Deh Dih, Tapo Ibrahim Haidery, Korangi Creek,

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Appendix B

Laboratory Test Results

KGI-2009-898

November 2009

PROJECT: **32 acres land out of survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek, Karachi**

CLIENT: **M/s. Block by Block**

GRAINSIZE, ATTERBERG LIMITS & SPECIFIC GRAVITY TESTS

S.NO.	BH NO.	SAMPLE	DEPTH	Per cent finer than sieve												Size in mm				Liquid Limit	Plasticity Index	Specific Gravity
			(METER)	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#100	#200	0.05	0.01	0.005	0.001			
1	BH-1	SPT-1	1.5	-	-	-	-	-	-	-	100	99	96	76	36	-	-	-	-	-	-	-
2	BH-1	SPT-4	6.0	-	-	-	-	100	90	69	60	49	29	21	11	-	-	-	-	-	-	2.65
3	BH-1	SPT-6	9.0	-	-	-	-	-	-	-	-	100	96	76	15	-	-	-	-	-	-	-
4	BH-1	SPT-17	25.0	-	-	-	-	-	-	-	100	98	97	95	96	-	-	-	-	-	-	-
5	BH-2	SPT-1	1.0	-	-	-	-	-	-	-	100	99	98	78	27	-	-	-	-	-	-	-
6	BH-2	SPT-2	2.0	-	-	-	-	-	-	-	100	99	94	66	7	-	-	-	-	-	-	2.66
7	BH-2	SPT-6	9.0	-	-	-	-	-	-	100	92	64	57	37	7	-	-	-	-	-	-	-
8	BH-2	SPT-13	19.0	-	-	-	-	-	-	-	100	99	96	88	38	-	-	-	-	-	-	-
9	BH-3	SPT-1	1.5	-	-	-	-	-	-	100	99	99	96	76	11	-	-	-	-	-	-	-
10	BH-3	SPT-3	4.5	-	-	-	-	-	-	100	97	90	86	66	16	-	-	-	-	-	-	2.68
11	BH-3	SPT-6	9.0	-	-	-	-	-	-	-	-	100	96	76	17	-	-	-	-	-	-	-
12	BH-4	SPT-1	1.5	-	-	-	-	-	-	100	97	95	93	73	25	-	-	-	-	-	-	-
13	BH-4	SPT-3	4.5	-	-	-	-	-	-	-	100	99	96	87	21	-	-	-	-	-	-	2.67
14	BH-4	SPT-7	10.5	-	-	-	-	-	-	-	100	99	97	76	15	-	-	-	-	-	-	-

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November 2009

PROJECT: **32 acres land out of survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek, Karachi**

CLIENT: **M/s. Block by Block**

GRAINSIZE, ATTERBERG LIMITS & SPECIFIC GRAVITY TESTS

S.NO.	BH NO.	SAMPLE	DEPTH	Per cent finer than sieve												Size in mm				Liquid Limit	Plasticity Index	Specific Gravity
			(METER)	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#100	#200	0.05	0.01	0.005	0.001			
15	BH-5	SPT-1	1.5	-	-	-	-	-	-	-	-	100	99	98	96	72	57	29	6	32	11	2.70
16	BH-5	SPT-3	4.5	-	-	-	-	-	-	-	-	100	99	79	21	-	-	-	-	-	-	-
17	BH-5	SPT-5	7.5	-	-	-	-	-	-	-	100	99	98	83	23	-	-	-	-	-	-	-
18	BH-6	SPT-1	1.5	-	-	-	-	-	-	-	-	-	100	99	98	75	56	30	9	34	12	-
19	BH-6	SPT-3	4.5	-	-	-	-	-	-	-	-	-	100	99	98	79	60	35	8	30	10	2.69
20	BH-6	SPT-5	7.5	-	-	-	-	-	-	100	99	96	91	74	15	-	-	-	-	-	-	-
21	BH-6	SPT-10	15.0	-	-	-	-	-	-	-	100	99	95	73	14	-	-	-	-	-	-	-
22	BH-7	SPT-1	1.5	-	-	-	-	-	-	-	100	99	98	96	95	80	69	37	7	34	13	-
23	BH-7	SPT-2	3.0	-	-	-	-	-	-	-	100	99	98	78	17	-	-	-	-	-	-	2.65
24	BH-7	SPT-6	9.0	-	-	-	-	-	-	100	99	96	93	72	12	-	-	-	-	-	-	-
25	BH-8	SPT-1	1.5	-	-	-	-	-	-	100	99	98	98	88	29	-	-	-	-	-	-	-
26	BH-8	SPT-2	4.5	-	-	-	-	-	-	-	100	99	96	75	14	-	-	-	-	-	-	2.64
27	BH-8	SPT-5	7.5	-	-	-	-	-	-	-	100	97	93	73	13	-	-	-	-	-	-	-
28	BH-9	SPT-1	1.5	-	-	-	-	-	-	-	-	100	99	98	97	78	59	30	9	34	13	2.71

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November 2009

PROJECT: **32 acres land out of survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek, Karachi**

CLIENT: **M/s. Block by Block**

GRAINSIZE, ATTERBERG LIMITS & SPECIFIC GRAVITY TESTS

S.NO.	BH NO.	SAMPLE	DEPTH	Per cent finer than sieve												Size in mm				Liquid Limit	Plasticity Index	Specific Gravity
			(METER)	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#100	#200	0.05	0.01	0.005	0.001			
29	BH-9	SPT-3	4.5	-	-	-	-	-	-	-	100	99	98	97	96	73	53	27	6	32	12	-
30	BH-9	SPT-5	7.5	-	-	-	-	-	-	-	-	100	99	98	97	71	57	29	65	34	13	2.69
31	BH-9	SPT-8	12.0	-	-	-	-	-	-	-	100	97	88	79	11	-	-	-	-	-	-	-
32	BH-10	SPT-1	1.5	-	-	-	-	-	-	-	100	99	98	88	16	-	-	-	-	-	-	-
33	BH-10	SPT-2	3.0	-	-	-	-	-	-	-	100	99	96	82	11	-	-	-	-	-	-	-
34	BH-10	SPT-5	7.5	-	-	-	-	-	-	100	99	98	94	77	13	-	-	-	-	-	-	2.67
35	BH-10	SPT-10	15.0	-	-	-	-	-	-	-	100	99	94	71	3	-	-	-	-	-	-	-

KGI-2009-898

November 2009

PROJECT: **32 acres land out of survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek, Karachi**

CLIENT: **M/s. Block by Block**

CHEMICAL TESTS ON SOIL

S.NO.	BH NO.	SAMPLE	DEPTH (METER)	TOTAL SALT CONTENT (%)	CHLORIDE CONTENT (%)	SULPHATE CONTENT (%)	pH
1	BH-1	SPT-1	1.5	0.407	0.175	0.010	5.8
2	BH-2	SPT-1	1.5	0.510	0.210	Trace	5.0
3	BH-3	SPT-1	1.5	0.460	0.205	0.123	6.4
4	BH-4	SPT-1	1.5	0.510	0.200	Trace	6.3
5	BH-5	SPT-1	1.5	0.470	0.200	0.098	6.3
6	BH-6	SPT-1	1.5	0.520	0.225	Trace	5.6
7	BH-7	SPT-1	1.5	0.560	0.235	0.120	5.9
8	BH-8	SPT-1	1.5	0.540	0.230	0.098	6.1
9	BH-9	SPT-1	1.5	0.480	0.190	Trace	5.9
10	BH-10	SPT-1	1.5	0.380	0.155	Trace	6.0

PROJECT: **32 acres land out of survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek, Karachi** KGI-2009-898

CLIENT: **M/s. Block by Block** November 2009

CHEMICAL TESTS ON WATER

S.NO.	BH NO.	SAMPLE	DEPTH (METER)	TOTAL SALT CONTENT (ppm)	CHLORIDE CONTENT (ppm)	SULPHATE CONTENT (ppm)	pH
1	BH-1	WS-1	1.6	3000	11000	5768	5.0
2	BH-6	WS-1	2.0	40000	16500	5768	5.6
3	BH-10	WS-1	2.0	32000	13000	4120	5.4

KGI-2009-898

November 2009

PROJECT: **32 acres land out of survey nos, 295 to 301, Deh Dih, Tapo Ibrahim Haidery, Korangi Creek, Karachi**

CLIENT: **M/s. Block by Block**

DIRECT SHEAR TEST

S.NO.	BH NO.	SAMPLE	DEPTH (Meter)	COHESION (kPa)	ANGLE OF INTERNAL FRICTION (Degree)
1	BH-1	SPT-4	6.0	0.0	25.09
2	BH-2	SPT-2	3.0	0.0	28.41
3	BH-4	SPT-5	7.5	0.0	31.24
4	BH-8	SPT-3	4.5	0.0	36.84

Appendix C

Pile Capacity Calculations

(A) - CALCULATION OF ULTIMATE SKIN FRICTION :

Depth	Strata Encountered	Diameter of Pile (m)	Length of Layer (m)	Effective σ for this layer	Effective overburden (kN/m^2)	phi	c (kN/m^2)	q_{uc} (kN/m^2)	α adhesion	α reduction-rock	β correction	δ	tan δ	k_s	FOS	Q_{skin} (kN)	$Q_{skin\ (Cum)}$ (kN)
0-1	cohesionless	0.56	1	15	7.50	25	-	-	-	-	-	25	0.47	1.000	2.5	1	1
1-2	cohesionless	0.56	1	5	17.50	25	-	-	-	-	-	25	0.47	1.000	2.5	3	3
2-3	cohesionless	0.56	1	5	22.50	25	-	-	-	-	-	25	0.47	1.000	2.5	4	8
3-4	cohesionless	0.56	1	5	27.50	28	-	-	-	-	-	28	0.53	1.000	2.5	5	13
4-5	cohesionless	0.56	1	5	32.50	28	-	-	-	-	-	28	0.53	1.000	2.5	6	19
5-6	cohesionless	0.56	1	5	37.50	28	-	-	-	-	-	28	0.53	1.000	2.5	7	26
6-7	cohesionless	0.56	1	5	42.50	28	-	-	-	-	-	28	0.53	1.000	2.5	8	34
7-8	cohesionless	0.56	1	5	47.50	28	-	-	-	-	-	28	0.53	1.000	2.5	9	43
8-9	cohesionless	0.56	1	5	52.50	28	-	-	-	-	-	28	0.53	1.000	2.5	10	53
9-10	cohesionless	0.56	1	5	57.50	28	-	-	-	-	-	28	0.53	1.000	2.5	11	63
10-11	cohesionless	0.56	1	5	62.50	28	-	-	-	-	-	28	0.53	1.000	2.5	12	75
11-12	cohesionless	0.56	1	5	67.50	28	-	-	-	-	-	28	0.53	1.000	2.5	13	88
12-13	cohesionless	0.56	1	5	72.50	28	-	-	-	-	-	28	0.53	1.000	2.5	14	101
13-14	cohesionless	0.56	1	5	77.50	28	-	-	-	-	-	28	0.53	1.000	2.5	14	116
14-15	cohesionless	0.56	1	5	82.50	28	-	-	-	-	-	28	0.53	1.000	2.5	15	131
15-16	cohesionless	0.56	1	5	87.50	28	-	-	-	-	-	28	0.53	1.000	2.5	16	148
16-17	cohesionless	0.56	1	5	92.50	28	-	-	-	-	-	28	0.53	1.000	2.5	17	165
17-18	cohesionless	0.56	1	5	97.50	28	-	-	-	-	-	28	0.53	1.000	2.5	18	183
18-19	cohesionless	0.56	1	5	102.50	28	-	-	-	-	-	28	0.53	1.000	2.5	19	202
19-20	cohesionless	0.56	1	5	107.50	28	-	-	-	-	-	28	0.53	1.000	2.5	20	222

(A) - CALCULATION OF ULTIMATE SKIN FRICTION :

Depth	Strata Encountered	Diameter of Pile (m)	Length of Layer (m)	Effective σ for this layer	Effective overburden (kN/m^3)	phi	c (kN/m^2)	q_{uc} (kN/m^2)	α adhesion	α reduction-rock	β correction	δ	tan δ	k_s	FOS	Q_{skin} (kN)	$Q_{skin\ (Cum)}$ (kN)
0-1	cohesionless	0.60	1	15	7.50	25	-	-	-	-	-	25	0.47	1.000	2.5	1	1
1-2	cohesionless	0.60	1	5	17.50	25	-	-	-	-	-	25	0.47	1.000	2.5	3	3
2-3	cohesionless	0.60	1	5	22.50	25	-	-	-	-	-	25	0.47	1.000	2.5	4	8
3-4	cohesionless	0.60	1	5	27.50	28	-	-	-	-	-	28	0.53	1.000	2.5	6	14
4-5	cohesionless	0.60	1	5	32.50	28	-	-	-	-	-	28	0.53	1.000	2.5	7	20
5-6	cohesionless	0.60	1	5	37.50	28	-	-	-	-	-	28	0.53	1.000	2.5	8	28
6-7	cohesionless	0.60	1	5	42.50	28	-	-	-	-	-	28	0.53	1.000	2.5	9	36
7-8	cohesionless	0.60	1	5	47.50	28	-	-	-	-	-	28	0.53	1.000	2.5	10	46
8-9	cohesionless	0.60	1	5	52.50	28	-	-	-	-	-	28	0.53	1.000	2.5	11	56
9-10	cohesionless	0.60	1	5	57.50	28	-	-	-	-	-	28	0.53	1.000	2.5	12	68
10-11	cohesionless	0.60	1	5	62.50	28	-	-	-	-	-	28	0.53	1.000	2.5	13	80
11-12	cohesionless	0.60	1	5	67.50	28	-	-	-	-	-	28	0.53	1.000	2.5	14	94
12-13	cohesionless	0.60	1	5	72.50	28	-	-	-	-	-	28	0.53	1.000	2.5	15	109
13-14	cohesionless	0.60	1	5	77.50	28	-	-	-	-	-	28	0.53	1.000	2.5	16	124
14-15	cohesionless	0.60	1	5	82.50	28	-	-	-	-	-	28	0.53	1.000	2.5	17	141
15-16	cohesionless	0.60	1	5	87.50	28	-	-	-	-	-	28	0.53	1.000	2.5	18	158
16-17	cohesionless	0.60	1	5	92.50	28	-	-	-	-	-	28	0.53	1.000	2.5	19	177
17-18	cohesionless	0.60	1	5	97.50	28	-	-	-	-	-	28	0.53	1.000	2.5	20	196
18-19	cohesionless	0.60	1	5	102.50	28	-	-	-	-	-	28	0.53	1.000	2.5	21	217
19-20	cohesionless	0.60	1	5	107.50	28	-	-	-	-	-	28	0.53	1.000	2.5	22	238

(A) - CALCULATION OF ULTIMATE SKIN FRICTION :

Depth	Strata Encountered	Diameter of Pile (m)	Length of Layer (m)	Effective σ for this layer	Effective overburden (kN/m^3)	phi	c (kN/m^2)	q_{uc} (kN/m^2)	α adhesion	α reduction-rock	β correction	δ	tan δ	k_s	FOS	Q_{skin} (kN)	$Q_{skin\ (Cum)}$ (kN)
0-1	cohesionless	0.76	1	15	7.50	25	-	-	-	-	-	25	0.47	1.000	2.5	2	2
1-2	cohesionless	0.76	1	5	17.50	25	-	-	-	-	-	25	0.47	1.000	2.5	4	4
2-3	cohesionless	0.76	1	5	22.50	25	-	-	-	-	-	25	0.47	1.000	2.5	5	11
3-4	cohesionless	0.76	1	5	27.50	28	-	-	-	-	-	28	0.53	1.000	2.5	7	18
4-5	cohesionless	0.76	1	5	32.50	28	-	-	-	-	-	28	0.53	1.000	2.5	8	26
5-6	cohesionless	0.76	1	5	37.50	28	-	-	-	-	-	28	0.53	1.000	2.5	10	35
6-7	cohesionless	0.76	1	5	42.50	28	-	-	-	-	-	28	0.53	1.000	2.5	11	46
7-8	cohesionless	0.76	1	5	47.50	28	-	-	-	-	-	28	0.53	1.000	2.5	12	58
8-9	cohesionless	0.76	1	5	52.50	28	-	-	-	-	-	28	0.53	1.000	2.5	13	71
9-10	cohesionless	0.76	1	5	57.50	28	-	-	-	-	-	28	0.53	1.000	2.5	15	86
10-11	cohesionless	0.76	1	5	62.50	28	-	-	-	-	-	28	0.53	1.000	2.5	16	102
11-12	cohesionless	0.76	1	5	67.50	28	-	-	-	-	-	28	0.53	1.000	2.5	17	119
12-13	cohesionless	0.76	1	5	72.50	28	-	-	-	-	-	28	0.53	1.000	2.5	18	138
13-14	cohesionless	0.76	1	5	77.50	28	-	-	-	-	-	28	0.53	1.000	2.5	20	157
14-15	cohesionless	0.76	1	5	82.50	28	-	-	-	-	-	28	0.53	1.000	2.5	21	178
15-16	cohesionless	0.76	1	5	87.50	28	-	-	-	-	-	28	0.53	1.000	2.5	22	200
16-17	cohesionless	0.76	1	5	92.50	28	-	-	-	-	-	28	0.53	1.000	2.5	23	224
17-18	cohesionless	0.76	1	5	97.50	28	-	-	-	-	-	28	0.53	1.000	2.5	25	249
18-19	cohesionless	0.76	1	5	102.50	28	-	-	-	-	-	28	0.53	1.000	2.5	26	275
19-20	cohesionless	0.76	1	5	107.50	28	-	-	-	-	-	28	0.53	1.000	2.5	27	302

TOTAL END BEARING RESISTANCE :

Depth	Strata Encountered	Diameter of Pile (m)	Depth of Layer (m)	Effective Overburden (kN/m^3)	Φ	N_q	FOS	Q_{END} (kN)
0-15	Sand	0.56	15.0	82.5	28.0	50.0	2.5	406.6
15-20	Sand	0.56	20.0	107.5	28.0	50.0	2.5	529.8
0-15	Sand	0.60	15.0	82.5	28.0	50.0	2.5	466.7
15-20	Sand	0.60	20.0	107.5	28.0	50.0	2.5	608.1
0-15	Sand	0.76	15.0	82.5	28.0	50.0	2.5	748.8
15-20	Sand	0.76	20.0	107.5	28.0	50.0	2.5	975.7

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Annex – V:
Environmental Monitoring Reports

Ambient Air Quality Test Report

Project Name:	THE MANGROVE-CREEK SIDE DEVELOPMENT	**Test Report No:**	QTS/EMC/ MCD/22/2591-A
		Sample Duration:	08hr's
Sample Description:	Ambient Air Quality Test	**Location:**	24°47'32.60"N 67°06'19.07"E

PARAMETERS									
Date	**Time**	**CO (mg/m^3)**	**NO ($\mu g/m^3$)**	**NO_2 ($\mu g/m^3$)**	**SO_2 ($\mu g/m^3$)**	**PM 10 ($\mu g/m^3$)**	**PM 2.5 ($\mu g/m^3$)**	**SPM ($\mu g/m^3$)**	**Lead ($\mu g/m3$)**
09-02-2022	10:00	0.00	20	22	51	58	04	102	ND
	11:00	0.26	23	20	43	54	15	115	
	12:00	0.19	05	19	40	23	05	124	
	13:00	0.08	35	18	36	112	45	171	
	14:00	0.12	27	21	30	102	51	182	
	15:00	0.23	21	25	28	91	42	155	
	16:00	0.16	12	33	36	82	36	142	
	17:00	0.22	16	26	39	71	28	105	
MIN		0.00	05	18	28	23	04	102	
MAX		0.26	35	33	51	112	51	182	
AVG		0.15	19.9	23.5	38.2	72.8	28.1	138.0	
SEQS		5	40	80	120	150	75	500	1.5
LDL-Limits		0.00ppm	1.0ppm	1.0ppm	1.0ppm	10.0$\mu g/m^3$	2.5$\mu g/m^3$	1 $\mu g/m^3$	-

Ambient Air Quality Test Report

Project Name:	THE MANGROVE-CREEK SIDE DEVELOPMENT	**Test Report No:**	QTS/EMC/ MCD/22/2591-B
		Sample Duration:	08hr's
Sample Description:	Ambient Air Quality Test	**Location:**	24°47'41.01"N 67°06'12.47"E

PARAMETERS									
Date	**Time**	**CO (mg/m^3)**	**NO ($\mu g/m^3$)**	**NO_2 ($\mu g/m^3$)**	**SO_2 ($\mu g/m^3$)**	**PM 10 ($\mu g/m^3$)**	**PM 2.5 ($\mu g/m^3$)**	**SPM ($\mu g/m^3$)**	**Lead ($\mu g/m3$)**
10-02-2022	10:00	0.01	22	14	32	51	41	106	
	11:00	0.06	31	46	31	59	38	110	
	12:00	0.09	46	73	44	54	28	121	
	13:00	0.08	41	64	57	49	35	162	
	14:00	0.10	15	59	62	52	40	176	
	15:00	0.13	37	45	55	51	34	145	ND
	16:00	0.10	28	31	43	46	33	122	
	17:00	0.12	21	25	36	59	30	114	
MIN		0.01	15	14	31	46	28	106	
MAX		0.13	46	73	62	59	41	176	
AVG		0.083	30.2	44.4	45.3	52.6	34.8	133.8	
SEQS		5	40	80	120	150	75	500	1.5
LDL-Limits		0.00ppm	1.0ppm	1.0ppm	1.0ppm	10.0$\mu g/m^3$	2.5$\mu g/m^3$	1 $\mu g/m^3$	-

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

Project Name:	THE MANGROVE-CREEK SIDE DEVELOPMENT	**Test Report No:**	QTS/EMC/ MCD/22/2591-B
		Sample Duration:	08hr's
		Sampling Date:	09/02/2022
Sample Description:	Ambient Air Quality Test	**Location:**	24°47'41.01"N 67°06'12.47"E

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m3	08 Hours	0.083	5.0	0.00	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m3	08 Hours	30.2	40.0	1.0	Chemiluminescence
Nitrogen Dioxide (NO2)	µg/m3	08 Hours	44.4	80.0	1.0	
Sulphur Dioxide (SO2)	µg/m3	08 Hours	45.3	120.0	1.0	Ultraviolet Fluorescence Method
Ozone (O3)	µg/m3	01 Hour	16.5	130.0	0 ppm	Non Dispersive UV Absorption Method
Particulate Matter (PM10)	µg/m3	08 Hours	52.6	150.0	10.0	β Ray Absorption Method
Particular Matter (PM2.5)	µg/m3	08 Hours	34.8	75.0	2.5	
Total Suspended Particles (TSP)	µg/m3	08 Hours	133.8	500.0	1.0	
Lead	µg/m3	08 Hours	ND	1.5	-	ASS Method

*SEQS= Sindh Environmental Quality Standards.
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**

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Tel. No. 92-21-34311466, 92-21-34382860, 92-21-34321532, Fax. No. 92-21-34311467

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Ambient Air Quality Test Report

Project Name:	THE MANGROVE-CREEK SIDE DEVELOPMENT	**Test Report No:**	QTS/EMC/ MCD/22/2591-C
		Sample Duration:	08hr's
Sample Description:	Ambient Air Quality Test	**Location:**	24°47'48.50"N 67°06'29.61"E

PARAMETERS									
Date	**Time**	**CO (mg/m^3)**	**NO ($\mu g/m^3$)**	**NO_2 ($\mu g/m^3$)**	**SO_2 ($\mu g/m^3$)**	**PM 10 ($\mu g/m^3$)**	**PM 2.5 ($\mu g/m^3$)**	**SPM ($\mu g/m^3$)**	**Lead ($\mu g/m3$)**
11-02-2022	10:00	0.00	21	11	33	28	17	96	
	11:00	0.01	42	14	41	31	12	102	
	12:00	0.12	44	13	36	44	31	108	
	13:00	0.18	32	16	26	69	38	112	
	14:00	0.13	05	22	43	40	16	126	
	15:00	0.10	40	21	31	35	17	134	ND
	16:00	0.09	38	16	26	36	25	120	
	17:00	0.03	22	15	31	41	32	116	
MIN		0	5	11	26	28	12	96	
MAX		0.18	44	22	43	69	38	134	
AVG		0.084	29.3	16.1	33.6	42.1	23.8	114.4	
SEQS		5	40	80	120	150	75	500	1.5
LDL-Limits		0.00ppm	1.0ppm	1.0ppm	1.0ppm	10.0$\mu g/m^3$	2.5$\mu g/m^3$	1 $\mu g/m^3$	-

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

Project Name:	THE MANGROVE-CREEK SIDE DEVELOPMENT	**Test Report No:**	QTS/EMC/ MCD /22/2591-C
		Sample Duration:	08hr's
		Sampling Date:	11/02/2022
Sample Description:	Ambient Air Quality Test	**Location:**	24°47'48.50"N 67°06'29.61"E

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m3	08 Hours	0.084	5.0	0.00	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m3	08 Hours	29.3	40.0	1.0	Chemiluminescence
Nitrogen Dioxide (NO2)	µg/m3	08 Hours	16.1	80.0	1.0	
Sulphur Dioxide (SO2)	µg/m3	08 Hours	33.6	120.0	1.0	Ultraviolet Fluorescence Method
Ozone (O3)	µg/m3	01 Hour	12.4	130.0	0 ppm	Non Dispersive UV Absorption Method
Particulate Matter (PM10)	µg/m3	08 Hours	42.1	150.0	10.0	β Ray Absorption Method
Particular Matter (PM2.5)	µg/m3	08 Hours	23.8	75.0	2.5	
Total Suspended Particles (TSP)	µg/m3	08 Hours	114.4	500.0	1.0	
Lead	µg/m3	08 Hours	ND	1.5	-	ASS Method

*SEQS= Sindh Environmental Quality Standards.
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**

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Ambient Air Quality Test Report

Project Name:	THE MANGROVE-CREEK SIDE DEVELOPMENT	**Test Report No:**	QTS/EMC/MCD/22/2591-D
		Sample Duration:	08hr's
Sample Description:	Ambient Air Quality Test	**Location:**	24°47'48.50"N 67°06'29.61"E

PARAMETERS									
Date	**Time**	**CO (mg/m^3)**	**NO ($\mu g/m^3$)**	**NO_2 ($\mu g/m^3$)**	**SO_2 ($\mu g/m^3$)**	**PM 10 ($\mu g/m^3$)**	**PM 2.5 ($\mu g/m^3$)**	**SPM ($\mu g/m^3$)**	**Lead ($\mu g/m3$)**
11-02-2022	19:00	0.09	16	19	27	44	21	106	
	20:00	0.13	14	18	24	49	26	113	
	21:00	0.15	19	15	19	51	29	128	
	22:00	0.18	21	13	18	54	31	142	
	23:00	0.30	12	16	22	82	42	156	
12-02-2012	00:00	1.09	26	12	29	131	41	194	ND
	01:00	0.84	31	14	31	114	33	161	
	02:00	0.63	28	17	26	96	24	126	
MIN		0.09	12	12	18	44	21	106	
MAX		1.09	31	19	31	131	42	194	
AVG		0.459	21.0	15.5	24.5	79.6	31.0	142.6	
SEQS		5	40	80	120	150	75	500	1.5
LDL-Limits		0.00ppm	1.0ppm	1.0ppm	1.0ppm	10.0$\mu g/m^3$	2.5$\mu g/m^3$	1 $\mu g/m^3$	-

Quality Testing Services Karachi Q.T.S

Ambient Air Quality Test Report

Project Name:	THE MANGROVE-CREEK SIDE DEVELOPMENT	**Test Report No:**	QTS/EMC/MCD/22/2591-D
		Sample Duration:	08hr's
		Sampling Date:	11/02/2022
Sample Description:	Ambient Air Quality Test	**Location:**	24°47'48.50"N 67°06'29.61"E

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m3	08 Hours	0.459	5.0	0.00	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m3	08 Hours	21.0	40.0	1.0	Chemiluminescence
Nitrogen Dioxide (NO2)	µg/m3	08 Hours	15.5	80.0	1.0	
Sulphur Dioxide (SO2)	µg/m3	08 Hours	24.5	120.0	1.0	Ultraviolet Fluorescence Method
Ozone (O3)	µg/m3	01 Hour	14.2	130.0	0 ppm	Non Dispersive UV Absorption Method
Particulate Matter (PM10)	µg/m3	08 Hours	79.6	150.0	10.0	β Ray Absorption Method
Particular Matter (PM2.5)	µg/m3	08 Hours	31.0	75.0	2.5	
Total Suspended Particles (TSP)	µg/m3	08 Hours	142.6	500.0	1.0	
Lead	µg/m3	08 Hours	ND	1.5	-	ASS Method

*SEQS= Sindh Environmental Quality Standards.
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**

Lab Report Ref. No. : EMC/QTS/MCD/22/2769 Reporting Date: 15/03/2022

Project Name: The Mangrove-Creek Side Development

SAMPLE DESCRIPTION

Sample ID: Noise Level Test
Sample Description: Ambient Noise
Location: **24°47'48.98"N 67° 6'30.43"E**
No. of samples: 04
Sample Collected/Submitted by: QTS representative
Sampling Date: 15/03/2022

NOISE LEVEL TEST REPORT

S.NO.	TIME	Noise Level Readings			
		Minimum	Maximum	Average	Limits
1	11:00	51.0	54.6	52.8	*SEQS-Limits: 55dB(A)
2	12:00	49.2	52.4	50.8	
3	13:00	53.1	55.0	54.0	
4	14:00	50.6	53.5	52.0	

*SEQS=Sindh Environmental Quality Standard for Residential Area- Category "A".
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

EPA Certified Lab
EPA/LAB/Certificate/QTS-11/2013

BUREAU VERITAS Certification

QMS/III/018 WA	
Revision : 03	Date 14.01.2021

Report Ref. No. : QTS/2021/2282-B

Reporting Date: 03/12/2021

Project Name: The Mangrove Project

SAMPLE DESCRIPTION

Sample ID: Korangi creek (Outside Plot)
Sampling Method: APHA-1060-B & C
Sample Type: Liquid/Grab
Sample Collected/Submitted by: QTS representative
Sampling Date : 25/11/2021
Sample Receipt at QTS – Date : 25/11/2021

ANALYTICAL TEST REPORT

S.NO.	PARAMETERS TO BE ANALYZED	LDL	UNITS	RESULTS	TEST METHOD
1	pH value	0.01	-	8.1	USEPA 150.1
2	Biochemical Oxygen Demand$(BOD)_5$ at 20^0C	0.1	mg/L	991.4	Hach method
3	Chemical Oxygen Demand(COD)	1.0	mg/L	4957	Hach 8000
4	Total Suspended Solids(TSS)	1.0	mg/L	09	Hach 8006
5	Total Dissolved Solids(TDS)	1.0	mg/L	34400	Hach 8160
6	Oil & Grease	0.001	mg/L	1.20	APHA 5520-D
7	Cyanide(as CN-)total	0.001	mg/L	0	Hach 8027
8	Ammonia(NH_3)	0.1	mg/L	10.1	Hach 10031
9	Lead(Total)	0.001	mg/L	0.001	ASTM-D3559
10	Mercury(Total)	0.001	mg/L	0.001	ASTM-D3223
11	Dissolved Oxygen(DO)	0.1	mg/L	3.8	Hach 10360
12	Total Hardness(as $CaCO_3$)	0.1	mg/L	9800	Hach 8213

USEPA=United State Environmental Protection Agency method
Hach USA, method
BDL=Below Detection Limit
LDL= Least Detectable Value

Terms & 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.

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

Annex – VI:
Traffic Study

Final Report

Traffic Impact Study for Mangrove Creekside Development, Karachi

April 2023

Exponent Engineers

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1. INTRODUCTION

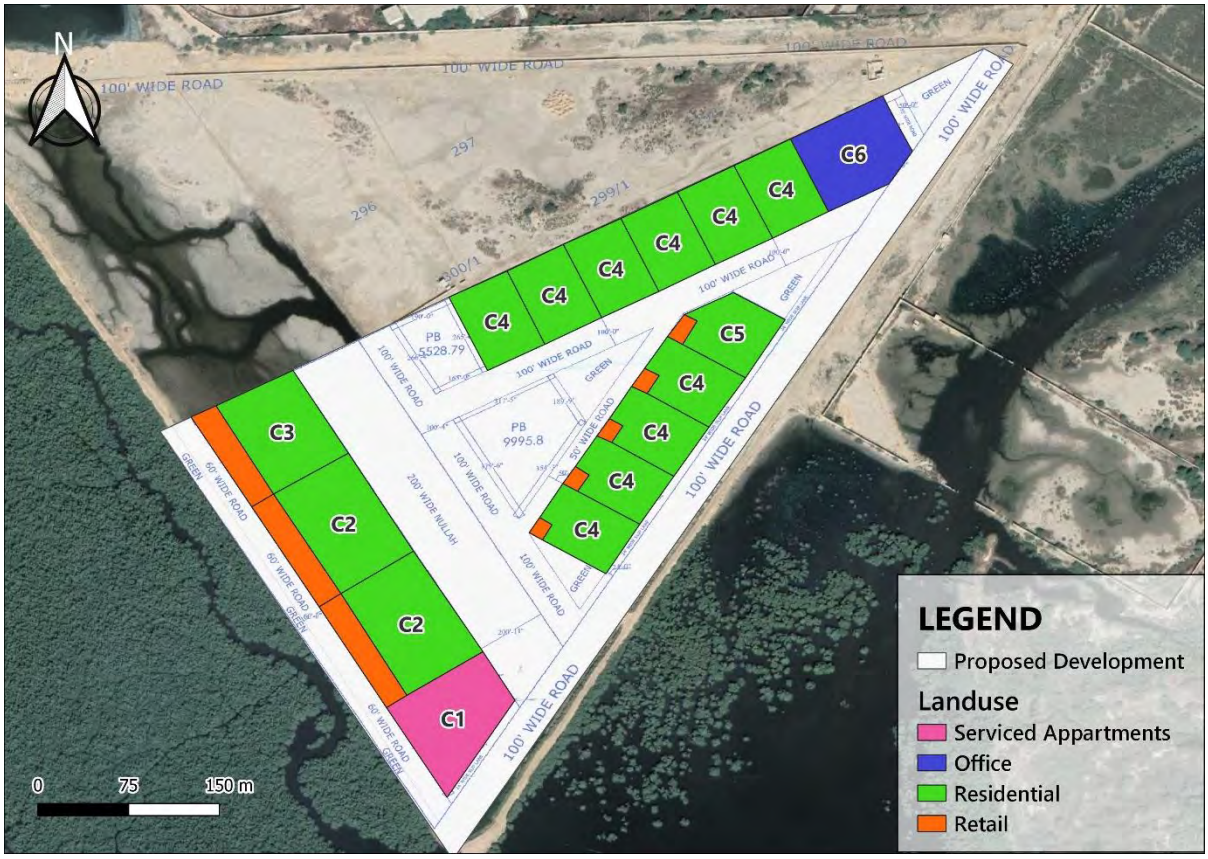
1.1 Background:

Man has been associated with several different activities since the inception of mankind, but travelling is the most primary activity performed by man for fulfilling his basic needs of life. Since ages the modes of travelling have been transformed with integrating demands and purposes for travel. Thus, it is not audacious to state that almost every human activity is always related with a travelling need, even when driving from one place to another for leisure, the reason for travel still exists. Enlightening the above statement, characteristics of the trips produced or attracted reveal that there are many reasons behind these and therefore trips can be classified based on reason to travel.

The above discussion suggests that all land use-based activities produce trips and thus have some impact / contribution on the traffic network in the vicinity or 'Influence Area'. However, size of this Influence Area depends on factors such as the magnitude of human activity, placement along the existing traffic network, number of trips generated and / or attracted, existing traffic situation in the area, and socio-economic characteristics of the area as well as of the people involved in the activities, etc.

The proposed project of The Mangrove Creekside Development is a mix land use development comprising of Residential, Commercial, Retail and Service Apartments Land uses. The development has been divided into 7 types of plots. Plot Type C1 is dedicated for Service Apartments, Plots Type C2, C3 &C4 (Main Road Facing) and C5 are dedicated for Residential and Retail land uses while Plot Type C4 (Back Side) has residential land use. Since the proposed development has Residential, Retail and Commercial land use, a reasonable number of trips are expected to be attracted and generated by the development. The proposed project site is located in Korangi Creek, Karachi. Figure 1.1 shows the plot types and their respective land uses.

Figure 1.1 Plot Types and their Land uses

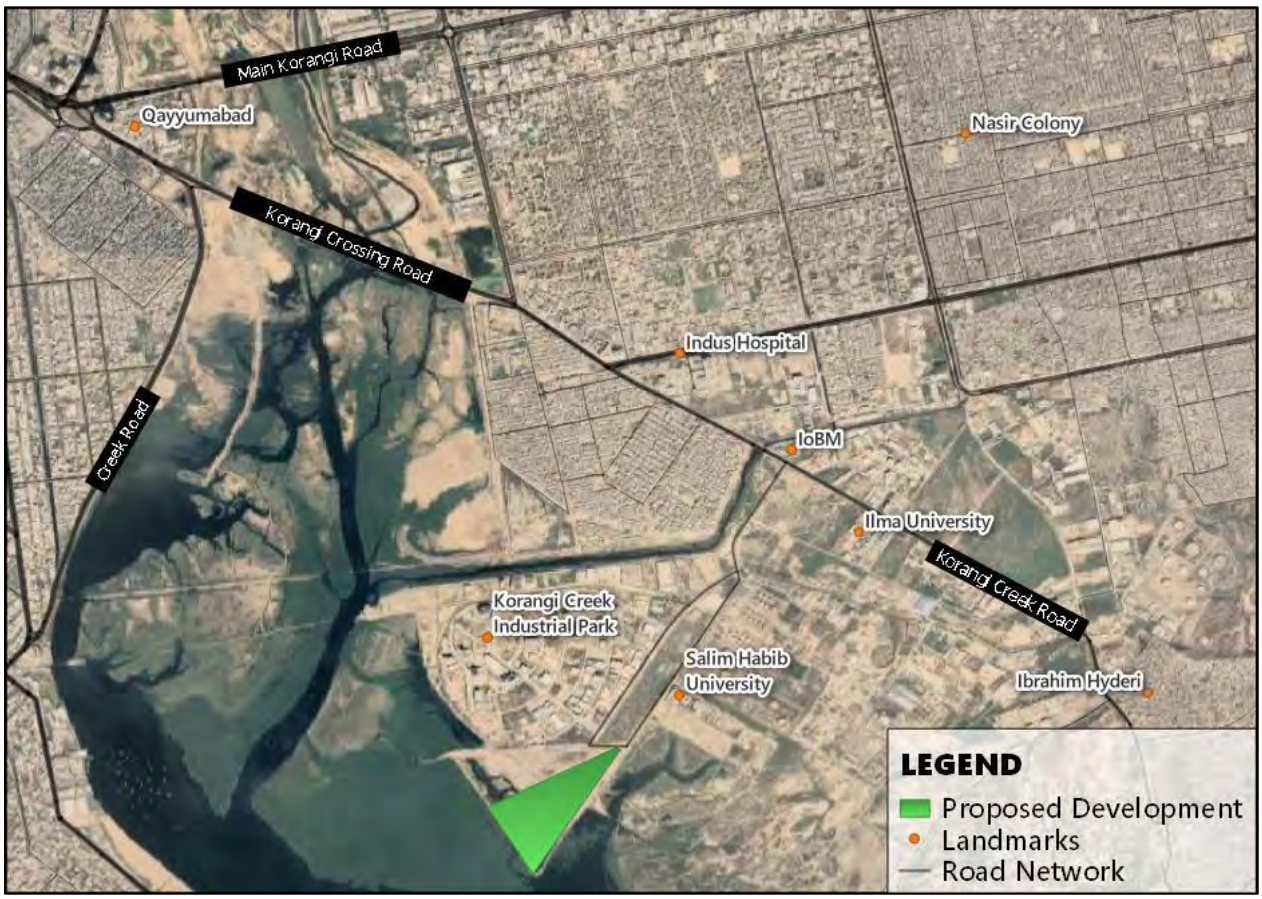


Exponent Engineers (Pvt.) Ltd. has been assigned to evaluate the potential traffic impacts of the proposed development. This detailed traffic impact study identifies the base data and assumptions, explains the methodologies used, and summarizes the findings of the study. The traffic impact analysis conducted for this report includes analysis for full built scenario. Subsequent sections of the report describe and elaborate the approach in further details.

1.2 Project Location and Study Area:

The area under consideration in this study is located in Korangi Creek Industrial Area. The project area lies beside the sea front mangroves in Korangi Creek. The Korangi Creek has also planned several industrial and high-rise multi-land use schemes in the project vicinity. One of which is The Mangrove Creekside Development, Karachi, which would result in major trip generation / attraction from all across the city. The road closest to the project is Pakistan Refinery Road. The traffic of the project shall use the junctions on the Korangi Creek Industrial Park Road to access or egress the development. This road also gets traffic from all other areas of Korangi and therefore carries significant traffic at present. The land use around project vicinity is primarily industrial under development. However, there are couple of universities also located within the project vicinity.

Figure 1.2 Project Locations and Study Area



1.3 Project Land use:

The planned project has predominantly 4 land uses i.e., Office, Retail, Residential and Service Apartment. Land use bifurcation along the project plan is shown in Figure 1.3 and Table 1.1.

Table 1.1: Showing land use areas of the development.

S. No.	Land use	GFA (sq. ft)
1.	Residential	9,136,634
2.	Retail	385,009.6
3.	Office	600,817.6
4.	Serviced Appt.	954,879.1

Figure 1.3 Study Area

1.4 Purpose of the study:

The purpose of this study is to investigate the traffic impacts of the development. This includes:

- Existing Traffic Pattern & Road Network Inventory in Study Area
- Estimation of Trip Production / Attraction & Distribution
- Internal Circulation of Traffic within the development
- Identification Project Traffic Impact on external junctions
- Suggesting Mitigation Measures (if needed)

1.5 Organization of Report:

The report is organized in such way that:

Chapter 1 discussed a brief introduction about the project along with its location and land use area back up.

Chapter 2 discusses the existing condition which outlines the road network and land uses surrounding the site.

Chapter 3 discusses the parking requirement, traffic circulation within development and future traffic estimation and anticipated traffic generation and distribution for the development.

Chapter 4 discusses performance of junctions within the study area by taking cumulative traffic impact and analysis of internal junctions of the proposed Development.

2. Existing Condition

2.1 Introduction:

As part of this analysis for The Mangrove Creekside Development, a comprehensive data collection effort is undertaken to develop a detailed description of existing conditions in the study area. The assessment of conditions relevant to this study includes an inventory of the street, traffic volumes on these facilities, and operating conditions at key intersections.

2.2 Existing Road Infrastructure

There are 4 major roads available in the project's vicinity. These include the following, which is also shown in Figure 2.1:

- ✓ Pakistan Refinery Road
- ✓ Korangi Creek Industrial Park Road
- ✓ Salim Habib University Road
- ✓ Korangi Creek Road

The existing transportation mix is predominantly private cars with very small proportion of motorcycles. As discussed earlier, since there are not many developments exist at present in the project vicinity, no major traffic circulation is recorded.

Figure 2.1: Existing Road Infrastructure

2.2.1 Existing Major Junction within the Study Area

a. Junction 1:

This junction is a three-legged un-signalized junction. It is located between Korangi Creek Road and Pakistan Refinery Road. At this junction, turning movement counts would help to determine the traffic coming to and from the development from all directions.

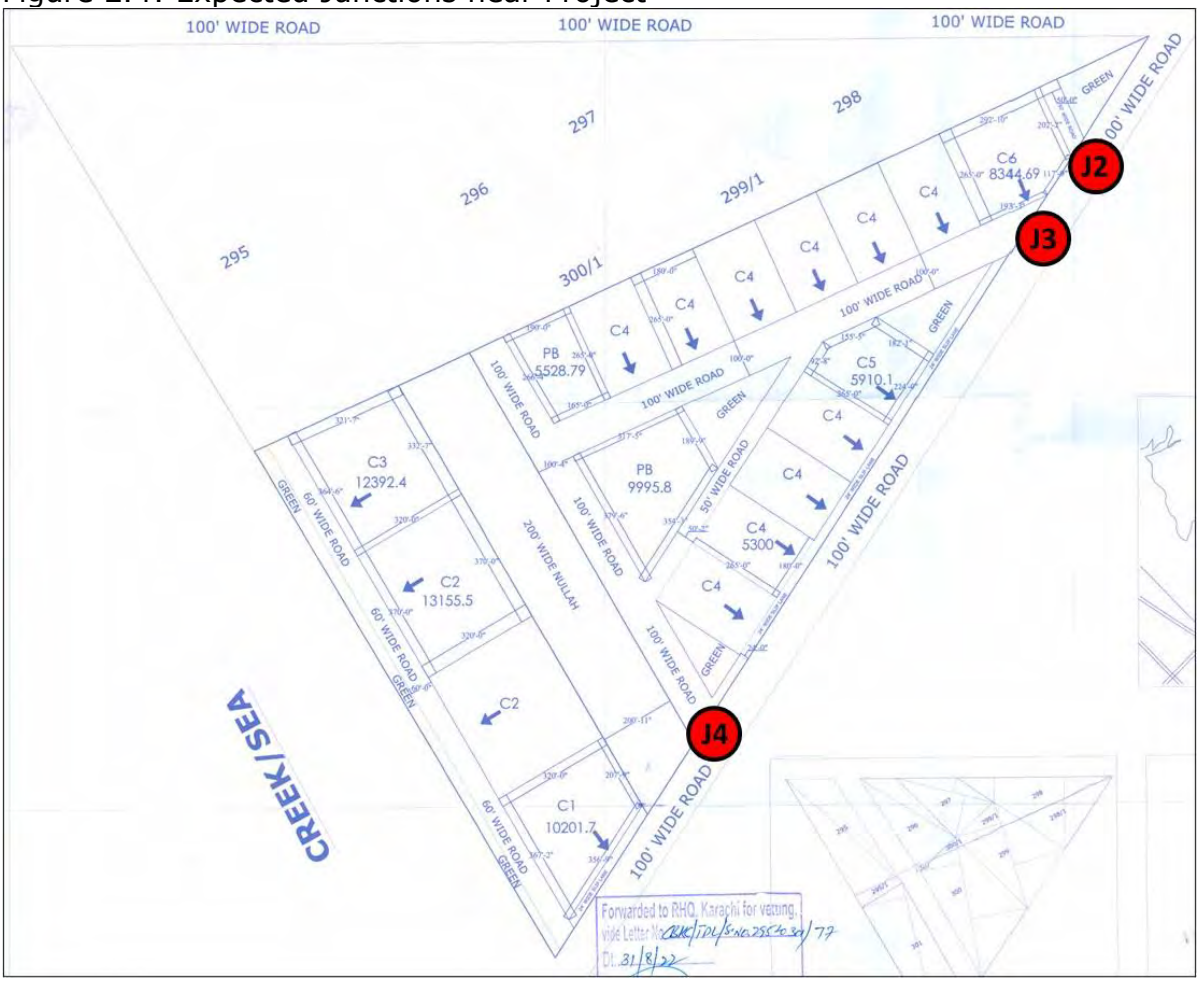
Figure 2.2: Existing Major Junction within the study area

Figure 2.3: Turning Movement Count Survey Data on Junction 1

2.2.2 Expected Junctions after the development of Project.

Junctions 2,3 & 4 do not exist today but after the development of the project these junctions will play a vital role in entering and exit of project's traffic. These junctions will connect all three entrances of the project with the 100 feet wide external road. Site Visit of these junctions suggested that at this moment there is no traffic at these junctions therefore traffic count surveys are not performed there. Figure below shows Junction 2,3 & 4.

Figure 2.4: Expected Junctions near Project



3. Future Traffic Estimation and Parking Assessment

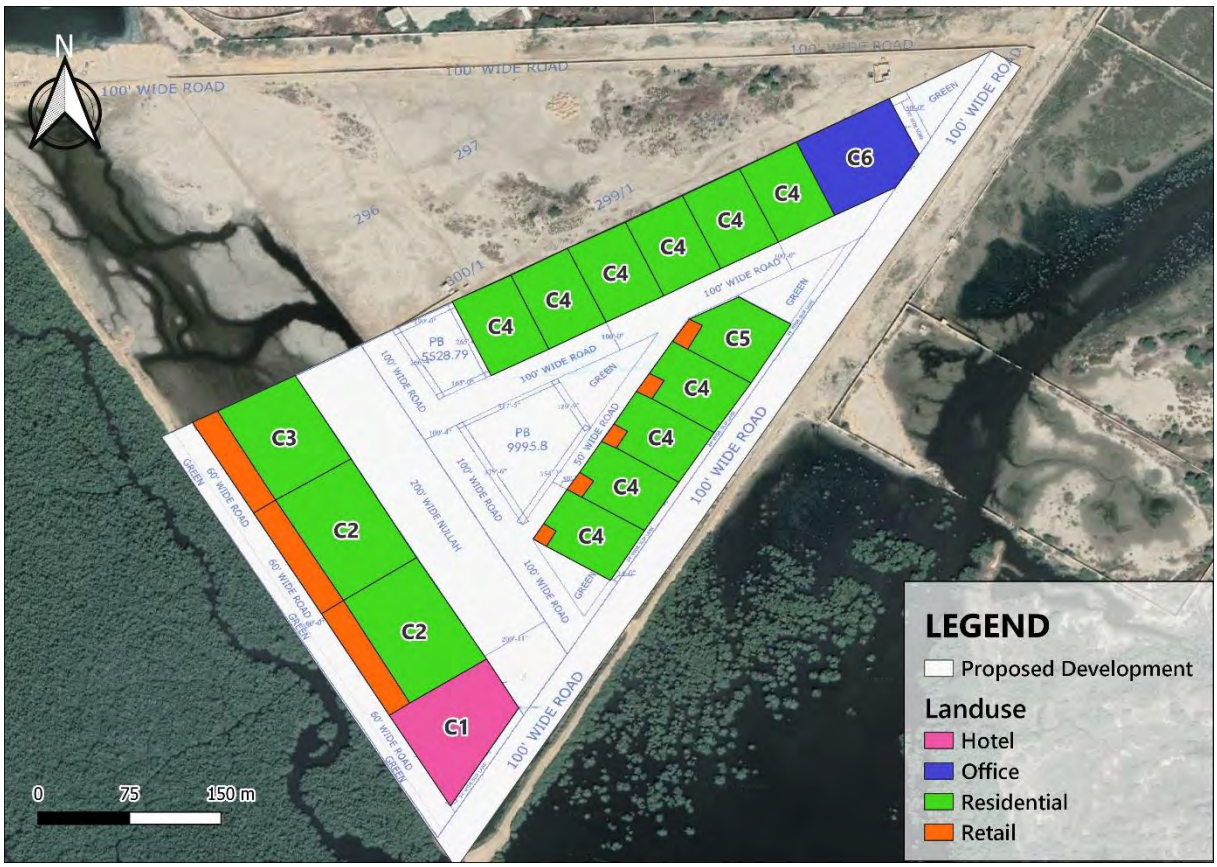
3.1 Introduction:

This part of the report discusses the future traffic generation and its distribution on the road network of the study area. It also focuses on the potential land uses for future traffic generation within the study area. A detailed discussion on traffic distribution and traffic growth is a part of this section.

3.2 Proposed Land use:

The proposed project of The Mangrove Creekside Development is a mix land use development comprising of Residential, Commercial, Retail and Service Apartments Land uses. The development has been divided into 7 types of plots. Plot Type C1 is dedicated for Service Apartments, Plots Type C2, C3 & C4 (Main Road Facing) and C5 are dedicated for Residential and Retail land uses while Plot Type C4 (Back Side) has residential land use. Since the proposed development has Residential, Retail and Commercial land use, a reasonable number of trips are expected to be attracted and generated by the development. The proposed project site is located in Korangi Creek, Karachi.

Figure 3.1 Plot Types and their land uses



3.3 Trip Generation & Attraction:

3.3.1 Residential, Retail, Office & Service Apartments Land use:

In Pakistan, no published data is available from which trip generation rates for any land use can be estimated. For All Land uses in Mangroves Creekside development, assumptions were taken from previously performed studies which are similar in nature to the development under discussion. The assumptions for estimating AM & PM peak hours traffic volumes are summarized below:

Assumptions

The basic assumptions Total trip generation for morning and evening peak hour were calculated, based on following considerations:

- Every 1.5 and 1.6 dwellings generate 1 trip during morning peak hour and evening peak hour respectively on typical weekday.
- Every 30.99 sq. meter of retail space would contribute for 1 trip during evening peak hour.
- Every 50.12 sq. meter of office space would contribute for 1 trip during morning and evening peak hour.
- Every 182.38 sq. meter of service apartments contribute for 1 trip during morning and evening peak hour.

3.4 Peak Hour Traffic Generation & Distribution:

Since the development under consideration is a mixed land use development, it is anticipated that the development would generate a substantial amount of traffic during both morning and evening peak hours. From field data collection and historical dataset analysis, it is evident that morning peak hours are from 09:00 AM -10:00 AM and evening peak hours are from 06:00 PM - 07:00 PM. Hence, for this project, both morning and evening weekday peaks are analyzed. The traffic generation calculated in table below is used to understand the anticipated operational performance of the study area road network. It will also provide a more accurate representation of the anticipated vehicle movements to and from the site. The trips generated are then distributed on in and out bound ratio:

- In Residential land use during morning peak hour on typical weekday 23% trips are inbound & 77% trips are outbound.
- In Residential land use during evening peak hour on typical weekday 44% trips are inbound & 56% trips are outbound.
- In Retail land use during evening peak hour on typical weekday 85% trips are inbound & 15% trips are outbound.
- In Commercial Land use during morning peak 10% of trips are outbound and 90% are in bound.
- In Commercial Land use during morning peak 90% of trips are outbound and 10% are in bound.

- In Service Apartments Land use during morning peak 44% of trips are outbound and 56% are inbound.
- In Service Apartments Land use during evening peak 56% trips are outbound and 44% trips are inbound.

Table 3.1: Trip Generation for Morning & Evening Peak Scenarios.

Land Use	Morning Peak			Evening Peak		
	Inbound	Outbound	Total	Inbound	Outbound	Total
Office	983	109	1,092	109	983	1,092
Residential	498	1,677	2,182	900	1,146	2,046
Retail	-	-	-	981	175	1,156
Serviced Appt.	272	214	486	214	272	486
TOTAL	**1,753**	**2,000**	**3,760**	**2,204**	**2,576**	**4,780**

3.5 Parking Analysis

The analysis of the parking scenario of any proposed development is one of the main essences of Traffic Impact Study. This section enlightens parking requirements for the proposed development. Efficient parking provision, keeping in view of the development and its surrounding environment's requirements, is necessary for the success of any project.

3.6 Parking Required

Since the proposed development serves Office, Retail, Residential and Serviced Apartment land uses, therefore their parking estimations are done separately.

3.6.1 Residential Parking Requirement

As per Cantonment Board Korangi Creek (CBKC) bylaws, for residential land use 1 parking stall per 1,000 sq. ft. is required. A total of 9,134 parking stalls will be required to fulfil the residential car parking requirement. The details of Parking required for residential land use are shown in Table 3.2.

Table 3.2: Parking Requirement for residential land use

Plot Type	Area (Sq. ft)	Parking Ratio (sq. ft / stall)	Parking Required
Plot C5	553,185	1,000	553
Plot C4	496,080		496
Plot C4	496,080		496
Plot C4	496,080		496
Plot C4	496,080		496
Plot C4	496,080		496
Plot C4	496,080		496
Plot C4	496,080		496
Plot C4	496,080		496

Plot Type	Area (Sq. ft)	Parking Ratio (sq. ft / stall)	Parking Required
Plot C4	496,080		496
Plot C4	496,080		496
Plot C2	1,231,360		1,231
Plot C2	1,231,360		1,231
Plot C3	1,159,929		1,159
Total Required Parking			**9,134**

3.6.2 Retail Parking Requirement

For Retail land use parking ratio of 800 sq. ft. / stall is calculated from Cantonment Board Korangi Creek (CBKC) bylaws. A total of 482 parking stalls will be required for the retail land use. The details of Parking requirement are shown in Table 3.3.

Table 3.3: Parking Requirement for retail land use

Plot #	Area (Sq. ft)	Parking Ratio (sq. ft / stall)	Parking Required
Plot C5	34,574	800	43
Plot C4	31,005		39
Plot C4	31,005		39
Plot C4	31,005		39
Plot C4	31,005		39
Plot C2	76,960		96
Plot C2	76,960		96
Plot C3	72,495		91
Total Required Parking			**482**

3.6.3 Office Parking Requirement

For Office Land use parking ratio of 800 sq. ft. / stall is calculated from Cantonment Board Korangi Creek (CBKC) bylaws. Hence, the required parking stalls would be 751. The details of Parking required for Office land use can be seen in Table 3.4.

Table 3.4 Parking Requirement for Office Land use

Plot #	Area (sq. ft.)	Parking Ratio (sq. ft / stall)	Parking Required
Plot C6	600,817	800	751

3.6.4 Service Apartments Parking Requirement

For Serviced Apartment Land use parking ratio of 800 sq. ft. / stall is calculated from Cantonment Board Korangi Creek (CBKC) bylaws. Hence, the required parking stalls would be 1,194. The details of Parking required for Service Apartment land use can be seen in Table 3.5.

Table 3.5 Parking Requirement for Serviced Appt. Land use

Serviced Appt. Land Use			
Plot #	**Area (sq. ft.)**	**Parking Ratio (sq. ft / stall)**	Parking Required
Plot C1	954,879.1	800	1,194

3.7 Traffic Circulation Plans

3.7.1 Entrance Scenario in Morning Peak

In morning peak, 983 trips are attracted to Office land use, 498 trips are attracted to Residential land use whereas 272 trips are attracted to Service Apartments. The detailed entry scenario in morning peak is presented in Figure 3.2.

Figure 3.2 Entrance Volumes to the Development in Morning Peak

3.7.2 Entrance Scenario in Evening Peak

In evening peak, 109 office trips are attracted to Office Plot, 900 trips are coming to Residential Plots, 981 trips are coming to Retail Plots and Further 214 trips entering Service Apartments. The detailed entry scenario in evening peak is presented in Figure 3.3.

Figure 3.3 Entrance Volumes to the Development in Evening Peak

3.7.3 Exit Scenario in Morning Peak

In morning peak, 109 trips are exiting from Office Plot, 1,677 trips are exiting from Residential Plots whereas 214 trips are exiting from Serviced Apartments. The detailed exit scenario in morning peak is presented in Figure 3.4.

Figure 3.4 Exit Volumes to the Development in Morning Peak

3.7.4 Exit Scenario in Evening Peak

In evening peak, 983 trips are exiting from Office Plot, 1,146 trips are exiting from Residential plots, 175 trips from Retail Plots whereas 272 trips are exiting from Serviced Apartments. The detailed exit scenario in evening peak is presented in Figure 3.5.

Figure 3.5 Exit Volumes to the Development in Evening Peak

4 . Traffic Impact Assessment

4.1 Introduction:

This section of the report discusses performance of junctions within the study area by taking cumulative traffic impact along with analysis of internal junctions of The Mangrove Creekside Development.

4.2 Software Used:

For the analysis, a software namely PTV VISSIM is used. The analysis is done by building the entire road network on this software and the simulation results extracted after running the actual condition on this software.

4.2.1 PTV VISSIM:

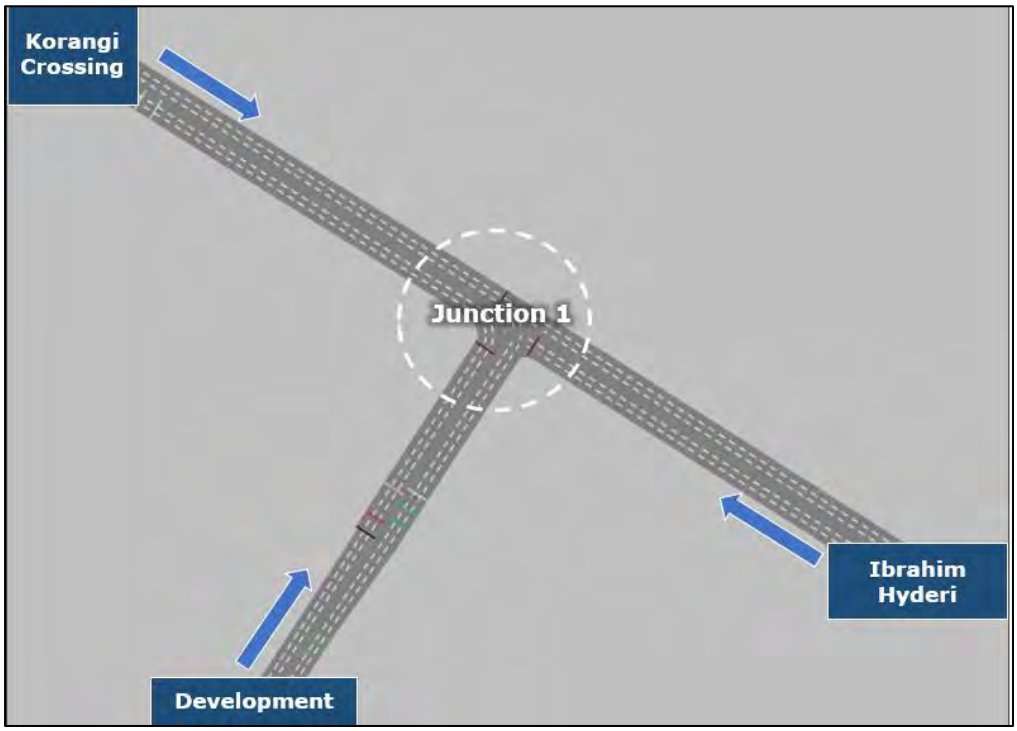
For the purpose of micro simulation commercial software VISSIM is used. VISSIM is a behavior based multi-purpose traffic simulation program. It is a tool which gives a chance to do optimization of complex technical systems with the help of simulation. It deals with a variety of urban and highway applications, by integrating public and private transportation. Complex scenarios can be visualized to an extent of detail to demonstrate the operational aspects of the traffic model. It also provides with the opportunity to model other road users such as pedestrians and cyclists and to replicate their behavior to simulate a real life like situation. The package also provides the user with the option to input user written programs in the form of *.vap and *.pua files, through which signal priority and other signal control options could be performed.

4.3 Model Setup:

A model for study area is developed for all cases and scenarios in VISSIM and simulated in VISSIM. The model developed for entire study area is shown in Figure 4.1. As discussed earlier the models have been developed for both morning and evening peaks for all scenarios.

Figure 4.1a: Internal Network developed in PTV VISSIM.

Figure 4.1b: External Network developed in PTV VISSIM.



Model for the checking of interfacing of External and Internal Traffic Flow is developed in order to simulate the base condition so that the future options can be tested. The area of influence is being finalized based on the possibility of affecting roads in the vicinity of the project. The geometry of the entrances and exits network is developed with the help of CAD drawings and then it has been digitized on the micro simulation software i.e., VISSIM with the help of links and connectors.

Calibrating a model is important because it gives confidence on the results network would give for future scenarios and hence it should replicate the existing situation as close as possible. Various field efforts were carried out to calibrate the model such as collecting on ground delays at junctions, observing queues and delays at various locations during peak hours etc. Hence based on the field visualization and data collection it can be assimilated that the model depicted close enough conditions for existing case and hence is reliable for future cases.

4.4 Intersection Performance Criteria:

The performance of the individual intersections was evaluated based on the following performance measure.

- Level of Service (LOS) based on Average Vehicle Delay (seconds).

4.5 Level of Service:

LOS is an index of the operational performance of the intersection based on the service measures such as delay, degree of saturation and density during a given flow period. LOS 'A' is the highest level with LOS 'F' occurring when traffic volumes are at or close to capacity with drivers experiencing significant delays.

4.6 Model Results:

The assessment criteria followed for estimating LOS for each junction is based on Table 4.1a & 4.1b.

Table 4.1a: Level of Service for Un-signalized Intersections (HCM)

S. No.	LOS	Un-Signalized Intersections
1	A	Less than or equal to 10 seconds
2	B	Greater than 10 to 15 seconds
3	C	Greater than 15 to 25 seconds
4	D	Greater than 25 to 35 seconds
5	E	Greater than 35 to 50 seconds
6	F	Greater than 50 seconds

Table 4.1b: Level of Service for Signalized Intersections (HCM)

S. No.	LOS	Signalized Intersections
1	A	Less than or equal to 10 seconds
2	B	Greater than 10 to 20 seconds
3	C	Greater than 20 to 35 seconds
4	D	Greater than 35 to 55 seconds
5	E	Greater than 55 to 80 seconds
6	F	Greater than 80 seconds

4.7 Development's Occupancy along Horizon Years

As per discussion with the developer, it is expected that in the year 2030 some of the plots will be 0% occupied, some will be 10% occupied and some will be 50% occupied as shown in Figure below. However, it is expected that till year 2040 all plots will be 90% occupied.

Figure 4.2: Population Settlement in 2030

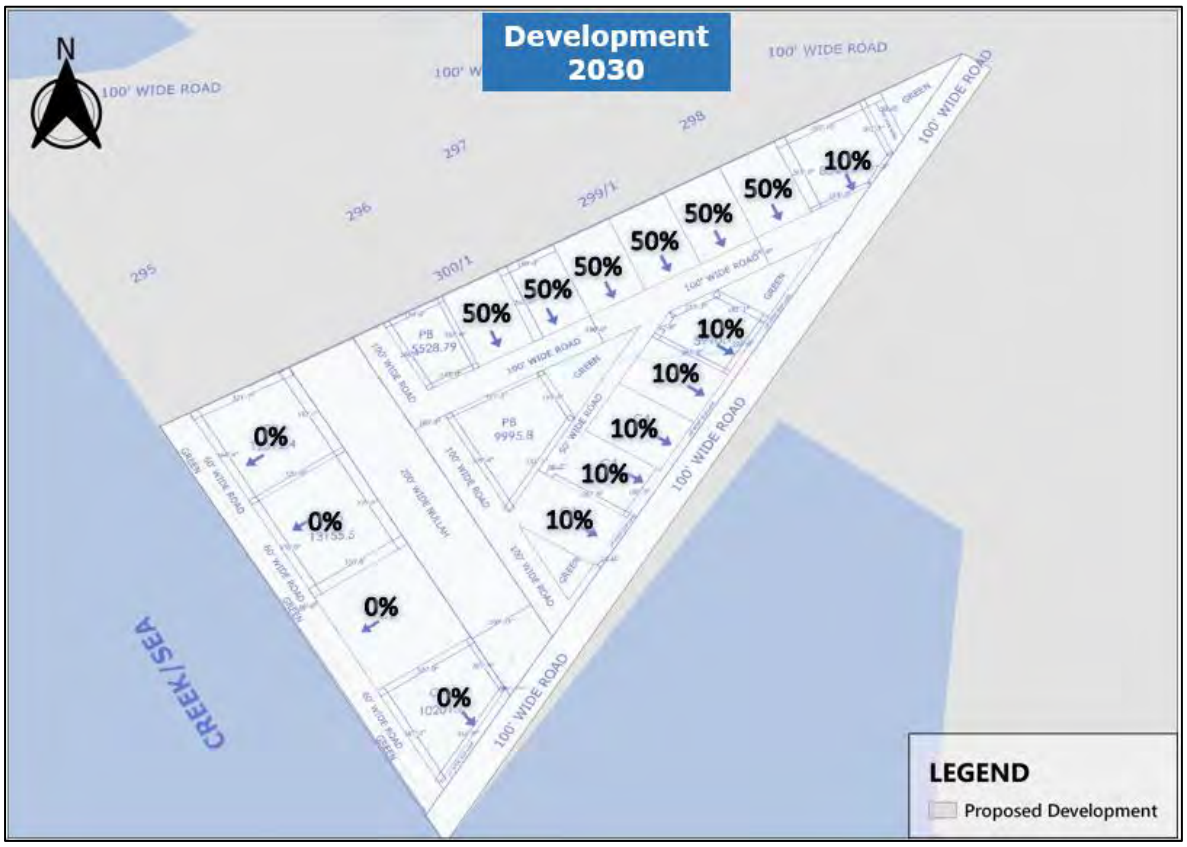
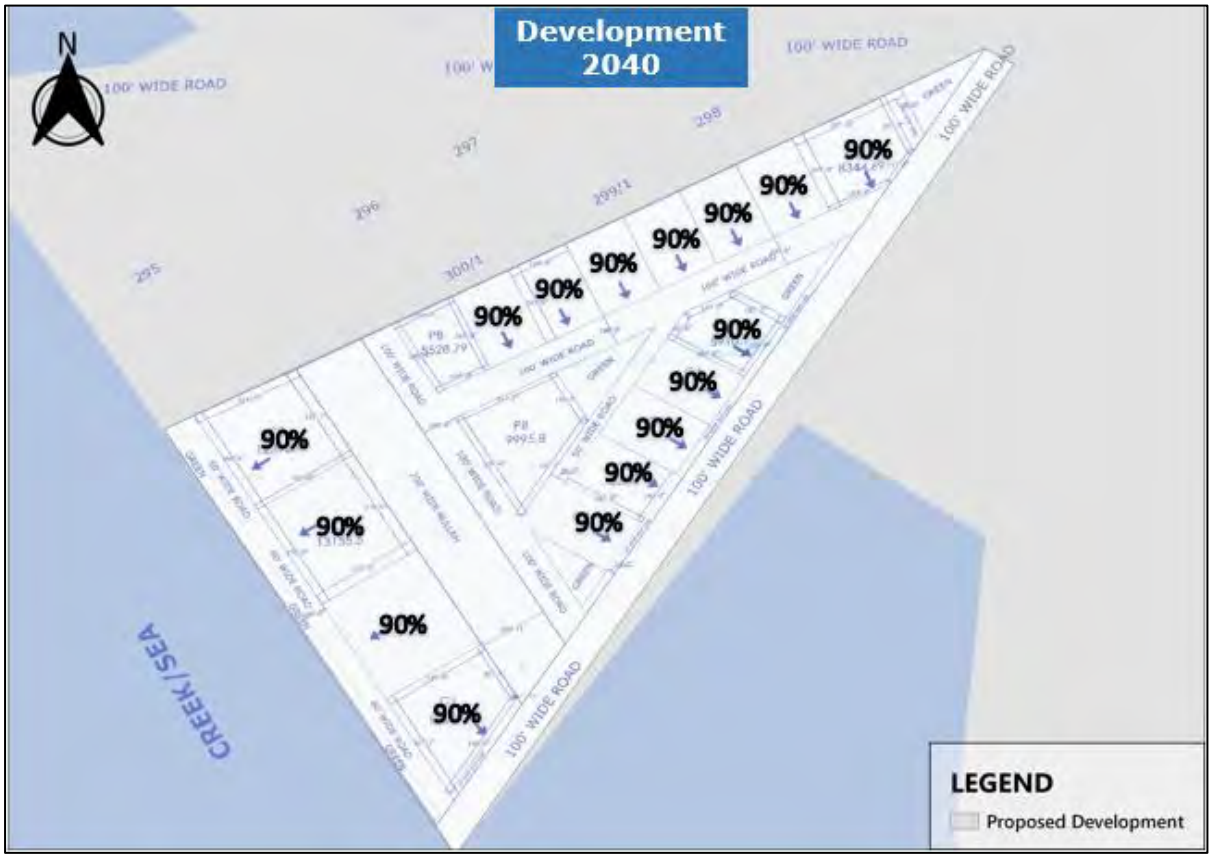


Figure 4.3: Population Settlement in 2040



4.8 Traffic Analysis for Internal Roads

To understand the traffic situation within the development, traffic analysis is performed for roads approaching to each plot. Figure 4.4 shows all 5 – locations from where delays for entry and exit traffic were calculated. Tables 4.3a and 4.3b show delay results for entry traffic and Table 4.4a and 4.4b shows delays for exit traffic.
Since the internal analysis can only be performed in only with development scenarios therefore it has been performed for both future target years i.e., 2030 & 2040 in only with development scenarios. Table below shows the same.

Table 4.2: Analysis Scenarios

Scenario No.	Scenario Name
Scenario 1	2030 - With Development
Scenario 2	2040 - With Development

Figure 4.4: Entry / Exit Delays Locations for Analysis

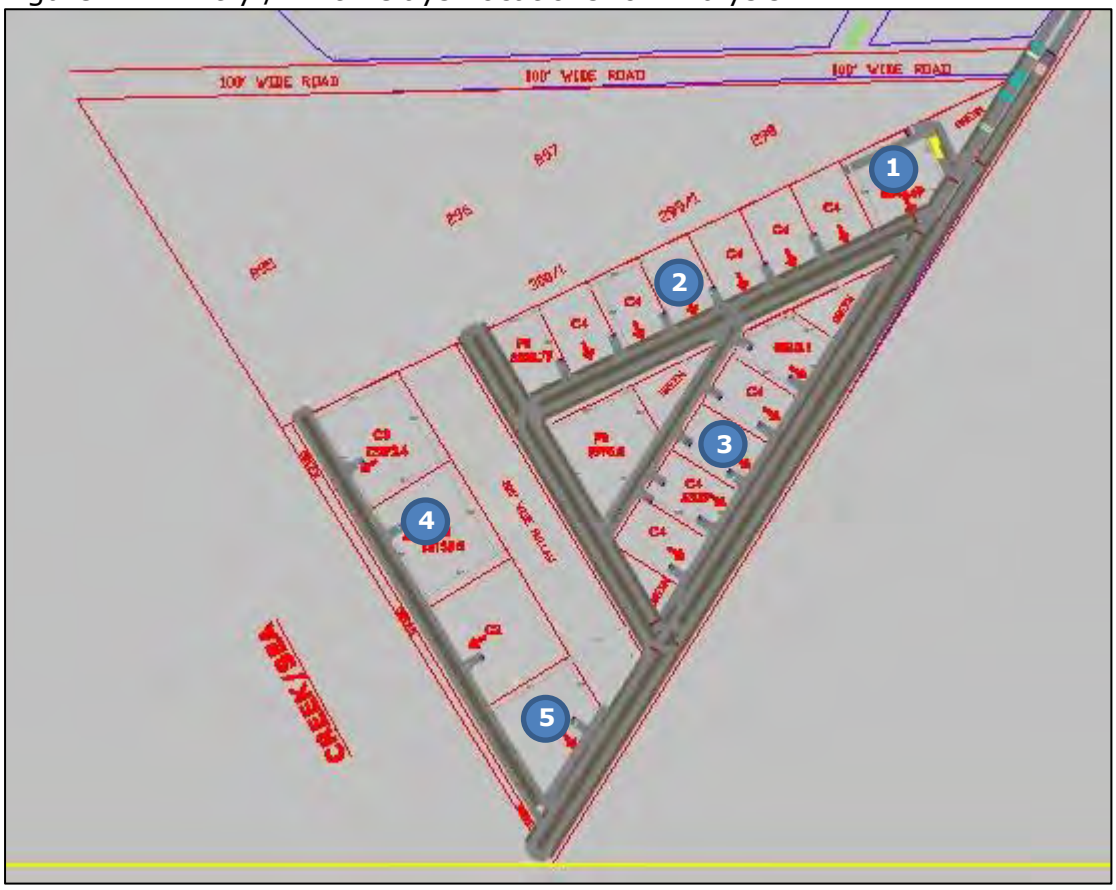


Table 4.3a: Plot wise Entry Traffic delays for AM Peak

S. No.	Plot #	Land use	Delay (sec)	
			2030	2040
1	Plot C1	Office	9.0	20.0
2	Plot C4	Residential	8.8	24.5
3	Plot C4	Res. & Retail	6.0	14.7
4	Plot C2, C3	Res. & Retail	-	16.5
5	Plot C5	Serviced Appt.	-	15.1
Avg. Delay Entrance			**7.9**	**18.1**

Table 4.3b: Plot wise Entry Traffic delays for PM Peak

S. No.	Plot #	Land use	Delay (sec)	
			2030	2040
1	Plot C1	Office	5.5	8.7
2	Plot C4	Residential	16.0	33.2
3	Plot C4	Res. & Retail	3.5	22.5
4	Plot C2, C3	Res. & Retail	-	25.6
5	Plot C5	Serviced Appt.	-	23.6
Avg. Delay Entrance			**8.37**	**21.48**

Table 4.4a: Plot wise Exit delays for AM Peak

S. No.	Plot #	Land use	Delay (sec)	
			2030	2040
1	Plot C1	Office	0.1	4.2
2	Plot C4	Residential	24.8	28.4
3	Plot C4	Res. & Retail	18.5	28
4	Plot C2, C3	Res. & Retail	-	33.2
5	Plot C5	Serviced Appt.	-	36.5
Avg. Delay Exit			**14.5**	**26.0**

Table 4.4b: Plot wise Exit delays for PM Peak

S. No.	Plot #	Land use	Delay (sec)	
			2030	2040
1	Plot C1	Office	5.5	5.7
2	Plot C4	Residential	16.0	25.2
3	Plot C4	Res. & Retail	3.5	30.0
4	Plot C2, C3	Res. & Retail	-	34.6
5	Plot C5	Serviced Appt.	-	35.8
Avg. Delay Exit			**17.8**	**20.3**

Junction Assessed:

The assessment of the traffic for the project needs a complete network for the study area shown in Figure 4.1. The junctions were analyzed for both AM and PM scenarios. These scenarios are shown in Table 4.5.

Table 4.5: Analysis Scenarios

Scenario No.	Scenario Name
Scenario 1	2023 - Do Nothing
Scenario 2a	2030 - Without Development
Scenario 2b	2030 - With Development
Scenario 3a	2040 - Without Development
Scenario 3b	2040 - With Development

4.9 Traffic Analysis for External Roads

As discussed above, for the analysis of the external traffic, four junctions (J1-J4) were selected. The delays are calculated from all directions of the junctions and in all scenarios with and without development. It is important to mention here that J2-J4 will have significant traffic only after the development of the project therefore delays are calculated on these junctions only in with development scenarios.

Table 4.6: Analysis Results for External junctions for Morning Peak

Delay Results (Sec) - AM Peak											
S. No.	Junction	2023		2030				2040			
				Without Development		With Development		Without Development		With Development	
		Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS
1	Junction 1	17.45	C	24.58	C	89.70	F	130.93	F	228.51	F
2	Junction 2	-	-	-	-	9.00	A	-	-	13.91	B
3	Junction 3	-	-	-	-	2.59	A	-	-	18.92	C
4	Junction 4	-	-	-	-	2.18	A	-	-	6.30	A

Table 4.7: Analysis Results for External Junctions for Evening Peak

Delay Results (Sec) - PM Peak											
S. No.	Junction	2023		2030				2040			
				Without Development		With Development		Without Development		With Development	
		Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS
1	Junction 1	22.43	C	29.71	D	32.81	D	47.17	E	130.86	F
2	Junction 2	-	-	-	-	10.85	B	-	-	12.14	B
3	Junction 3	-	-	-	-	0.06	A	-	-	18.07	C
4	Junction 4	-	-	-	-	0.02	A	-	-	9.38	A

From the results it is evident that in 2030 & 2040 in both without and with development scenarios delays are very high and are not in acceptable limits for urban areas and need to be mitigated. However, on other junctions delays are very low and are under acceptable limits.

4.10 Mitigation on Junction 1

The main reason behind the increase in delay in future scenarios is that in base case, this junction is un-signalized and only one lane in each direction is operational on Pakistan Refinery Road. In the above scenario, the delays are calculated by having the same configuration and without any improvement which is causing high delays.
To mitigate this, it is suggested to:

1. Signalize the Junction 1
2. Increase lanes on Pakistan refinery road from 1 to 3 as 100 feet right-of-way (ROW) is available on that road.

After taking these mitigation measures in the traffic model the results are significantly improved as shown in the Tables below.

Table 4.8: Results for External junctions for Morning Peak after mitigations

Delay Results (Sec) - AM Peak											
S. No.	Junction	2023		2030				2040			
				Without Development		With Development		Without Development		With Development	
		Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS
1	Junction 1	17.45	C	40.25	D	43.90	D	59.84	E	64.15	E
2	Junction 2	-	-	-	-	9.00	A	-	-	13.91	B
3	Junction 3	-	-	-	-	2.59	A	-	-	18.92	C
4	Junction 4	-	-	-	-	2.18	A	-	-	6.30	A

Table 4.9: Results for External Junctions for Evening Peak after mitigations

Delay Results (Sec) - PM Peak											
S. No.	Junction	2023		2030				2040			
				Without Development		With Development		Without Development		With Development	
		Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS
1	Junction 1	22.43	C	21.14	C	27.49	C	23.93	C	43.81	D
2	Junction 2	-	-	-	-	10.85	B	-	-	12.14	B
3	Junction 3	-	-	-	-	0.06	A	-	-	18.07	C
4	Junction 4	-	-	-	-	0.02	A	-	-	9.38	A

Annex – VII:
Waste Management Plan

Annexure 2

TPL Waste Management Plan (WMP)

Last updated on: 30th March 2023

Document Type: Annexure

Version: 1.1

Date: 30th March 2023

Version	Date	Description	Prepared by:	Reviewed by:	Approved by:
1.0	14th Mar 2023	First Publication	Khalil Shahab	Sitvat Jamal	Jamil Akbar
1.1	30th Mar 2023	Second Publication	Khalil Shahab	Sitvat Jamal	Jamil Akbar

1. Introduction

The Waste Management Plan (WMP) in its entirety will be implemented and monitored across all of TPL RMC's construction projects. This document, serving as a fundamental part of the Company's ESMS will also be embedded to the tender documents for each respective General Contractor (single / multiple) and will the Company will expect the General Contractor, its sub-contractors and all other third parties involved directly or indirectly towards any process in the development of the projects on-site.

Additionally, it is advisable for TPL to involve relevant stakeholders, including community members, in the design and implementation of the waste management plan to ensure it is appropriate for the local context, community and culture from a project by project basis. This WMP will also be incorproated into the Environment Impact Assessment (EIA) for each project and will provide the company an opporunity to directly engage with its stakeholders and keep them appraised of the WMP and the Company's commitment towards protecting all relevant stakeholders.

This WMP is developed in line with IFC's EHS Guidelines on Waste Management and to ensure the Company remains fully in compliance with not only local standards but also international best practices. Furthermore, The WMP will address a step by step process towards identifying and recording the type and related quanties of waste on site, how to be segregate, store and eventually dispse in an practical and ethical manner.

The key responsible team, led by the Head of ESG will remain the custodian of this document and ensure its full compliance on all projects at all times. It will be the responsibilty of the TPL Projects Team to ensure the full implementation of the WMP across all Tender Documents and on-site.

2. WMP Objectives

The objectives of this WMP are to:

- Develop a waste management plan that identifies the types and quantities of waste that will be generated during the construction process, and outlines how that waste will be handled and disposed of.
- Implementing measures to minimize waste generation, such as using materials and products that generate less waste and promoting recycling and re-use of materials.
- Properly segregating and storing different types of waste on site to prevent contamination and providing appropriate facilities for the storage and handling of hazardous waste.
- Ensuring that the disposal of waste is in compliance with all applicable laws and regulations, and that waste is disposed of in an environmentally sound manner, such as through proper landfilling or recycling.

Definitions of waste as part of the IFC Environment Health and Safety (EHS) guidelines are defined below:

Waste	• A waste is any solid, liquid, or contained gaseous material that is being discarded by disposal, recycling, burning or incineration. • It can be byproduct of a manufacturing process or an obsolete commercial product that can no longer be used for intended purpose and requires disposal.
Solid (Non Hazardous Waste)	• Generally, include any garbage. Examples of such waste include domestic trash and garbage; inert construction / demolition materials; refuse, such as metal scrap and empty containers (except those previously used to contain hazardous materials which should, in principle, be managed as a hazardous waste); and residual waste from industrial operations, such as boiler slag, clinker, and fly ash.
Hazardous Waste	• shares the properties of a hazardous material (e.g. ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment if improperly managed. Wastes may also be defined as "hazardous" by local regulations or international conventions, based on the origin of the waste and its inclusion on hazardous waste lists, or based on its characteristics.

The purpose of this plan is to provide information necessary to ensure that the management of waste at the site is undertaken in accordance with current legal national and international industry standards. In particular, this Plan aims to ensure maximum recycling, reuse and recovery of waste, wherever possible. It also seeks to provide guidance on the appropriate collection and transport of waste from the site to prevent issues associated with litter or more serious environmental pollution (e.g., contamination of soil and/or water).

Waste Management Framework

This WMP includes information on the legal and policy framework for construction & demolition waste management, estimates of the type and quantity of construction & demolition waste to be generated by the proposed development and makes recommendations for management of different waste streams.

Following are the best environmental practices for waste management requirements to consider:

- Applicable local and national legal compliance;
- Avoidance and minimization measures;
- Recording and manifesting;
- Segregation, labelling and storage;
- Monitoring of waste management contractors;
- Disposal mechanisms;
- Continual improvement measures;
- Training and awareness programs in alignment with recognized good international practice.

For simplicity, this WMP will follow the IFC guidelines of waste management including definitions and guidelines.

Demolition Waste

The demolition waste is expected to generate wastes including; scrap, excess construction materials, brick and clay tile, steel, and debris.

Categorization and Sorting

Waste can be categorized based on material, such as plastic, paper, glass, metal, and organic waste. Categorization may also be based on hazard potential, including chemical waste, toxic, or medical waste.

Table 1: Waste Categorization and Placement Guideline

S.#	Categorization and Sorting	Waste Bins (Colored bins)
1	Organic /Food waste	
2	Plastic waste	
3	Hazardous/Medical waste	

4	Paper/Glass	
5	Demolished Waste	
6	Steel scraps	
7	Chemical waste	

Waste Minimization

To minimize waste, the following steps shall be taken:

- Avoidance and minimization measures shall be adopted at an early stage through designing out and contract management;
- Substituting raw materials or inputs with less hazardous or toxic materials, or with those where processing generates lower waste volumes
- Only the required number of materials shall be ordered as per the Project BOQ with a minimum quantity for contingency purposes. Instituting procurement measures that recognize opportunities to return usable materials such as containers and which prevents the over ordering of materials
- Explore all alternatives for non- hazardous material prior to purchasing hazardous material.
- Prior consideration shall be given to the sizes of waste skips/bins available when ordering products that could potentially generate waste. The intent is to avoid unused products and/or their containers from becoming wastes that require special handling.

Segregation

A specific area shall be laid out and labeled to facilitate the separation of waste materials. All waste receptacles are to be kept clean and should be clearly marked in order to avoid contamination of materials. The labeling system shall be clear and simple. If the relevant receptacles are clearly identified this will aid the bulk of the workforce in depositing the correct materials into the appropriate receptacle

Table 2: list of common chemicals used in construction		
S.#	**Chemical Name**	**Quantity**
1	Concrete curing compounds	
2	Polymer bonding agents	
3	Mold releasing agents	
4	Protective and decorative coatings	
5	Installation aids	
6	Floor Hardeners and Dust – Proofers	
7	Non-Shrink High Strength Grout	
8	Surface Retarders	
9	Bond-aid for plastering	
10	Ready to use plaster	
11	Guniting Aid	

Storage

The materials which are generally stored at construction sites will include cement, sand, steel, crush and other chemical drums etc. All these materials will be kept as per their nature or type and will be stored in separate compartments in accordance to their nature at the construction site.

- Waste is stored in a manner that prevents the commingling or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spills. Examples include sufficient space between incompatibles or physical separation such as walls or containment curbs
- Store in closed containers away from direct sunlight, wind and rain · Secondary containment systems should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment
- Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters. The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location
- Provide adequate ventilation where volatile wastes are stored.

Hazardous waste storage activities should also be subject to special management actions, conducted by employees who have received specific training in handling and storage of hazardous wastes:

- Provision of readily available information on chemical compatibility to employees, including labeling each container to identify its contents
- Limiting access to hazardous waste storage areas to employees who have not received proper training

- Clearly identifying (label) and demarcating the area, including documentation of its location on a facility map or site plan
- Conducting periodic inspections of waste storage areas and documenting the findings
- Preparing and implementing spill response and emergency plans to address their accidental release
- Avoiding underground storage tanks and underground piping of hazardous waste

Transportation

On-site and Off-site transportation of waste should be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public. All waste containers designated for off-site shipment should be secured and labeled with the contents and associated hazards, be properly loaded on the transport vehicles before leaving the site, and be accompanied by a shipping paper (i.e., manifest) that describes the load and its associated hazards,

The Contractor shall obtain all necessary authority approvals and No Objection Certificates (NOC) from and liaise with the Local Municipality and all other authorities to undertake haulage works, including but not limited to approved routes, load weights, and travel times. The Contractor shall load all trucks transporting demolished earth materials or loose debris from the site in a manner that prevents materials from being dropped on streets and shall ensure that truck tyres are in good condition.

The contractor shall fasten suitable tarpaulins over the load before it leaves the site. Similarly, trucks bringing loose materials to the site shall be adequately covered, and trucks must not be overloaded.

Disposal

The following disposal techniques will be adopted.

Table 3: Waste Management Collection and Disposal Techniques

Activity	Best Practice
Generation of Construction waste	• Implement resource conservation, and encourage staff (through training) to reduce waste, reuse waste and recycle waste wherever possible
Disposal of biodegradable domestic waste	• Collect all bio-degradable domestic camp waste and dispose of at the designated landfill area or compost area • Properly collect and dispose biodegradable and hazardous waste so that any potential harm to domestic and feral animals can be avoided.
Disposal of non-biodegradable waste (non-recyclable)	• Dispose of in landfill or at a licensed waste disposal site in Sindh • Do not burn materials which may lead to the release of toxic or hazardous substances (see SEQS)

Table 3: Waste Management Collection and Disposal Techniques	
Activity	**Best Practice**
Disposal of recyclable waste	• Sell recyclable waste to local vendors
Generation of sanitary waste	• Provide latrines at all campsites • Prohibit staff from fouling the site
Collection of domestic waste	• Provide garbage bins, at a radius of the approx.50ft for the collection of domestic camp waste • Arrange for regular collection of camp waste and transfer to a storage area / disposal • Collect non-biodegradable waste separately and dispose of at designated waste disposal area • Enforce use of garbage bins and prevent littering of the site
Disposal of sanitary waste	• Treat sanitary waste with septic tanks at main camps • Dispose of sanitary waste through burial at temporary and sub camps
Incineration of waste on site	• No fire is allowed in open areas. • Do not burn materials such as plastics and polyethylene which may lead to the release of toxic or hazardous substances. • Collected to be disposed responsibly in municipal waste dumping sites.
Generation of construction waste	• Reduce construction waste by reusing waste as a fill material (prior to testing to confirm suitability of material)
Collection of construction waste	• Collect construction waste separately to domestic waste • Collect and remove all construction waste from the project site
Disposal of construction waste	• Reuse material as fill material or sell to local vendors • Sell or reuse gates removed from structures • Treat construction wastes water and dispose of after treatment • Do not bum materials which may lead to the release of toxic or hazardous substances
Disposal of packaging	• Do not burn packaging materials which may lead to the release of toxic or hazardous substances
Disposal of medical waste	• Incineration at nearby hospital (or equivalent facility)

Table 3: Waste Management Collection and Disposal Techniques	
Activity	**Best Practice**
Disposal of hazardous waste (fuel, oils, Admixture chemicals, Asbestos)	• Handover to specialized and EPA certified disposal contractor. • Demolished surplus excavated material must be disposed of in accordance with local municipal regulations. • Dispose of all solid, liquid, and gaseous contaminants in accordance with all statutory and contractual requirements, and discharge gaseous contaminants in such a manner that they shall be diluted with fresh air sufficiently to reduce toxicity to an acceptable level. • Liquid contaminants shall be contained in approved vessels for disposal at approved off-site locations. The contractor shall dispose of solid contaminants by removing refuse arising from the execution of the works from the site to approved locations or as otherwise approved. • For chopping refuse in hoppers and shutters, covered or designed chutes or refuse buckets that completely confine the material and prevent dust emission and odour shall be used.

Training & Communication

The contractor will provide on-site instruction of appropriate separation and handling methods for appropriate stages of the Project. Toolbox talks will be carried out on waste issues and all subcontractors will be expected to attend. This will ensure that everyone feels they are included and that their participation is meaningful.

Monitoring

Monitoring activities associated with the management of hazardous and non-hazardous waste should include:

- Regular visual inspection of all temporary waste storage collection and storage areas for evidence of accidental releases and to verify that wastes are properly labeled and stored. When significant quantities of hazardous wastes are generated and stored on site, monitoring activities should include:
    - Inspection of vessels for leaks, drips or other indications of loss
    - Identification of cracks, corrosion, or damage to tanks, protective equipment, or floors
    - Verification of locks, emergency valves, and other safety devices for easy operation (lubricating if required and employing the practice of keeping locks and safety equipment in standby position when the area is not occupied)
    - Checking the operability of emergency systems

  - Documenting results of testing for integrity, emissions, or monitoring stations (air, soil vapor, or groundwater)
  - Documenting any changes to the storage area, and any significant changes in the quantity of materials in storage

- Regular audits of waste segregation and collection practices
- Tracking of waste generation trends by type and amount of waste generated, preferably by facility departments
- Characterizing waste at the beginning of generation of a new waste stream, and periodically documenting the characteristics and proper management of the waste, especially hazardous wastes
- Keeping manifests or other records that document the amount of waste generated and its destination
- Periodic auditing of third-party treatment, and disposal services including re-use and recycling facilities when significant quantities of hazardous wastes are managed by third parties. Whenever possible, audits should include site visits to the treatment storage and disposal location
- Regular monitoring of groundwater quality in cases of Hazardous Waste on site storage and/or pretreatment and disposal

Recording & Reporting

The contractor must record the information about the source, composition, quantity, and final disposition of the waste. This information is needed for regulatory compliance, risk assessment, setting reduction targets and objectives, and corporate statistics. The **Waste Tracking Form**, as shown in **Table 4**, shall be used to record this information by all team members. It is the responsibility of the Team Leader to assign a suitable person to sign off the Waste Tracking Form before the waste is dispatched outside. Moreover, the team leader shall ensure, at each stage of the project, that the waste management system operates effectively and in compliance with the waste management plan

Table 4: Waste Tracking Form									
Site: _____					**Month: _____**				
S. No	**Date**	**Item(s)**	**Solid Waste (Kg)**	**Liquid Waste (L)**	**Organic Waste (Kg)**	**Demolished Waste (Kg)**	**Hazardous Waste (Kg)**	**Disposal Mechanism**	**Sign**
1									
2									
3									
4									
5									
6									
7									
8									
9									
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Annex – VIII:
Labor Management Plan and
Grievance Redress Mechanism

Annexure 8

TPL Labor Management Plan and Grievance Redress Mechanism

Last updated on: 30th March 2023

Document Type: Annexure

Version: 1.1

Date: 30th March 2023

Version	Date	Description	Prepared by:	Reviewed by:	Approved by:
1.0	14th Mar 2023	First Publication	Khalil Shahab	Sitvat Jamal	Jamil Akbar
1.1	30th Mar 2023	Second Publication	Khalil Shahab	Sitvat Jamal	Jamil Akbar

1. Introduction

The LMP serves to direct management and control of actions that can bring labor-related hazards while the project is being implemented. The LMP is a requirement that must be met by all employees of proponent, as well as all of its consultants, contractors, subcontractors, labor supply contracting agencies, third parties, and other staff involved across TPL's projects

The key responsible team, led by the Head of ESG will remain the custodian of this document and ensure its full compliance on all projects at all times.

2. LMP Objectives

The objectives of this LMP are to:

- Develop and disseminate commonly recognized labor policies so that participants in the project will have a point of reference;
- Ensure that all project participants, whether direct workers or not, abide by employment legislation by creating the necessary working circumstances that are compliant with applicable legislative requirements;
- Assist and guide TPL employees who will work on the project in carrying out labor management procedures;
- Encourage just and equitable labor practices to ensure equal opportunity, non-discrimination, and fair treatment for both male and female employees;
- Create, nurture, and oversee a positive management-employee relationship;
- Protect project workers, especially those who are at risk, such as women and people with disabilities, children (of working age, in accordance with the IFC Performance Standard 2 - PS2) and migrant workers, contracted workers, community workers and primary supply workers, as appropriate;
- Give project participants and workers easy access to ways to voice their complaints about the workplace.

The LMP's description of the key labor requirements and risks associated with project would help TPL determine the resources needed to resolve labor difficulties. The LMP is a dynamic document that is initiated early in the planning stage of the project and is evaluated and updated as the project is developed and carried out. As a result, this document defines the types of personnel and their management that the Project is expected to use. Important LMP components will be included in the contractual obligations of contractors and subcontractors. All contractors and subcontractors shall prepare and implement labor management plans in line with the LMP.

TPL has prepared this document based on the existing labor laws in Pakistan and its ratified international agreements, and in accordance with the guidelines of the PS2 of the IFC. Furthermore, the scope and procedures of the LMP, constitute a special labor framework, against which compliance is mandatory for TPL and its consultants, contractors, subcontractors, and suppliers associated with this project. The LMP will be applicable to all types of workers that will be employed by TPL and all personnel

employed by the Board in relation to the execution of the project; and therefore, its use and knowledge is mandatory, as necessary.

3. Scope of the LMP Application

The LMP is required by the IFC's PS2 on 'Labor and Working Conditions.' Its scope encompasses:

- Labor and contracts;
- Management of workers;
- Occupational Health and Safety; and
- Access of information and grievance mechanisms.

The main objective of PS2 is to promote constructive worker-management engagement and provide benefits for project development by treating project personnel fairly and giving them safe and healthy working circumstances. The goal of this LMP is to make project planning and execution easier by identifying the major personnel requirements and the environmental and social (E&S) actions needed to manage labor-related project challenges. Along with fundamental guidelines that apply to all forms of work, the LMP also addresses problems and issues unique to the Project. No matter how they are hired or whatever labor policy they fall under, as described below, the LMP is applicable to all workers employed by the Project as specified in PS2.

- Direct Workers: People employed or engaged directly by the TPL to work specifically in relation to the Project;
- Contracted Workers: People employed or engaged through third parties to perform work related to core functions of the project, regardless of location;
- Supply Chain Workers: People employed or engaged by the TPL and its contractors' primary suppliers.

4. Overview of Labor across TPL's Real Estate Projects

These Labor Management Procedures apply to all Project workers whether direct, contracted, primary supply and community workers as per PS-2.

The proposed project will involve direct workers (Employees hired by PM, specialists engaged from the market, etc.); contracted workers engaged in construction work and consultancy services for the project (e.g., for preparation of E&S documents); and primary supply workers (e.g., for equipment required for the project).

The LMP has been developed to manage labor risks during the implementation of the project. The LMP is in line with national requirements as well as the objectives of the IFC's environmental and social framework, specifically objectives of Labor and Working Conditions Standard 2: (PS2).

5. Labor Requirement

PS 2 divides workers into four categories: direct workers, contracted workers, and supply workers that involves all Project workers. At this stage, community workers are not anticipated for project. The workers are further categorized as follows:

5.1 Direct workers[1]

Direct employees of project are individuals who are hired by the TPL to perform work that is explicitly related to the Project. For the purpose of carrying out a variety of project operations, direct workers will include the project-based staff and the permanent staff of the PM. It will consist of multiple senior and junior engineers qualified in civil engineering. Additionally, the PM will include experts in financial, procurement, environmental, and social management. As part of the PM, TPL may additionally hire consultants and support personnel who will be paid on a contract basis. The national and provincial labor regulations will serve as the basis for these consultants' terms and conditions. The project may employ consultants to carry out as many short-term tasks as are required. Any civil officials who are seconded to assist with project implementation must adhere to the occupational health and safety criteria outlined in this LMP.

The PM will be tasked with:

- General project responsibilities for project management, financial management, procurement, monitoring and evaluation, and environmental and safety management;
- Technical responsibilities to help divisions working on the project; and
- Support services (office manager, assistants, driver, others).

PM staff may be transferred from within TPL, hired or seconded for the implementation of project including technical and non-technical staff.

5.2 Contracted Workers

For the purpose of carrying out document preparation and carrying out various civil works under the Project, TPL will hire a number of contractors and consultants. Contractors, subcontractors, and their employees who are employed by project may include consultants who are preparing the feasibility studies and detail design for the project as well as consultants for environmental and social assessment studies. Both expert and unskilled labor will be employed by civil work contractors. Below is a description of the various categories of project contracted employees:

[1] A "direct worker" is a worker with whom the project has a directly contracted employment relationship and specific control over the work, working conditions, and treatment of the project worker. Where government civil servants are working in connection with the project, whether full-time or part-time, they will remain subject to the terms and conditions of their existing public sector employment agreement or arrangement, unless there has been an effective legal transfer of their employment or engagement to the project.

5.3 Permanent / Skilled staff of contractors (construction company)

Project managers, site engineers, construction foremen, supervisors, environmental, social, health, and safety (ESHS) officers, as well as administrative and financial officers for the project/subprojects will all be involved in the project.

5.4 Skilled workers engaged by sub-contractors

Contractors will mobilize their relevant workers and subcontractors to meet project needs based on the expertise needed for each type of project operations. Welders, fitters, steel workers, electricians, technicians, drivers, and operators of large machinery are just a few examples of the specialized workers. It would be expected of the staff to possess knowledge pertinent to the needed tasks.

5.5 Unskilled community members engaged by the contractor/subcontractors

To reduce the number of migrant workers at construction sites, local labor will be hired to the extent possible as unskilled and skilled workers, particularly for simple tasks like building ancillary structures, levelling, and excavating land, loading and unloading materials, supporting construction workers, cleaning up construction sites, watering work sites, and watchmen. The contractor will be legally obligated to engage with TPL /PM to prioritize the impacted communities and vulnerable groups, including female workers and labors with disabilities at their request, in order to ensure equal chances in employment.

5.6 Project Management and Supervision Support

Consultants with the necessary experience will be hired by TPL to perform the following tasks: supporting the PM in the selection of the contractor(s), developing designs, project management, construction supervision, and contract management. Additionally, consultants will help PM monitor the contractor(s)' environmental and social performance as outlined in their environmental and social management plans, as well as their adherence to workplace health and safety regulations.

5.7 Independent Monitoring Consultants (or Monitoring and Evaluation (M&E) Consultants)

PM may hire independent monitoring consultants. Independent monitoring experts are in charge of ensuring adherence to approved project-related plans and programmes, including the environmental and social concerns. The independent monitoring consultants may be hired at the start of the implementation phase, and they will finish their job between six and a year after all project activities have been successfully finished.

5.8 Supply Chain Workers

Skilled and unskilled workers who will be associated with the primary suppliers for the project.

6. Number of Project Workers

6.1 Direct Workers

The staff of the PM comprises of, among others, the Project Director, project manager, several senior and junior engineers, procurement, financial management personnel, and E&S specialists. Direct workers carry out key functions such as project management, coordination, fiduciary, environmental and social management, monitoring and evaluation, and reporting.

6.2 Contracted Workers

The precise number of project workers who will be contracted is not entirely known right now. An approximation of the number of consultants that will work on the design and construction supervision is available, however the number of laborers who will be contracted for civil and other works under this project is unavailable.

6.3 Construction Works Contractors & Workers

The number of workers expected to be engaged for the construction works of the project is not known at this stage.

7. Workforce Characteristics

The number of project workers required for the projects falling under the project shall be identified by the Project design team in line with PM of project. However, given the nature of the project workforce (mostly semiskilled construction labor) and characteristics of the labor force market in Karachi, it is likely the workforce, especially the lower-skilled workers, will be mostly male.

There will, however, be females also available in the project areas to join in and contribute to the project. The expectation is that the majority of labor will be locally hired with the exception of a few skilled workers. Provisions will be made to train and hire as many as possible from local communities where the activities are taking place. Furthermore, professional business/capacity building companies might be contracted in order to carry out surveys, trainings, and other assessments within the project. The nature of labor force will be skilled workers/experts.

8. Timing of Labor Requirements

8.1 Direct Workers

The direct personnel will typically be needed full-time and all year long when the project is being implemented. The year-round construction season can be a little longer or a little shorter depending on the weather. The contractor shall be responsible for organizing the labor force to fit the season and the type of job. Throughout the course of the project, additional experts and consultants will be retained as needed. However, it is apparent that they will be employed in accordance with the implementation of various sub-components for specified time slots. The timing for the engagement of contracted workers will be revealed at a later point.

8.2 Contracted Worker

The PM will hire consultants and contractors who will hire people based on their degree of ability and sub-project requirements based on the scope of work included in project. When the construction contracts are granted and the contractors produce their work plans, the specifics of the timing of the number of labor requirements, frequency, types of jobs, and length of the requirement will be decided. This LMP may need to be changed at that moment. The maximum number of hours worked per day should be 8, with at least one hour allotted for rest.

8.3 Supply Chain Workers

The project may require the use of primary supply workers. The supply chain worker provisions of PS2 apply to those suppliers with whom the project will have a sufficiently significant and ongoing relationship

9. ASSESSMENT OF KEY POTENTIAL LABOR RISKS

The primary risks that project operations provide to workers and other project staff are covered in this chapter. The main occupational risks are:

9.1 Key Potential Labor Risks

The main labor risks associated with the project are assessed to be related to risk of:

- Occupational health and safety (OHS) risks,
- Child and forced labor,
- Labor influx,
- Labor Disputes over Terms and Conditions of Employment,
- Sexual Exploitation and Abuse (SEA)/Sexual Harassment (SH),
- Risk from communicable disease,

- Risk from unsafe potable water,
- Lack of provision of basic facilities – water, food, toilets, washing hand facilities, medical aid,
- Unfair recruitment and selection practices which could discriminate against women, vulnerable groups,
- Poor work safety culture, accidents/incidents, Lack of provision of PPE,
- Salary, wages, and benefits are not in labor laws followed,
- Sub-standard campsite facilities and campsite management,
- Lack of unified rules and regulations for all workers,
- Lack of proper grievance redress channel for workers.

9.2 Occupational Health and Safety Risks

The project's construction and operation activities are primarily responsible for the health and safety risks that could affect the project's workforce, including PM, consultants, construction workers and O&M personnel.

The typical risks include being exposed to the physical dangers of using construction equipment, working near moving traffic, operating cranes, and hoisting equipment, working on or near scaffolding, tripping, and falling, handling bitumen, burns, being exposed to noise and dust, falling objects, traffic risks from operating project-related vehicles, exposure to hazardous materials, and exposure to electrical risks from using tools and machinery. Furthermore, exposure to untreated sewage, risk of disease from vectors drawn to standing water (treated and untreated), risk of flooding, working in confined spaces, risk of acute poisoning from harmful gases/ reagents/ chemicals.

To reduce the risks to the health and safety of employees, it is crucial to identify hazards and manage associated risks. Additionally, it is projected that taking a proactive approach to risk management will lead to significant cost savings, a decrease in compensation claims, and a reduction in noncompliance with health and safety laws, with overall safer and better working conditions for all involved.

Labor related risks will be minimized by adhering to the mitigation hierarchy, which dictates:

I. Hazard Elimination
II. Substitution of process, substance, or tools
III. Prevention of contact with risky object i.e., create barriers, install guards, etc.
IV. Implementation of safe system of work such as permit to work systems, fixing of time limits on hazardous activities performance
V. Use of appropriate personal protective equipment (PPE)

To ensure a safe and healthy workplace, the PM along with its consultants and contractors will take reasonable care to identify all foreseeable health and safety hazards, which hold the potential to harm employees. Hazards may arise from the

work process, the equipment and materials in use, the work environment, or other people involved.

The project and all associated workers will follow occupational health and safety regulations. All contractors must include a comprehensive description of their occupational health and safety management strategy with their bids. One of the factors the PM will consider when choosing the contractors is the applicability of these safety provisions and their previous track record in doing so. All contractors must make sure that workers wear personal protective equipment (PPE), get safety training, and take other preventative measures as specified in the IFC/WB OHS Guidelines and in a setting that complies with PS2 criteria. Both the company and the employee are accountable for safety, where they must work together to create and implement an OHS programme as well as safe work practices and procedures.

The following table provides a summary of the major OHS risks related to the project's activities:

Table 1: Key Potential Occupational Hazards/Risks and Control Measures

Activity	Hazards / Risks Involved	Prevention / Control Measures
Untrained employees at jobs or illegal individuals entering the work area	• All the risks listed in this table apply to unskilled people and are therefore relevant to all activities. • Possibility of allowing incompetent staff to engage in a high-risk activity that could harm them or others.	• Only physically, mentally fit, qualified, and competent people should be hired. • Make sure that everyone on staff has gone through the induction procedure, which includes orientation and training on the dangers specific to the working site and the tasks to be performed. • All Standard Operating Procedures (SOPs) must specify the necessary training and skills. • Every day before work starts, a Toolbox Talk must be completed. • The work area will only be accessible to those who have completed the risk assessment. • Any access to places where work is to be done must be regulated and only authorized by a responsible employee or contractor.
Shifting of material at work sites	• Ergonomic injuries • Slips, trips, and fall	• Create a secure entrance to the worksite. • Avoid inclement weather and only labor during the day, when it is not too hot or raining. • Keep a mobile phone on hand as a backup communication tool and a radio. • Choose the least dangerous route. • Use hard hats with chin straps and non-slip shoes.
Moving Machinery	• Accidents can occur when workers come into contact with vehicles or equipment during the mobilization and use of materials and equipment. • Personal Injury / Fatality / Equipment & Utility Damage • Struck by vehicle	• To operate the mobile equipment to be used and to work near mobile equipment to be used, workers must have the necessary training and competence. • A regular preventative maintenance inspection programme is required for all plant, including mobile equipment, and supporting infrastructure. • The design and installation of guards should follow the relevant machine safety regulations. • All unauthorized individuals and non-essential workers must stay outside of the operating area and swing radius of the equipment.

	• Blind spot • Toppling of the equipment • Contact with power transmission	• Installation of reverse alarms and warning lights in all vehicles and large machinery. • Drivers and operators must keep a maintenance log. • Sloping or benching for excavations deeper shall be designed. • Availability of banks man / flag man. • Means of access/egress (ladder) required if it is 4 feet deep or more. • Spoil dirt must remain at least 1 meter from of the trench/excavation. • Trench/ Excavations are to be identified and barricaded. • Personnel are not permitted to work in trench excavations where water is accumulating. • Fall Protection is required for walkways over deeper than 2 feet. • Identification, isolation, protection of underground utilities and structures nearby to be taken care.
Chemical / Fuel	• Chemical burns/ dermatitis/ Skin irritation. • Inhalation / Ingestion & Absorption Spillage. • Fire	• Development of safe working procedures. Reduction of number of workers exposed to hazards & duration and frequency of exposure. • Use of personal protective equipment. • Regular environmental and medical monitoring. Availability of Firefighting equipment. • Earth bonding while transferring fuel. • Use of drip trays. • Lined secondary containment, availability of spill containment kit. • Provision and Display of Material Safety Data Sheets (MSDS) • Chemical & Fuel handling training for workers.
Fire	• Accidental fires due to electrical short circuit. • Burns / Fatality. • Equipment Damage	• Automatic fire detection system and control system should be provided. • Emergency back-up power should be provided for the automatic systems. • Matches, cigarettes, etc. should be prohibited. • Soldering, welding, or cutting torches should be used after taking hot work permit from the consent authority.
Electrical	• Poor electrical installations and faulty electrical appliances. • Contact with live parts causing shock and burns • Short circuits.	• Ensure safety of electrical installation and its maintenance. • Provision of safe and suitable equipment. • Provision of safety devices • Carry out preventive maintenance. • Lock Out Tag Out (LOTO) Procedure. • Permit to Work (PTW) for maintenances. • Personal Protective Equipment (PPE) Utilization
Biological	Workers working for project are prone to following biological hazards: • Vector borne diseases	• Employees shall understand the risks through proper instruction, training and supervision • Provision of adequate welfare and sanitation facilities • Effective arrangement for monitoring health of staff.
Manual Handling	Physical / Back Injuries	• Use proper lifting tools

		• Only authorized person should operate material handling equipment. • Assess weight of the material, distance to be carried and hazardous etc., before lifting the load. Wear PPE while handling of materials. Whenever possible, mechanized materials handling shall be adopted. While lifting a load physically, keep the load as near as possible to the body with feet properly placed for body balance. Bend knees, keep back straight, keep the load closed to the body and lift the load.
Hot Works	• Burn /Personal Injury Equipment & • Utility Damage • Fire & Explosion	• Clearing the area of combustible materials • Provision of suitable fire extinguishers • Maintaining a careful watch throughout the work by supervisors • A permit to work (PTW) system can help manage the risk on larger projects • Plant and equipment: select electrical and engine driven plant of suitable capacity to prevent overheating • Smoking: bring the rules on smoking to the attention of all workers and visitors to the site and enforce them. • Electrical installations: should be of sufficient capacity for the intended use and designed, installed, inspected, and maintained by competent people.
Lifting Operations	• Personal Injury / Fatality • Equipment & Utility Damage • Equipment Failure. Falling objects	• Use of Inspected and certified crane and Lifting gear • Cordon Off Lifting radius. • Competent Crane operator & rigger/ Signaler. • Ensure availability of lift Plan & load chart. • Ensure ground is stable • Ensure pre-operational check listing of crane. • Prohibition on standing / working under suspended load. • Use of Tag line to control load's movement /swing. • Prohibition of lifting operation in windy conditions.
Confined Spaces	• Personal Injury / Fatality • Entrapment, oxygen deficiency, toxic & explosive atmospheres, and asphyxiation. • Heat & humidity.	• Ensure working in confined spaces under PTW system. • Effective Emergency Response Plan (ERP) • Standby Men • Atmospheric / Gas Testing • Ventilation • Illumination
Other activities	• Working under Adverse Weather Conditions	• Other than during emergency restoration operations where the greatest efforts must be taken to prevent any mishaps, the erection or maintenance work shall not be performed during high wind, thunderstorms, or unfavorable weather conditions that would make the work hazardous.
	• Risks associated with operation of vehicles (eg, accidents)	• For the project, only licensed drivers will be hired. • The project drivers will receive training on safe driving techniques. The cars will be kept in good working

		condition and equipped with all necessary safety features, such as safety belts.
	• Improper use of PPE (Personal Protective Equipment)	• All times will be spent wearing the proper PPE. • Each employee must dress appropriately for the job in order to comply with PPE regulations, reducing or at the very least preventing safety risks and protecting themselves from them. • PPE needs to be in good shape. • PPE should only be bought from reliable vendors.
	• Poor Housekeeping/ Maintenance	• Facilities for employees must be sufficient, spotless, and well-maintained. • Where dangerous products are handled, it should be illegal to smoke, eat, or drink in the workplace. • It is crucial to immediately clean up any oil or other liquid spills on the floor because they are a major contributing factor to mishaps. • Aisles should be broad enough to safely and comfortably fit both people and vehicles. • All tools should be routinely inspected, cleaned, and repaired, and any worn or damaged tools should be removed from service. • Each trash can should have a distinct label (e.g., recyclable glass, plastic, scrap metal, etc.) • Every storage space needs to be identified.
	• Covid-19 Considerations	• Work tasks will be rearranged, or the number of workers on the jobsite reduced, to allow for social/physical distancing, or workers will be rotated through a 24-hour schedule. • All workers will receive prevention training to help them avoid the spread of COVID-19. • Communication strategy/plan to support regular communication, accessible updates, and clear messaging to employees about the most up-to-date facts and statistics, as well as applicable procedures.

9.3 Child and Forced Labor

People under the age of 18 will not be employed on construction projects that involve hazardous work. Workers, as part of a contractual requirement, will be required to provide legally recognized documents such as a Computerized National Identity Card (CNIC) to verify their age in order to ensure that no children are hired to work on the project. However, if other labor-related risks emerge during project implementation, the PM will devise procedures to mitigate the effects. This will include regular community awareness raising sessions to educate residents on the prohibition and negative consequences of child and forced labor.

The above social impact is estimated to be low because: (i) local labor will be prioritized for use in construction activities, while measures to control the age of hired workers will be implemented; (ii) the contractor/subcontractors shall not hire child labor for project-related jobs, where a commitment not to use child labor is one of the required conditions in the bidding documents; and (iii) workers will be trained on labor

safety, traffic safety, and sanitation before beginning work. (iv) Contractor supervision PM staff will monitor and report the absence of forced labor.

9.4 Labor Influx

The Project's focus will be on localizing economic benefits with limited opportunities for outside workers to service work that requires specialized/skilled labor which is not available in project localities. Due to the availability of local labor supply in the province and the scale of work anticipated under the Project, a large-scale labor influx is not anticipated. Except for a few managers, supervisors, and skilled workers, the majority of workers can be found locally or in nearby areas. The preference for local labor (based on skill and experience capacity) is expected to reduce the risk of labor influx.

9.5 Labor Disputes over Terms and Conditions of Employment

Labor disputes are unavoidable in a new construction environment. Demand for limited employment opportunities; labor wage rates and payment delays; disagreement over working conditions; and health and safety concerns in the workplace are all likely causes of labor disputes. Furthermore, employers such as contractors/subcontractors may retaliate against workers who demand legitimate working conditions, raise concerns about unsafe or unhealthy working conditions, or raise any grievances, and such situations may lead to labor unrest. However, in order to implement the project policy on fair labor treatment in accordance with PS2, project contractors/subcontractors will be required to provide their labor with employment information while negotiating with the laborers to reach an agreement on terms and conditions of employment before signing labor contracts. The most efficient mitigating actions to deal with labor disputes during project implementation will be to monitor the implementation of the terms of work conditions that have been agreed upon by both sides and to establish the grievance redress mechanism (GRM) for laborers.

9.6 Sexual Exploitation and Abuse (SEA) / Sexual Harassment (SH)

Although the number of new employees will be relatively small, as was previously mentioned, new employees may develop strong social ties with the local populations outside of their own social circles. This may result in undesirable and/or unlawful behavior, such as unwelcome sexual advances against women and children and SEA/SH. This risk has been rated as Moderate. All contractors will be expected to follow the procedures outlined in the Procurement Regulations in order to establish a written contract with their employees that is materially consistent with PS2's goal. A Code of Conduct created by the Contractors and authorized by PM will be required to be signed by the employees.

9.7 Summary of Labor Risks & Impacts

The table below presents a summary of the potential risks and impacts related to labor and working conditions, together with mitigation measures to avoid, eliminate, or reduce associated impacts.

Table 2: Risks & Impact Mitigation				
Category	**Worker Impacts/ Risks**	**Project Impacts/ Risks**	**Mitigation Measures**	**Responsibility**
Recruitment and selection of workers	Perception of unfair recruitment and selection processes	Community tensions – stop work practices that will affect implementation	Human Resources Policy, including at least: • Selection criteria for each position • Equal opportunities for men, women, and transgenders • Method and place of recruitment • Maximize work opportunities for local citizens • Enhance local employee's skills base through training	PM, contractors, and consultants
Conditions of employment (earnings/ benefits)	Perceptions that wages/ salaries and benefits are less for locals relative to outsiders	Work stoppages, protests, absenteeism, sit-ins, sabotage and conflict at the workplace	The PMs policy needs to follow: • Contract arrangements and content • Equal pay for equal work • Process for pay increases • Pay scales and increments as well as other benefits	PM, contractors, and consultants
Labor relations (conflict handling)	Workers feel aggrieved and do not know how to communicate their issues	Work stoppages, protests, absenteeism, sit-ins, sabotage, and conflict at the workplace	The PMs policy needs to include the following: • Effective grievance redress process which should be gender sensitive • Disciplinary procedures • Workplace rules and regulations • Demobilization procedures • Effective information dissemination to workers	PM, contractors, and consultants

Labor communication mechanisms	• Workers are not informed about activities or events that affect them • Workers are unable to communicate collective issues plaguing them • Rumors/ misinformation spreading	• Inadvertent actions due to rumors or incorrect perceptions • Poor morale and unproductive work force	• Effective communication mechanisms including: ○ Regular written communication for all workers about the project activities and operations ○ Worker committees/ organizations/ unions ○ Use of notice boards/ toolbox	PM, contractors, and consultants
Child Labor	Recruitment of individuals, who by virtue of age, would be exposed to hazardous situations and be subject to impaired social development	Increased health & safety risk to workforce, potential non-compliance with national labor laws, and reputational risk to the project	Human resources and contracting policies covering recruitment and selection processes that specifically address issues associated with child labor	PM, contractors, and consultants
Employment conditions, wages, and benefits	Perceptions that wages, salaries, and benefits are not fair	Work stoppages, protests, absenteeism, sit-ins, sabotage, and conflict at the workplace	• Human resources policy with respect to equal pay for equal work according to the local conditions and industry averages • An effective employee complaints/ grievance process	PM, contractors, and consultants
Worker's relations/ interaction with community	• Disturbing nearby communities due to the worker's routine activities • Communities are negatively impacted by some camp activities	All negative actions on community may cause hindrance in the project construction/ operation as well as other project related activities such as road blockage, community sit ins resulting in prevention of	• Implement the control measures to avoid/ and or minimize the impacts of camp and living conditions of workers on communities. Control measures include: ○ Encourage to recruit local labor/ staff ○ Limited interaction of outsiders/ foreign	PM, contractors, and consultants

		workers, and contractors from entering the project site	workers with the local/ nearby community of the camp ○ Provision of cultural sensitivity awareness training to facilitate appropriate actions interaction with communities ○ Limited movement of workers during the peak working hours of community	
SEA/SE aspects	SEA/ SH risks for the communities as well as for workers	-	• Communities will be informed and consulted before commencing works inside or near the communities • Awareness raising among communities will be carried out for SEA/SH risks • Strict code of conduct will be maintained by the construction crew. Local norms will be respected • Project staff will receive training on the prevention of SEA/SH • Provision related to SEA/SH will be incorporated in the bidding documents • Workers will be required to sign the Code of Conducts prepared by the Contractors which will be reviewed, and approved by PM • Training and awareness raising will be carried out for the	PM, contractors, and consultants

			workers on SEA/SH aspects • Identification and mapping of service providers	
Worker Accommodation/ camp specifications	Accommodation is considered sub-standard which leads to discontent amongst the residents and concerns about perceived health risks	• Workers have low morale • Perception amongst workers that the project does not care for their welfare, affecting the project	Build camps to minimum specifications. The following plans will be applied as necessary: • Minimum health requirements • Minimum camp specifications • Operations accommodation • Emergency Response Plan • Security Management Plan	Contractors
Camp Management Practices	Residents do not live in harmony and the potential for conflict arises. Residents do not know how to make a complaint	-	• Implement an induction program to be attended by all residents that covers at least the following: ○ Camp rules and regulations ○ Code of conduct ○ Camp grievance mechanism ○ Camp disciplinary procedure ○ Cultural awareness ○ Health, safety, and security ○ First aid kits are adequately stocked	Contractors
Housekeeping	The general appearance of the camp deteriorates making camp life unpleasant	The overall camp experience is compromised which in turn leaves workers demoralized and unproductive.	• Ensure that campgrounds and common areas are routinely cleaned and organized with appropriate signage in place	Contractors

			• Establish easily accessible, designated smoking areas which are clearly highlighted and regularly cleaned • Ensure that equipment and facilities are kept clean and well maintained	

10. OVERVIEW OF LABOR LEGISLATION

This chapter presents an overview of the labor legislation in the country relevant to the project, along with relevant IFC requirements related to workers and working conditions. Key regulations to be defined within the LMP for each respective project will be considered:

- Labor Rights in the Constitution of Pakistan (1973)
- International Labor Standards Applicable in Pakistan
- International Labor Organization (ILO) Labor Conventions – Ratifications from Pakistan
- Federal Labor Laws
- Factories Act, 1934
- The Industrial Relations Act, 2012
- West Pakistan Maternity Benefits Ordinance, 1958 (The West Pakistan Maternity Benefit Rules, 1961)
- The Industrial and Commercial Employment Act, 2013
- The Employees Old-Age Benefits Act, 1976
- Minimum Wages (Unskilled Workers) Act, 2013
- The Disabled Persons (Employment and Rehabilitation) Act 2015
- Employment of Child Act (ECA), 1991
- The Protection Against Harassment of Women at the Workplace Act, 2010

10.1 Provincial Labor Laws

In 2010, subjects of labor and employment were devolved to provinces under the 18th Amendment to the Constitution of Pakistan, as a result of which the federal labor laws became applicable on provinces under Article 270 AA (6) of the Constitution of Pakistan. The 18th Constitutional Amendment in Pakistan has altered the landscape of the labor administration system in the country. Provinces now have a greater responsibility and resources in terms of legislation and implementation. Each province has developed its own labor policy to protect worker's rights. The policy relevant to the project is the Sindh Labor Policy, 2018.

This Policy sets out the framework on industrial relations, social and economic wellbeing of the people of the province of Sindh.

After the Eighteenth Amendment, Sindh adopted various laws which comprised of labor laws, welfare and industrial relations laws, where the applicable labor laws are outlined below and will be taken into consideration for each project:

- The Sindh Workers Compensation Act 2015
- The Sindh Minimum Wages Act 2015
- The Sindh Terms of Employment (Standing Orders) Act ,2015
- The Sindh Payment of Wages Act 2015
- Sindh Bonded Labor (Abolition) Act 2015
- The Sindh Prohibition of Employment of Children Act 2017
- The Sindh Occupational Health & Safety Act, 2017
- The Protection against Harassment of Women at the Workplace (Amendment) Act 2022
- The Sindh Differently Abled Persons (Employment, Rehabilitation, and Welfare) Act, 2017

11. The IFC Performance Standard (PS): PS 2 on Labor & working Conditions

The IFC's stipulations related to Labor are outlined in its PS2. The PM will be required to promote sound worker-management relationships and provide safe and healthy working conditions. Key objectives under PS2 dictate:

- To promote the fair treatment, non-discrimination, and equal opportunity of workers.
- To establish, maintain, and improve the worker-management relationship.
- To promote compliance with national employment and labor laws.
- To protect workers, including vulnerable categories of workers such as children,
- migrant workers, workers engaged by third parties, and workers in the client's supply chain.
- To promote safe and healthy working conditions, and the health of workers.
- To avoid the use of forced labor.

PS2 applies to project workers including full time, part time, temporary, seasonal, and migrant workers. Where government civil servants are working in connection with the project, whether full time or part time, they will remain subject to the terms and conditions of their existing public sector employment agreement/ arrangement, unless

there has been an effective legal transfer of their employment or engagement to the project. PS2 will not apply to government civil servants.

Project workers will be provided with information and documentation that is clear and understandable regarding their terms and conditions of employment. The information and documentation will set out their rights under national labor law and PS requirements (which will include collective agreements), including their rights related to hours of work, wages, overtime, compensation, and benefits. This information will be provided at the beginning of the working relationship and when any material changes occur.

The Table below provides the conformance of the National Labor Act with the key elements of the IFC PS 2.

Table 3: Conformance of the Pakistan National Labor Act with Key Elements of PS2

Key Elements of PS2	Provisions in Pakistan Labor Laws
Equal opportunity and non-discrimination	The law contains important provisions prohibiting discrimination based on sex and disability, including equal wages for equal work.
Timely payment	• Wages must be paid before the expiry of the 7th working day after the last day of the wage period • Where the employment of any person is terminated by or on behalf of the employer, the wages earned by him shall be paid before the expiry of the second working day from the day on which his employment is terminated.
Minimum wage	The minimum wage as fixed by provinces in each year
Work hours	• Under the Factories Act 1934, no adult employee can be required or permitted to work in any establishment in excess of nine hours a day and 48 hours a week • Section 8 of the West Pakistan Shops and Establishments Ordinance, 1969 likewise, restricts weekly work hours at 48 hours that includes rest and prayer times
Worker rights	Regular leaves and benefits. The employer must provide reasons for termination.
Prevents use of all forms of forced and child labor	The national and provincial labor laws prohibit use of all forms of forced labor and child labor.
Protection of workers	The labor laws encompass a large array of rights to protect workers including the right to decent work and freedom of association to equal opportunity and protection against discrimination. Specific rights related to the workplace include health and safety in the workplace and the right to privacy at work, amongst many others.
Occupational Health & Safety	This law provides for comprehensive OHS and empowers the Department of Labor to conduct inspections of establishments and to impose penalties for violations of non-compliance.
Working Age of Workers	Under the Factories act 1934, no child who has not completed his fourteenth year shall be allowed to work in any factory.
Women	Under the Ordinance of 1958, women with at least four months employment in an establishment immediately preceding the day of delivery are eligible to get a total of twelve weeks of maternity leave, six weeks before and six weeks after the childbirth.

Persons with Disabilities (PWD)	Persons with Disabilities Rights and Protection Act 2013 provides for rights to discrimination free employment opportunities
Migrant Workers	No special provisions for migrant workers
Contract Workers	In the case where the wages of a worker employed by a contractor are not paid by the contractor, the wages must be paid by the employer of the establishment.
Supply Chain Workers	The law does not assign any responsibility to the project on the supplier's laborers and their working conditions. Workers of suppliers will have to be the responsibility of the suppliers.
Freedom of Association and collective bargaining	Article 17 of the Constitution not only guarantees freedom of association but also collective bargaining as a fundamental right. Keeping in view this provision, labor law in Pakistan allows formation and joining of trade unions/ associations to both the employers and the employees.
Access to a grievance redress mechanism	Workers can seek direct civil law redress from the Labor courts for complaints regarding terms and conditions employment and wages, health and safety, maternity welfare, and child labor offences are subject to criminal prosecution.

The table below, on the other hand, describes the main gaps of the government system with respect to the IFC Standards:

Table 4: Main Gaps of Government System with respect to IFC Standards

WB ES Standard	Legislation	Gaps
PS2: Labor and Working Conditions	Factories Act 1934 Occupational Health & Safety Act 2017	Working Conditions: • The Act does not specifically require that development be assessed and reviewed in terms of labor and working conditions including OHS requirements before approval. • The Labor Act does not require development projects to prepare Labor Management Procedures/ Plans or OHS plans. • The Labor Act prohibits the use of child labor, however, it does not stipulate what age constitutes a child. The Child Labor (Prohibition and Regulation) Act 2000 prohibits the employment of any child below the age of 14 while children between the ages of 14 and 16 are allowed to work.

12. BRIEF OVERVIEW OF LABOR LEGISLATION: OCCUPATIONAL HEALTH AND SAFETY

This chapter discusses the legislation for OHS aspects in Pakistan. Also discussed in the chapter are the IFC guidelines on these aspects.

12.1 Occupational Health and Safety (OHS)

The project will observe and ensure the protection against OHS risks to the workers embodied in various international laws, national, and provincial laws and administrative issuances governing the public sector. Observing and enforcing OHS protection should aim at: the promotion and maintenance of the highest degree of physical, mental, and social well-being of workers in all occupations; the prevention amongst workers of departures from health and safety caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; and placing and maintenance of the workers in an occupational environment adapted to his/her physiological and psychological capabilities.

12.2 International Conventions

ILO Conventions

ILO has formulated more than forty regulations, particularly concerning with the OHS issues. It has several major regulations as follows:

ILO Technical Convention: C187 – Promotional Framework for Occupational Safety and Health Convention. This Convention stresses:

i. A safe and healthy working environment by formulating a national policy
ii. Each member shall promote and advance, at all relevant levels, the right of workers to a safe and healthy working environment
iii. In formulating its national policy, each Member, in light of national conditions and practice in consultation with the most representative organizations of employers and workers, shall promote basic principles such as assessing occupational risks or hazards; combatting occupational risks or hazards at source; and developing a national preventative safety and health culture that includes information, consultation and training.

Prevention of Major Industrial Accidents Convention, 1993 (No. 174)
The purpose of this convention is the prevention of major accidents involving hazardous substances and the limitation of the consequences of such accidents. The convention protects workers, the public, and the environment by preventing major accidents either on or off site and provides guidance on appropriate emergency planning.

Safety and Health in Construction (1992)
The objective of this code is to provide practical guidance on a legal, administrative, technical and educational framework for safety and health in construction with a view to: preventing accidents and diseases and harmful effects on the health of workers arising from employment in construction: ensuring appropriate design and implementation of construction projects: providing means of analyzing from the point of view of safety, health and working conditions, construction processes, activities, technologies and operations, and of taking appropriate measures of planning, control and enforcement.

Safety and Health in Building and Civil Engineering Works (1972)
Code of practice relating to occupational safety and occupational health in civil engineering and the construction industry, includes provisions concerning the work environment and equipment, fire protection, noise, machinery (including building machinery and electrical machinery, ionizing radiations, explosives, handling, occupational health, welfare, and healthcare services).

This code of practice covers 42 topics related to safety and health in building and civil engineering. The Main topics include workplaces and equipment, scaffolds, ladders and stairs, lifting appliances; railways, road and similar transport; construction equipment; electricity, blasting, concrete work, other building operations, excavations, underground construction, work in compressed atmosphere, work clothes, and personal protective equipment; hygiene and welfare; medical supervision.

United Nations and Group 20 Countries

The United Nations has adopted 17 Sustainable Development Goals with specific target on OSH. Similarly, the G20 summit placed OSH on the agenda.

Provincial Legislation on OHS

The Occupational Health and Safety Act 2017 is the applicable local legislation as this Act applies to all Workplaces. Details of each chapter are described below:

Chapter I identifies the duties of the employer as follows:

1. Undertake practical measures for Safety & Health and Welfare;
2. Identify, assess and address existing & new hazards;
3. Report and investigate incidents;
4. Provide and apply Safe Systems of Work, Safe tools & equipment & appliances
5. Safe use, handling, storage, disposal and transport of materials and substances;
6. Control physical, chemical, biological, ergonomic, psychosocial or other hazards, affecting workers and others;
7. Provide Information, Instruction and Training to ensure Safety &Health at Work;
8. Maintain workplace in safe, clean, orderly and risk-free condition with safe means of access;
9. Inform workers regarding work hazards, risks involved and preventive and protective measures;
10. Provide adequate PPE to prevent risk from injury and ill health;
11. Maintain records of all accidents at workplace;
12. Provide first aid arrangements and emergency provisions;
13. Take measures to prevent fires & measures in the event of fire; and
14. Collaborate in the case of simultaneous operations or joint premises

The duties of workers and volunteers are identified as follows:
1. Ensure safety & health of others who may be affected by his acts & omissions & not willfully do anything to endanger himself or others;
2. Use & take care of PPE provided by the employer;
3. Do not willfully interfere or misuse any appliance or equipment or convenience provided for safety &health of persons at workplace;

4. Resolve any situation being unsafe posing immediate threat with the employer or cease work until the dispute is resolved
5. Until the dispute is resolved, employer may assign the affected workers some temporary alternative work; and
6. Worker shall report any occupational accident, occupational Disease, dangerous occurrences, or commuting accident as per company OSH Policy.

The general duties of suppliers have been identified below:
1. Design & construction to be safe & without risk to safety & health;
2. Testing & examination;
3. Adequate information;
4. substance to be safe & without risk; and
5. Includes supply, handling, assembling, installing, erecting & testing of tools, machinery & equipment

Chapter II states rules that that Government has made for the safety and health of workers in any establishment by notification in official gazette.
The rules include the following matters:
1. Cleanliness and maintenance of building;
2. Illumination, ventilation, temperature, noise, dust, fumes and artificial ventilation;
3. Disposal of wastes and effluents;
4. Floors, stairs, mean of access, proper working space, overcrowding, pits, sumps, opening in floors, and allied things;
5. Drinking water and conservancy;
6. Guarding and fencing of machinery at work and work at, on or near moving machinery;
7. Self-acting machines and device for cutting off power; revolving machinery and pressure plants;
8. Instruction, training and supervision in relation to employment on dangerous machines and fencing or casing of machinery, wet floors, open wiring, safety fitting etc.;
9. Explosives or inflammable dust, gas and precautions against dangerous fumes etc.;
10. Precaution in case of fire;
11. Personal protective equipment;
12. Excessive weights;
13. Loading and earth moving machinery;
14. Cranes, hoists, lifts and other lifting operations;
15. Scaffolding and work at heights; and
16. Safety of building, machinery and manufacturing process

Whereas, The Sindh Occupational Health & Safety Act calls for:
1. Written Statement of Policy;
2. Consultation – formation of OHS Committee with worker representation; appointment of OHS officer;
3. Training of Health & Safety Representative;
4. Precautions against Contagious & Infectious Disease at Workplace; and
5. Compulsory Vaccination and Inoculation

Chapter III details enforcement measures and requires:

1. Registration of workplaces and approval of site, buildings and other constructions to be used as workplaces; and
2. Notification and investigation of accidents, dangerous occurrences and occupational illnesses

Chapter IV details the formation of Occupational Health and Safety Council headed by the Secretary Labor having members from industry, representatives from employers, representatives of workers, professionals, members from civil society and member from the Labor Directorate.

The Act has also fixed penalties and offences in case of non-compliance with the provisions of the Act. The maximum penalty for non-compliance is PKR 250,000/-

The Sindh Occupational Health & Safety Rules 2019 outline the measures to be undertaken to implement the requirements of the Sindh OSH Act 2017. The organization needs to formulate OHS Policy which is the requirement of the Act. The contractors and suppliers shall comply with the provisions of the Act.

The Labor Policy 2010 – Government of Pakistan

The Labor Policy 2010 addresses the importance of OHS legislation in Pakistan as provided below:

- Labor laws relating to occupational health and safety will be consolidated and rationalized to avoid overlapping and inconsistencies
- Government shall enact suitable legislation to ensure health and safety of construction workers
- A Tripartite council on Health & Safety has been set up to identify health and safety hazards for workers of all economic sectors and to make recommendations for safety measures on a continuous basis.

IFC/WBG EHS Guidelines

The IFC has guidelines for Environment, Health, & Safety (EHS) that serve as useful references for general issues as well as sector specific activities. Projects are expected to comply with this guideline as required by the policies and the standards. The EHS Guidelines are mainly on occupational health and safety, community health and safety as well as on construction and decommissioning. It contains guidelines cross cutting on environmental (waste management, ambient air quality, noise, and water pollution), occupational health and safety issues amongst others, applicable to all the industry sectors.

13. RESPONSIBLE STAFF

PM Responsibility

The overall management of the Project is the responsibility of the PM of project. PM will oversee the LMP's implementation. The LMP must be followed in all aspects of the procurement process. Contractor(s) and subcontractor(s) shall be hired in a transparent manner based on their experience and competency. The contractor(s) must ensure that all LMP requirements for labor (direct and contracted), protection, and facilities are met, and this must be included in the written agreement.
As follows, the E&S team at PM will implement and monitor the provision of this LMP:

- Ensure that the workers are in accordance with the E&S regulations, including the LMP and OHS provisions;
- Confirm that the duties owed to the direct workforce are carried out as outlined in this LMP and contractual documents;
- Track the project workers' training;
- When conducting activities, keep an eye out for any potential dangers of significant safety issues;
- Create and put into action a grievance procedure for direct employees that includes tracking the progress of complaints and their outcomes as well as ensuring that complaints received from employees are quickly addressed.
- Ascertain that the project's workers are aware of the grievance procedure;
- Keep records of the hiring process, including age and gender verification, as well as the hiring of the hired staff. Orient new hires to environmental, social, and occupational health and safety issues and provide ongoing training for these personnel.
- Report any incidents or accidents involving project personnel and information about labor and occupational health and safety performance to the World Bank.

Contractors' Responsibilities

Occupational Health and Safety: To guarantee adherence to every LMP requirement, the contractor(s) must appoint OHS representative(s). Every month, the contractor must give the PM a report on all incidences. The contractor is responsible for making ensuring that employees are taught in using personal protective equipment and safety precautions.
Immediately notifying the PM of serious situations is required. Regular meetings between the PM of project and the contractor(s) will be held to assess progress and make sure that the OHS requirements of the LMP have been met. Follow-up on the action plans developed for the accidents that happened on specific sites. When executing the safety measures in the LMP, any challenges must be addressed by the contractor.

Labor and Working Conditions: Contractors shall maintain records in compliance with the procedures set forth in this LMP. PM may at any point request records in order to verify that labor rules are being observed. The PM will compare records to actuals at least once every month and, if required, may mandate rapid corrective action. A summary of issues and solutions will be delivered in quarterly reports to the World Bank.

Worker Grievances: Project's current grievance procedures will still be available to the Project staff, however, contractors will be required to establish a separate grievance redress system for employees that satisfies the minimum requirements of this LMP. The PIU's social development specialist will review all records on a monthly basis. In instances where workers' complaints are not resolved by the national/provincial system, the PM will nonetheless remain informed of decisions and reflect in quarterly reports to the World Bank.

Additional Training: Each contractor is required to, at all times, have a qualified safety officer on board. If training is required, this will be the contractor's responsibility. The safety officer will provide instructions to contractor staff. PM will also arrange training to address risks associated with labor influx and will also provide a schedule for training required. The contractor will be obligated to make staff available for this training, as well as any additional mandatory trainings required by PM, as specified by the contract.
The staff will receive training on the prevention of SEA/SH, codes of conduct, as well as on gender and GBV in general. The PM will be responsible for (i) training, (ii) implementation, and (iii) supervision of OHS aspects.
It will be a condition in the construction contracts that the contractors give preference to local labor. This entails that wherever possible, unskilled work opportunities should be made available to community members.

14. POLICIES AND PROCEDURES

All project staff and contractors must be informed of the project management policies and processes (s). Contracts must be drafted in conformity with PS 2 principles and Sindh Labor Laws, and all recruitment processes must be open. Copies must be in Sindhi or Urdu to the greatest extent practicable. Urdu and Sindhi must be used for training sessions and procedure writing. The project team will prepare the following subsequent actions:

Labor Policies and Procedures

These policies and procedures will be updated and modified, if necessary, after the allocation of the contracts of the different positions of the PM. As specified in the national labor laws, the employment of project workers will be based on the principles of non-discrimination and equal opportunities. There will be no discrimination with respect to any aspects of the employment relationship, including recruitment, compensation, working conditions and terms of employment, access to training, promotion, or termination of employment. The following measures will be followed by contractors and monitored by the PM with support from Human Resource Department to ensure fair treatment of all employees:

- Recruitment procedures will be transparent, public, non-discriminatory, and open with respect to ethnicity, religion, sexual orientation, disability or gender
- Applications for employment will only be considered if submitted via the official application procedures established by contractors
- Clear job descriptions will be provided in advance of recruitment and will explain the skills required for each post

- All workers will have written contracts describing terms and conditions of work and will have the contents explained to them, after which the workers will sign the contract.
- Unskilled labor will be preferentially recruited from the surrounding communities, and settlements.
- Employees will be informed at least two months before their expected release date of the coming termination.
- The contracted workers will not be required to pay any hiring fees. If any hiring fees are to be incurred, these will be paid by the Employer.
- Depending on the origin of the employer and the employee, employment terms and conditions will be communicated in two languages, in the national language and the language that is understandable to both parties
- In addition to the written documentation, an oral explanation of conditions and terms of employment will be provided to workers who may have difficulty understanding the documentation.
- It is noted that language related problems are not expected, but if they are, interpretation will be provided for workers as necessary.
- All workers will be 18 years old or above for civil works. This will be a requirement in contracts with construction works contractors.
- Normal working time should not exceed 40 hours per week. With a five-day working week, the duration of daily work is limited by the internal work regulations approved by the employer after prior consultation with the representatives of the workers, in compliance with the established working week duration.

The PM will inform the IFC of any significant event (social issues) as soon as possible, but no later than five working days, after the occurrence of the event. Such events include strikes or other workers' demonstrations. The PM will prepare a report on the event and the corrective measures and subsequently submit it to the World Bank within 30 days of the event.

Occupational Health & Safety

The project PM is committed to comply with the legislation that relates to the occupational health and safety requirements as stipulated in the main law governing OHS and Sindh Factories Act 2015 Chapter 3 in Sindh as well as other provincial and federal OHS Acts. The Sindh Hazardous Substance Rules of 2014 regulates certain occupations as hazardous and contain special provisions to regulate the working conditions in those occupations. In addition, there are other laws to be complied with dealing with OHS including The Mines Act 1923; Social Security Ordinance 1965; Workmen's Compensation Act 1923; Shop and Establishment Ordinance 1969 and Dock Laborer Act 1934 as well as WB PS2 and PS 4. These laws and standards will enable OHS hazards identification and risk elimination through promotion of appropriate skills, knowledge, and attitudes towards hazards.

The PM will have a designated Occupational and Community Health and Safety Specialist and an Environmental Representative for an agreed period. This specialist must have a minimum bachelor's degree in civil/environmental engineering/environmental sciences and certificate course in OHS (e.g., The National Examination Board in Occupational Safety and Health - NEBOSH) with a minimum of 5 years of experience as OHS professional in construction of infrastructure projects. Extensive knowledge of all OHS legislation, OHS guidelines and standards are required.

It is important that all staff must be given induction training so that they are aware of the hazards specific to the project and its activities. This is in addition to toolbox talks and other training needs identified during project implementation.
The PM will ensure that all workers irrespective of any category should be provided with appropriate type of protective masks, helmet, overall and safety shoes, and safety goggles, protective clothing as well as other appropriate PPE as per work job hazard analysis and method statements (such as working on live wires). The PM and contractors must also ensure appropriate demarcation of workplace and notices for hazardous area where applicable; accident reporting, notification and investigation practices at each workplace required; safety sign and symbols displayed at workplace and ensure availability of first aid box; also identify and service agreement done with specialized hospitals for complicated accidental and health problems as well as specific details will be included in the emergency management plan.

Occupational Health & Safety Management Plans (OHSMP)
Contractors will be required to prepare OHSMP in accordance with OHS standards mentioned in the bidding documents, OHS provisions of ESMP, compliance with the local regulatory requirements, and IFC EHS Guidelines. All OHSMPs shall have a minimum requirement to include information and details on:

- Reporting and Investigation of Incidents /Illnesses
- Procedure for Waste Management
- Procedure for Housekeeping
- Procedure for Hazard Identification and Risk Assessment
- Training Procedure including Induction training
- Toolbox Talks
- Safe Systems of Work – work at heights, hot work, electrical HT/LT works, Excavation, Confined Spaces (Permits to Work)
- Personal Protective Equipment
- Emergency Response Procedure
- Monthly reporting procedure
- Camp management procedure
- Management of Food and Drinking Water at Campsite(s) and at construction site
- Project Site Security Procedure
- COVID 19 measures procedure

- Internal Auditing Procedure
- Management of visits by IFC, Government agencies
- Storage of fuel, hazardous substances
- Operation and maintenance of heavy equipment and overhead cranes.
- Recruitment procedures will be transparent, public, and non-discriminatory, and open with respect to ethnicity, religion, sexuality, disability, or gender.

Child Labor and Forced Labor

To prevent engagement of underage workers, the age employment scheme should be strictly adhered to by parties involved in hiring. The process of hiring Direct Workers should include a proper screening, with age verification to ensure no children are employed in the implementation of the project. Likewise, all contracts must have a provision as to the minimum age requirement and the hiring authority shall keep a registry of all hired workers.

Labor Influx & SEA/SH

All project workers will undergo relevant seminars and training to prevent risks of labor influx or SEA/SH issues. Project workers particularly those coming from other communities will be briefed on the culture and history of the area, allowing them to adapt to the community values and to avoid any conflicts due to the dissimilarities of their cultural backgrounds.

Discrimination and exclusion of Vulnerable groups

The employment of project workers will be based on the principle of equal opportunity and fair treatment, and there will be no discrimination with respect to any aspects of the employment relationship, such as recruitment and hiring, terms of employment (including wages and benefits), termination and access to training. This project shall comply with the national labor laws on gender equality in the workplace, which will include provision of maternity leave and nursing breaks and sufficient and suitable toilet and washing facilities, separate for men and women workers.

Development of a SEA/SH Action Plan and Mitigation Measures for Risks Related to Gender

According to the Note on Good practices to combat SEA/SH in the Framework of Financing Investment Projects involving major civil engineering works, all projects, whatever their risk level, should guarantee the minimum actions recommendations for addressing the risks of SEA/SH related issues.
The initial SEA/SH mitigation measures have been developed and included, where these measures may need to be reviewed and further modified in the EIA.

Labor Disputes over Terms & Conditions of Employment

Fair, reasonable, and lawful terms and conditions shall be applied in the contractual provisions of all project workers to prevent labor disputes. Moreover, there will be an efficient grievance redress mechanism in place to address any issues that may arise

during existence of the contract. The guidelines provided later in the document shall be strictly observed to avoid disputes over terms and conditions of employment.

All the contractors who will be engaged for the project will be required to produce their grievance procedure as a requirement under the tendering process which at a minimum comply with these requirements. In addition, good international practice recommends that the procedures be transparent, confidential, adhere to non-retribution practices, and include right to representation. After contractors are engaged, they will be required to produce proof that each worker has been inducted and signed that they have been inducted on the procedure.

Monitoring and Reporting

General Monitoring Activities: Processes for monitoring, assessment and audit will be developed to:

- Document the implementation and effectiveness of management and mitigation measures;
- Assess actual impacts against predicted impacts; and
- Demonstrate compliance with applicable legal and other requirements.

Monitoring will be undertaken for both direct hires (including casual labor) and contract workers.

Assessments: The Resident Engineer or Site Supervisor will take a lead in undertaking periodic assessments to determine the degree to which, the commitments outlined in this LMP are being met. This will include camp inspections and monitoring of grievances.

Audits: It is envisaged that, the site supervisor or resident engineer may, at its discretion, audit the contractors or suppliers to determine their compliance with this LMP. In addition, they may also, at its discretion, undertake audits of other third-party facilities and providers, as relevant to the Environmental and Social Management Plan. The Independent Environmental and Social Consultant, on behalf of project may also be engaged to conduct periodic monitoring reviews of the Project, largely based on the social and environmental controls set out in the Environmental and Social Management Plan.

Performance indicators: Performance indicators are used to measure and track performance against the effectiveness of mitigation and control measures described in this LMP. Indicators can be divided into two groups: leading indicators and lagging indicators. Leading indicators predict actions to be taken to prevent a risk from escalating - such as complaints from workers about, for example, the quality of camp food. An example of a lagging indicator would be a work stoppage over camp conditions. General performance indicators may also be relevant, such as training and awareness numbers. Performance indicators must be measurable against a specified target.

Labor and Working Conditions Performance Indicators: Performance indicators should be carefully recorded and graphed where relevant for remedial action to reduce

potential risks. They will form a key component of monthly reporting by the Resident Engineer or Site Supervisor.

Non-conformance and corrective action: The project ESMP alongside provisions in this LMP will be all used for tracking and stewardship of non-conformances identified as part of assessment and audit activities described in this LMP.

Training and Awareness: Before the development of a training and awareness program, a needs analysis will be conducted. The needs analysis will be based on requirements of this LMP. It involves a basic assessment of the knowledge and skills of the people involved in training implementation.

Internal Reporting: A periodic report will be compiled to address the labor and working conditions aspects contained in this Plan, including the following for both Consulting Engineer and contractor activities:

Workplace:

- Grievances lodged by type and number, illustrated with graphs. Open grievances by type and number;
- Disciplinary action by type and number;
- Induction training numbers, queries and comments;
- Issues raised by workers' committees and action taken;
- Workforce numbers by local and foreign workers - actual against planned;
- Actual demobilization numbers against planned targets. Incidents around demobilization;
- Industrial relations incidents - stoppages go slows, threats, damage to property, violence;
- Lost hours by category; and
- Absenteeism, sick leave and late arrivals.

Camp:

- Grievances lodged by type and number. Open grievances by type and number;
- Disciplinary action by type and number;
- Induction training numbers, queries and comments;
- Issues raised by camp committees and action taken;
- Camp numbers by local and foreign workers - actual against planned;
- Camp incidents;
- Food or lodging complaints; and Recreation activities.

External Reporting: Consulting Engineer and its contractors will meet all statutory notification and reporting requirements.

Disclosure: Disclosure will be done to enable workers understand information regarding safeguards in the workplace. This will be done during the induction period of the worker. Various tools will be used including Information, education and communication (IEC) materials and Meetings, Induction toolkit (Sexual and gender-based violence, EHS company policies, safety, code of conduct, child protection etc.)

Fatality and Serious Incidents

In the event of an occupational fatality or serious injury, the PM shall report to the IFC as soon as becoming aware of such incidents and inform the government authorities (where available) in accordance with national as well as Bank reporting requirements. Corrective actions shall be implemented in response to project-related incidents or accidents. The IFC or, where relevant the consultant, may conduct a root cause analysis for designing and implementing further corrective actions.

15. AGE OF EMPLOYMENT

This Chapter explains the standards and methodology for determining the minimum age of labor for project.

- **Minimum Age for Employment in the Project**

Article 11(3) of the Constitution of Pakistan prohibits the employment of children below the age of 14 years in any factory, mines, or any other hazardous employment. In accordance with this Article, the Employment of Child Act (ECA) 1991 does not permit child labor in the country. The ECA defines a child as a person who has not completed their fourteenth years of age, where it further states that no child shall be employed or permitted to work in any of the occupation set forth in the ECA or any workshop wherein any processes defined in the Act is carried out. The project PM and its contractors will be bound by the ECA to disallow any child labor at the project sites or campsites.

Under the Sindh Factories Act, 2015, no adult employee, defined as a worker who has completed his or her 18th year of age, can be required or permitted to work in any establishment in excess of nine hours a day and 48 hours a week. Similarly, no young person under the age of 18, can be required or permitted to work in excess of seven hours a day and 42 hours a week. The Factories Act, which governs the conditions of work of industrial labor, applies to factories, employing ten or more workers.

According to the PS 2 and the Sindh Prohibition of Employment of Children Act of 2017, no one under the age of 18 may be hired to work at the project site (s). The hiring process must specify how candidates' CNICs will be checked, so that no one under the age of 18 can be hired on site. It is necessary to inspect and confirm the applicant's original CNIC. The contractor(s) and the recruiting agents will be held accountable if any underage workers are discovered to be working on the project site(s). They will be fined and have their contracts terminated.

Under the ILO C138 (Minimum Age Convention, 1973), each Member of the Convention undertakes to pursue a national policy designed to ensure the effective abolition of child labor and to raise progressively the minimum age for admission to employment or work to a level consistent with the fullest physical and mental development of young persons. Article III thereof provides: (a) the minimum age for admission to any type of employment or work which by its nature or the circumstances in which it is carried out is likely to jeopardize the health, safety or morals of young persons shall not be less than 18 years; (b) the types of employment or work to which paragraph 1 of this Article applies shall be determined by national laws or regulations or by the competent authority, after consultation with the organizations of employers and workers concerned, where such exist; (c) notwithstanding, the provisions of paragraph 1 of this Article, national laws or regulations or the competent authority may, after consultation with the organizations of employers and workers concerned, where such exist, authorize employment or work as from the age of 16 years on condition that the health, safety, and morals of the young persons concerned are fully protected and that the young persons have received adequate specific instruction or vocational training in the relevant branch of activity.

The Sindh Prohibition of Employment of Children Act of 2017 states that any teenage worker (aged between 14 and 18) hired for training at the site(s) must be kept away from moving machinery and not given any dangerous tasks. Before allocating the task or job to an adolescent worker, a thorough risk evaluation of the assignment must be made.

Contractors will be required to verify and identify the age of all workers. This will require workers to provide official documents, which would include a birth certificate, CNIC, passport, or medical or school record. If a minor under the minimum labor eligible age is discovered working on the project, measures will be taken to immediately terminate the employment or engagement of the minor in a responsible manner, considering the best interests of the minor.

- **Age Verification**

Prior to the engagement of labor, age verification must be done and documented. Where available, verify the birthday on official records like a birth certificate, national identification card, or other reliable sources.

16. EMPLOYMENT TERMS AND CONDITIONS

This Chapter defines the employment terms and conditions applicable to the project employees.

General Requirements

The employment terms and conditions applicable to project employees as set out in the labor rules will apply to project employees who are assigned to work on the Project (Direct Workers). Terms and conditions of part-time workers are determined by their individual contracts.

The contractors' labor management procedure will set out terms and conditions for the contracted and subcontracted workers. These terms and conditions will be in line, at a minimum, with this LMP, the Sindh Factories Act 2015, and specified in the standard contracts to be used by the PM under the project.

A contract of employment, written in a language known to all parties, shall be executed between the PIU and the direct worker that specifies the following:

- The parties involved, including the name of the worker, age, citizenship, civil status, gender, and address;
- Location of work with regard to the needed services, acceptance of the parties, qualifications of the worker, and attestation that the worker is not related within the third degree of consanguinity or affinity to the hiring authority and/or its representative, and the worker has not been previously dismissed from government service by reason of administrative offense;
- Terms and Conditions of the contract, including the hours and place of work, remuneration payable to the worker, job description, summary of deliverables, duration of contract, procedure for suspension or termination of contract, statement that there is no employer and employee relationship between the contracting parties.

As provided in the Sindh Factories Act, 2015, each worker who has completed a period of 12 months continuous service in a factory shall be allowed, during the subsequent period of twelve months, holidays for a period of fourteen consecutive days. If a worker fails in any one such period of twelve months to take the whole of the holidays allowed to him or her, any holidays not taken by him or her shall be added to the holidays allotted to him or her in the succeeding period of twelve months.

A worker shall be deemed to have completed a period of 12 months continuous service in a factory without considering any interruption in service during those 12 months due to sickness, accident or authorized leave not exceeding 90 days in the aggregate for all three.

Non-Discrimination & Equal Work Opportunities

Article 19-A of the Constitution imparts the State's obligations aimed at achieving equality in the form of securing the well-being of the people, regardless of sex, caste, creed, or race, by raising their standard of living, by preventing the concentration of wealth and means of production and distribution in the hands of a few to the detriment of general interest and by ensuring equitable adjustment of rights between employers and employees.

The project PM is committed to equal opportunities for all its employees and potential employees where everyone is treated with respect and dignity, where there is equal opportunity for all. All employees under project, regardless of their affiliation, will be treated fairly and with respect. Selection for employment, promotion, training, or any other benefits will be on the basis of aptitude and ability. Decisions about pay and benefits, terms and conditions of employment, appraisals, dismissal, or redundancy will be made objectively and without unlawful discrimination.

All employees will be helped and encouraged to develop their full potential, and the talents and resources of the workforce will be fully utilized to maximize the efficiency of the organization.
The project PM will ensure that:

- Equality and non-discriminatory policy are adhered to within its own area of responsibility;
- Spread awareness on the equality in employment policy to the attention of the team members;
- Ensure that information on the equality of opportunity is included in all indication processes; and
- Ensure that the team members are available to attend relevant quality training programs (if any)

The PM is responsible for assuring that equality in employment is effectively communicated to all employees and all those involved with the organization at whatever level of position and for providing guidance where appropriate. It will also, in particular, provide full text and induction on equal opportunities to all new employees; translate this policy into Urdu and any other traditionally spoken languages and send to all relevant involved parties. In addition, upon any significant update, this policy will be presented to all members of staff or at department/ office meetings and re-translated to all relevant involved parties.
Each member of staff has a responsibility to:

- Follow any measures introduced to ensure equality of opportunity and prevent discrimination, harassment, or bullying
- Report any discriminatory acts
- Treat others fairly without prejudice
- Promote a work environment where an individual can feel valued and realize their potential whilst encouraging others to do so also

Failure to comply with the policy, procedures and practices outlined below will be considered within the framework of the PIUs disciplinary procedure. The PIUs equal opportunity policy also covers bullying and harassment issues at the workplace and in any work-related setting outside the workplace.

Working Hours

As per the Sindh Factories Act 2015 (Section 34), the Shops and Establishment Ordinance, 1969 (Section 8) and the Road Transport Ordinance, 1961 (Section 4) are used to determine working hours and any rest time in different industries.

Section 34 of the Factories act states “no adult worker shall be allowed (or required) to work in a factory for more than 48 hours in a week: if the factory is seasonal, 50 hours a week and if the work is of continuous nature, he may work for 56 hours in a week. As for the daily hours, these may not be more than 9 hours a day (in case of

seasonal: 10 hours). The working hours of an adolescent (15-18) are 5 hours in a day. The Factories Act is applicable to all areas employing 10 or more workers. The law makes provisions for one weekly holiday and if that is not given, a compensatory holiday must be given as soon as possible.

The Shops and Establishments Ordinance 1969 also limits weekly working hours to 48 hours. The ordinance also covers shops and commercial establishments not regulated by the Factories Act, where it states that any adult worker is required to work overtime, if asked, where the rate of overtime payment is double the usual pay (Section 47). Overtime is not payable to the contract workers who are employed on a piece rate basis. The normal hours of work for project workers shall not exceed 8 hours a day for 5 days for a total of a 40-hour work week, exclusive of time for meals.

Where exigencies of the service require such personnel to work for 6 days or 48 hours, the project workers shall be entitled to a compensatory time off to offset the overtime rendered. No worker shall be allowed to render services beyond the 48-hour overtime.

Leaves & Weekly Rest

Each project worker is entitled to a 2-day rest period during weekends (Saturday and Sunday). Workers shall be entitled to a rest day on regular holidays recognized by the province. Each worker is entitled to 10 days casual leave with full pay during a year. Workers are also entitled to 16 days sick leave with half pay (8 days with full pay) in a year. Festival holidays as notified by the provincial government with full pay (usually 10-13) are also allowed. If a worker is required to work on a festival holiday, he will be given one day additional compensatory holiday with full pay and a substitute holiday (300% of usual wages).

Maternity Leave

If a worker has completed 12 months of continuous service in a factory, they shall be allowed a paid annual leave of 14 consecutive days. Under the Maternity Benefits Ordinance 1958, leave is also allowed to pregnant women for a period of 12 weeks with full pay. It is unlawful for an employer to dismiss a women worker who is on maternity leave. The qualifying period for getting this leave is 4 months of preceding employment with the employer.

Remuneration

The laws relating to fixation and payment of remuneration include the Sindh Payment of Wages Act 2015, the Sindh Minimum Wages Act 2015 and the Sindh Terms of Employment (Standing Orders) Act 2015 and most recently the Sindh Wage Act Notification of 2022.

Workers' Welfare

The workers' welfare legislation includes Employees Old Age Benefits (EOAB) Act 1976 (with provisions for old age pension, old age grant, invalidity, and widow(er) pension). This Act is applicable to establishments employing five or more workers. Contribution has to be made both by the employer (5% of minimum wages) and employee (1% minimum wages). Employees Social Security Ordinance 1965 (applicable like the EOAB Act) provides benefits to employees in case of sickness, maternity, employment injury or death. The amount in this scheme is contributed only

by the employer to workers or their legal heirs in case of death, permanent total disablement, permanent partial disablement, and temporary disablement during working in an establishment. The Standing Orders 1968 also provides for compulsory group insurance against natural death and injury for all the permanency employees in a workplace.

Termination of Contract

The contract of employment shall cease at the end of the period stated in the contract. However, the contract may be pre-terminated by the hiring authority due to breach of any provision thereof, breach of trust, loss of confidence, and for reasons detrimental to the interest of the agency, provided that the project worker is informed in writing at least 30 days prior to the effectivity of such termination. Likewise, the project worker may pre-terminate the contract provided that a written notice is submitted to the hiring authority, stating therein the reasons for the pre-termination, at least 30 days prior to the proposed date of effectivity thereof, and the same has been received, accepted, and approved in writing by the hiring authority.

Industrial and Commercial Employment (Standing Industrial and Commercial Employment (Standing Orders) Ordinance 1968 was enacted to address to the contractual relationship between employer and employee. The ordinance is applicable to establishments employing 20 or more workers. The ordinance classifies workmen in six classes: permanent, probationers, badlis, temporary, apprentices and contract workers (the last category was added in 2006). The legislation requires that workmen should be provided the contract in writing, showing the terms and conditions of his service, at the time of hiring, promotion and transfer. It also requires that the wage rates paid to different categories of workers/work should be posted on the notice boards.

Termination of an employment contract may be either termination simpliciter, which is termination on grounds other than misconduct after a notice (section 12) or termination on account of misconduct (section 15). Notice of termination, for termination simpliciter, is mandatory for permanent employees. A notice of one month must be served before severing the employment relationship or payment of one month's wages in lieu of notice may be provided (Section 12.1). The law also obliges the employer to provide the termination certificate in writing stating the reason behind it. Although there is no specific provision for just cause dismissal, the requirement of written termination letter and section 41 of IRA 2008 which allow the labor court to inquire into the legitimacy of termination provide that there should be bona fide and valid reason for dismissal.

Termination on account of trade union membership and activity is an invalid reason for termination (ILO, 2000). While termination is being done on account of misconduct, worker has still the right of fair hearing. Of the many types of misconduct is "go slow", for which a worker can be fired. Termination on economic reasons/retrenchment has not been focused in law; however, law does provide the procedure of retrenchment (last come, first go) and preference for rehiring of retrenched workmen. In case of laying off the workers, they must also be given due notice or payment in lieu of notice. If the employer wants to close down the whole business or is terminating the employment of 50 or more workers, It must get the prior approval of labor court. An

individual whose employment is terminated has first to use internal mechanisms for dispute resolution, however if he is not satisfied with the decision, he may appeal to the labor court. In that case, labor court is authorized to go into all the facts of the case and determine whether the termination was valid and bona fide or not. The above-mentioned ordinance also provides for severance pay/gratuity to be paid (when an employee resigns or his services are terminated other than misconduct) equivalent to 30 days wages for every completed year of service or any part thereof in excess of 6 months (for 20 years of service, this means 90 weeks of severance pay).

Deductions

No deductions other than those agreed upon in the contract or those prescribed by law or regulations shall be made from a worker's remuneration. The hiring authority is prohibited to demand or accept from the worker any cash payment or gifts in return for admitting such worker to employment or for any other reasons connected with the terms and conditions of employment.

Medical Treatment of Sick & Injured Workers

Any worker subjected to any illness, injury, or accident which was sustained during the work period shall be transported to the nearest clinic or hospital by the hiring authority or its representative.

Collective Agreements

The duty to collectively bargain arises only between the "employer" and the "employee". Where neither party is an "employer" nor "employee" of the other, no such duty would exist. Considering that the terms and conditions provide that no employer-employee relationship shall exist between the contracting parties, there is no duty to bargain collectively.

Collective bargaining has also been called a fundamental right which emanates from article 17(1) of the Constitution. A trade union can move application for determination of Collective Bargaining Agent (CBA) if it has its members not less than one-third of those employed as workmen. However, if more than one union exists in the premises, the registrar of trade unions will conduct a secret ballot election/referendum and will issue the CBA certificate to union securing votes not less than one third of total votes. If none of the union is able to get one third of total votes, a run-off election between the top two unions will be held and the union getting majority votes will be certified as collective bargaining agent. Not every workman employed in the premises is eligible for voting (Section 24.5). When a union is certified as a CBA, no application for (re)determination of CBA can be made for a period of two years except where the registration of trade union/CBA is cancelled.

The CBA is entitled to undertake collective bargaining with the employer or employers on matters connected with employment, non-employment, the term of employment or the conditions of work other than matters which relate to the enforcement of any right guaranteed or secured to it or any workman by or under any law, other than this Act , or any award or settlement; represent all or any of the workmen in any proceedings;

give notice of, and declare, a strike and nominate representatives of workmen on the Board of Trustees of any welfare institutions or Provident Funds (IRA 2008: Section 24.13).

17. GRIEVANCE REDRESS MECHANISM

This Chapter describes the requirements for establishing a Grievance Redress mechanism (GRM) to be established for the project workers.

Legislative Requirements

As per Article 46 of the industrial Relations Ordinance (IRO) 2002, any worker may bring their grievance in respect of any right guaranteed or secured by or under any law or any award or settlement to the notice of the employer in writing, either him or herself or through the shop steward or CBA, within one month of the day on which cause of such grievance arises. The IRO 2002 reduces the delay from three months to one month. Where a worker brings his or her grievance to the notice of the employer, the employer must, within 15 days for the grievance, communicate his or her decision in writing to the worker.

GRM for Project Workers

For the Project, the PM and its contractors will establish a separate GRM (or make provisions in the overall GRM) for the project workers to address labor or workplace related concerns consistent with the applicable national and provincial laws and PS2 before the Project Effectiveness and highlight it in the Project Operations Manual (POM).

Typical grievances that may arise in the workplace include demand for employment, labor wage rates, delays in payment, discontentment with working conditions, labor camp issues, and overall health and safety conditions of the work environment. A GRM structure will be established for project workers (direct workers and contracted/ supply workers) as required under PS2. Handling of grievances will require objectivity, promptness, and responsiveness' to the needs and concerns of aggrieved workers.

The worker's GRM will also allow for anonymous complaints to be raised and addressed. Individuals who submit their complaints or grievances may request that their names be kept confidential, and this should be respected. Under PS2, a worker's GRM will be provided for all project workers, including direct workers, contracted/ supply workers, to raise workplace concerns, including SEA/SH issues at the workplace. Any type of worker who has any complaint or grievance has the right to present it and eventually receive a proper response against it.

According to PS2, different types of workers may approach the workers' GRM for the following key reasons (amongst many others):

- Demand for employment opportunities
- Labor wage rates and delays in payment of wages
- Disagreements over working conditions
- SEA/SH in the workplace

- Health & Safety concerns in the workplace

The workers' GRM which is different from the project GRM, will leverage existing procedures and systems, and will be established in the early stages of the project, whilst serving throughout project implementation. The workers' GRM will be based on the requirements of the IFC's PS2. Specifically, the workers' GRM will operate according to following key principles:

- It will be made available for all direct and contracted workers (and their organizations, wherever relevant)
- It will be proportionate to the nature and scale and the potential risks and impacts foreseen from the project
- It will be designed to promptly address concerns using an understandable and transparent process that provides timely feedback to those concerned in a language they understand without any backlash
- It will be a free to use system, where complaining workers will not pay any fees to use the worker GRM
- IT will utilize existing grievance systems and experiences. In this context, the worker GRM will leverage HR counselling procedures for direct workers that are available at their respective health ministries and departments, and will ensure HR procedures at contractor's organizations are consistent with the official worker GRM system characterized in this document, which will be further references in their working agreements, and monitored accordingly
- Anonymous grievances are also allowed and facilitated, and will be treated equally as any other grievances, whose origin is known, however, a suitable contact information is a must to be able to communicate responses back
- There will be no discrimination against those who express grievances, and any and all grievances will be treated confidentially
- It does not replace or override requirements to provide workplace processes to report work situations that a project worker believes are not safe or unhealthy
- Workers will be able to raise concerns regarding unsafe or unhealthy working conditions throughout the project
- It will not impede access to other judicial or administrative remedies that might be available under the law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements

The worker's GRM will contain the following design and procedures:

Information about the existence of the grievance mechanism will be readily available to all project workers through notice boards, the presence of "suggestion/ complaint boxes", including the different methods of communication, redressal timelines, rights of workers.

The complainant should be able to use mobile phone-based applications, and in person centers/ mechanisms for complaint registration and resolution, and a free hotline linked with a call center. The grievance will be addressed through each area of feedback value chain:

i. Uptake
ii. Sorting and processing
iii. Acknowledgement and follow up
iv. Verification, investigation, and action

v. Monitoring & Evaluation
vi. Provision of feedback to the complainant to ensure effectiveness

Grievance handling will be done in a transparent manner, where aggrieved workers will be informed within 10 days of their grievance application, either with a respective solution or with a request of extension.

The aggrieved worker will have the option to refer to a grievance log with key information that will be established by the PIU and quarterly reported upon.

If not satisfied with the outcome of the grievance at the contractor level, the aggrieved party will be able to access the Grievance Redressal Committee (GRC) established at the PIU level, where the GRC will be responsible for the redress mechanism in the areas of labor, environment, and social aspects along with project management.

The mechanism for resolving workers' grievances will be described in the context of staff induction training, which will be provided to all workers.

Collective Grievances and Disputes Resulting from the Negotiations of Collective Agreements

When a trade union is recognized, it is entitled to negotiate on a regular basis with the employer over terms and conditions existing at the workplace and the employer is obliged to negotiate with them also. The procedures followed in such circumstances are usually contained in the agreement, which states how the issues are raised, the procedure for negotiations, the composition of the parties involved in the negotiations, and the procedure to deal with issues that are not resolved through consensus. If the dispute is not resolved at the workplace, the parties to the dispute can utilize the dispute resolution mechanisms provided in the labor legislation.

Sexual Exploitation and Workplace Sexual Harassment

A separate GRM (or specific arrangements within existing GRM) will be established specifically for the purpose of confidentially receiving grievances related to SEA/SH. All SEA/SH related complaints, with the survivor's consent, will be referenced to the project identified service provider who will further manage the case in a survivor-centric approach and will report back to the project GBV GRM once the case is solved. In addition, the ESIA/ESMP will identify additional mitigation measures, including the contractors' ESMP or contractors specific LMP, where required. This will include engagement with communities on gender related risks, grievance, and response measures available as identified in the manual.

The PM will, with support from consultants, identify institutions and service providers who are actively engaging in the prevention of gender-based violence, sexual exploitation, and workplace sexual harassment in order to establish a manual for referencing potential survivors. The PM and the contractor are usually not equipped to handle complaints or provide relevant services to survivors, but will reference any person to relevant service providers, including health facilities, law enforcement agency's gender unit or others, as relevant using the information on available services.

All concerned responsible staff shall hold regular meetings with project workers to discuss any work-related issues and concerns. Every grievance raised by a worker will be documented with the actions undertaken by the PM and contractors to address such grievance. The aggrieved worker may raise any issue anonymously through a letter which shall be submitted to their immediate supervisor's office. Any grievances which are left unattended by the contractor can be submitted by the worker to the PIU, in which case, actions shall be taken to resolve the issue. Any labor dispute shall be first resolved through mediation, conciliation, and arbitration, in order to provide an efficient procedure in the settlement of disputes and to promote autonomy and freedom of the parties to make their own arrangements to resolve their grievance.

18. CONTRACTOR MANAGEMENT

The Project Team shall select contractors through a transparent process. It will review the following during the contractor selection process:

- Knowledge gathered through publicly available sources, such as company registers and papers pertaining to alleged infractions of applicable labor laws, such as inspection reports and other documentation from enforcement agencies;
- Business licenses, registrations, permits, and approvals;
- Labor management system documents, such as labor management procedures, that address OHS concerns;
- Identification, credentials, and certifications of labor management, safety, and health employees;
- Workers' certifications/permits/training to perform required work;
- Records of safety and health violations, reactions, recordable occurrences, and accompanying Root Cause Analysis (lost time incidents, medical treatment cases), first aid cases, high potential near misses, and necessary corrective and preventive actions (for example, revised job safety analysis, new or different equipment, skills training, and so forth);
- Accident and fatality records and notifications to authorities'/ lending agencies;
- Records of the benefits that employees are legally required to receive and evidence that they have enrolled in the relevant programmes;
- Worker payroll records, including hours worked and pay received;
- Identification of safety committee members and records of meetings; and
- Copies of prior agreements with suppliers and contractors that have clauses and terms that are materially consistent with ESS2.

The contract document shall include the contractor's commitment to:

- providing a construction management plan that includes reporting all pertinent project information, including workplace accidents;
- Employing suitably qualified personnel for high-risk jobs;
- Taking into account all occupational, safety and health considerations for its workers and at the site(s);
- Provision of first aid facilities;
- Provision of hygienic canteen and rest facilities at the site(s) and in camps (if applicable);
- Provision of PPE commensurate with the nature of job;
- Provision of traffic management plan;
- Conformance of all labor laws and regulations;

- Written code of conduct;
- Emergency response plans;
- Provision of site security plan;
- Labor influx management plan;
- Prohibition of child labor
- Employment of female workers for certain jobs and sexual harassment prevention

19. SUPPLY CHAIN WORKERS

The number and type of primary suppliers will be defined once the contractors define and prepare their work plans and make the corresponding adjustments to the designs to optimize them. The construction work under the Project will require the involvement of primary supplies including construction materials essential for the functions of the proposed infrastructure, such as cement, aggregates, sand, and bitumen.

Some contractors may also be able to produce such construction materials by their workforce. However, where the contractor will source:

i. Essential Materials
ii. Directly from Primary Suppliers
iii. On an ongoing basis, the workers engaged by such primary suppliers that meet all three criteria are deemed “primary supply workers”, as defined in PS2.

As discussed in Chapter 3 (Key Labor Risks), the OHS risks are also deemed to be generally significant in the construction sector including quarry sites. To address these potential risks, the following measures will be taken:

Selection of primary suppliers: When sourcing for primary suppliers, the project will require such suppliers to identify the risk of child labor/ forced labor and serious safety risks associated with the primary supply chain. The PM and the consultants will review and approve the purchase of primary supplies from the suppliers following such risk identification/ assessment. Where appropriate, the Project will be required to include specific requirements on child labor/ forced labor and work safety issues in all purchase orders and contracts with primary suppliers.

Remedial Process: If child labor/ forced labor and/or serious safety risks are identified, the PIU and the consultants will require the primary supplier to take the appropriate steps to rectify them. Such mitigation measures will be monitored periodically to assess their effectiveness. Where the mitigation measures are found to be ineffective, the PM and the consultants will, within reasonable period, shift the project’s primary suppliers to suppliers that can demonstrate that they are meeting the relevant requirements.

The PM will oversee the procurements of goods and materials requirements under the construction works. Project contractors will not be responsible for procurement and supply of materials and equipment under the same conditions and specifications on ESHS aspects in its contracting agreements.

Potential risks of child labor forced labor, and serious safety issues which may arise in relation to primary suppliers shall be identified in the EIA to be conducted in relation to each of the sub-projects.

Where there is a significant risk of child labor or forced labor related to primary supply workers, the Project Team will require the primary supplier to identify those risks in relation use of child

labor, forced labor. The labor management procedures will set out roles and responsibilities for monitoring primary suppliers.

Where there is a significant risk of serious safety issues related to primary supply workers, the Project Team shall require the relevant primary supplier to introduce procedures and mitigation measures to address such safety issues. These procedures and mitigation measures will be reviewed periodically to check their effectiveness. In case the Project Team is unable to control the primary suppliers with respect to their failure to address the safety issues with respect to child labor or forced labor, it may hire those suppliers who comply with requirements of PS2 and address the risks regarding use of labor or forced labor.

Annex – IX:
Stakeholder Engagement Plan and Grievance Redress Mechanism

Annexure 7

TPL Stakeholder Engagement Plan and Grievance Redress Mechanism (SEP and GRM)

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1.0	14th Mar 2023	First Publication	Khalil Shahab	Sitvat Jamal	Jamil Akbar
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1. Introduction

The SEP defines TPL's process to identify stakeholders, engagement parameters with stakeholders, recording mechanisms, information disclosure and subsequent reporting to stakeholders. This guideline will be fully embedded within the Environment Impact Assessment of each project, in line with IFC Risk Assessment requirements as well as local regulatory requirements in Pakistan.

2. Objectives of the Stakeholder Engagement Plan SEP

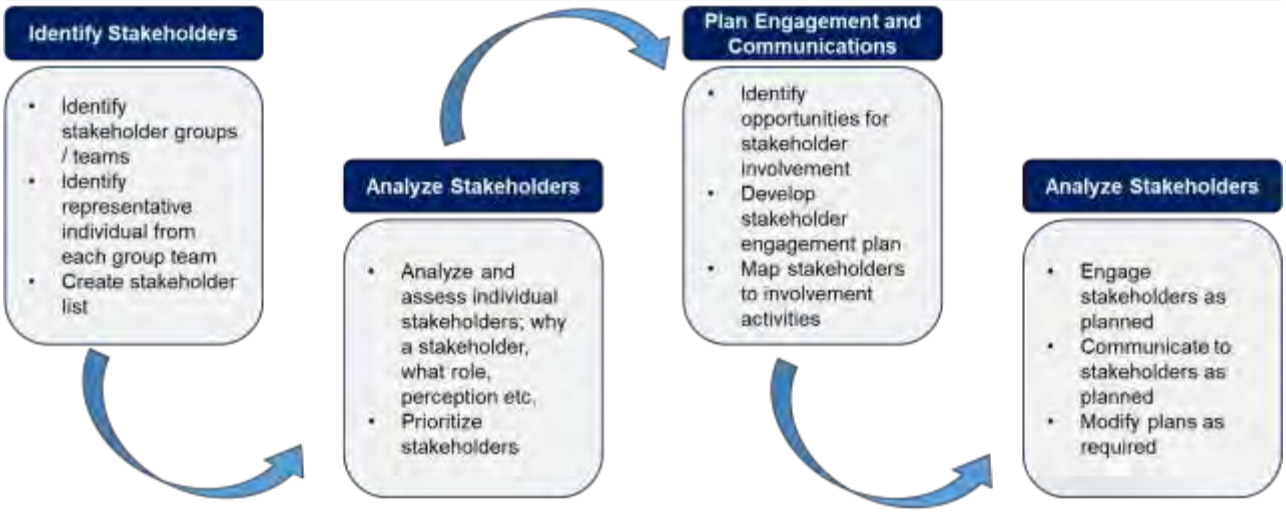
In line with the Company's ESG Policy, ESMS and IFC Perforamnce Standards, all of TPL's real estate development projects will develop a tailored SEP and Grievance Redress Mehchanism. The methodology in developing these systems will be in line with IFC Performance Standard 1 as well as local regulations in Pakistan including the Sindh Environemntal Protection Agency.

The Compay intends to comprehensively map stakeholders at the early concept stage of each proejct to ensure all affected individuals, communities and institutions are well informed ahead of the project so their feedback can be duly recorded and incorproated into TPL's Environemntal Impact Assessment and project plan across its entire cycle from design to construction to operations and management.

The overall objective of this SEP is to define a program for stakeholder engagement, including public information disclosure and consultation, throughout the entire project cycle.

The SEP outlines the ways in which the project team will communicate with stakeholders and includes a mechanism by which people can raise concerns, provide feedback, or make complaints about the project and any activities related to the project. The involvement of the local stakeholders will be pivotal to the success of the project to minimize and mitigate environmental and social risks related to the proposed project activities.

Figure 1.0: Stakeholder Engagement Process



3. Stakeholder Identification and Analysis

Stakeholder Identification

For meaningful and substantive engagement, it is necessary to determine who the stakeholders are and understand their needs and expectations for engagement, as well as their priorities and objectives in relation to the specific project and its nuances. This information will then be used to tailor engagement to each type of stakeholder. As part of this process it is particularly important to understand how each stakeholder may be affected – or perceives they may be affected – so that engagement can be modified accordingly. Project stakeholders are defined as individuals, groups or other entities who:

- are impacted or likely to be impacted directly or indirectly, positively or adversely, by the Project (also known as 'project affected parties'); and
- may have an interest in the Project ('other interested parties'). They include individuals or groups whose interests may be affected by the Project and who have the potential to influence the Project outcomes in any way.

Cooperation and negotiation with the stakeholders throughout the Project development often also require the identification of persons within the groups who act as legitimate representatives of their respective stakeholder group, i.e. the individuals who have been entrusted by their fellow group members with advocating the groups' interests in the process of engagement with the Project.

Community representatives may provide helpful insight into the local settings and act as main conduits for dissemination of the Project-related information and as a primary communication/liaison link between the Project and targeted communities and their established networks.

Verification of stakeholder representatives (i.e. the process of confirming that they are legitimate and genuine advocates of the community they represent) remains an important task in establishing contact with the community stakeholders. Legitimacy of the community representatives can be verified by talking informally to a random sample of community members and heeding their views on who can be representing their interests in the most effective way.

Methodology

The project intends to utilize various methods of engagement that will be used as part of its continuous interaction with project stakeholders. For the engagement process to be effective and meaningful, a range of various techniques need to be applied that are specifically tailored to the identified stakeholder groups. In accordance with best practice approaches, the project will apply the following principles for stakeholder engagement:

- ***Openness and life-cycle approach***: public consultations for the project will be arranged during the whole life-cycle, carried out in an open manner, free of external manipulation, interference, coercion or intimidation;
- ***Informed participation and feedback***: information will be provided to and widely distributed among all stakeholders in an appropriate format; opportunities are

provided for communicating stakeholders' feedback, for analyzing and addressing comments and concerns;

- ***Inclusiveness and sensitivity***: stakeholder identification is undertaken to support better communication and build effective relationships. The participation process for the projects is inclusive. All stakeholders at all times are encouraged to be involved in the consultation process. Equal access to information is provided to all stakeholders. Sensitivity to stakeholders' needs is the key principle underlying the selection of engagement methods. Special attention is given to vulnerable groups, in particular women, drug addicts, persons with disabilities, youth, elderly and the cultural sensitivities of diverse ethnic and religious minority groups and those living in remote or inaccessible areas.

Types of Stakeholders

The three potential categories of stakeholders are outlined below:

- **Affected Parties** – persons, groups and other entities within the Project Area of Influence (AOI)[1] that are directly influenced (actually or potentially) by the project and/or have been identified as most susceptible to change associated with the project, and who need to be closely engaged in identifying impacts and their significance, as well as in decision-making on mitigation and management measures;
- **Other Interested Parties** – individuals/groups/entities that may not experience direct impacts from the Project but who consider or perceive their interests as being affected by the project and/or who could affect the project and the process of its implementation in some way; and
- **Vulnerable Groups** – persons who may be disproportionately impacted or further disadvantaged by the project(s) as compared with any other groups due to their vulnerable status[2], and that may require special engagement efforts to ensure their equal representation in the consultation and decision-making process associated with the project.

Affected Parties

Affected parties are individuals, groups, and other parties that may be directly or indirectly affected by the project, positively or negatively. Affected Parties include local communities, community members and other parties that may be subject to direct impacts from the Project. The SEP focuses particularly on those directly affected, positively or adversely by the project activities. At this time, the client has identified directly affected parties under this category as:

- TPL
- Beneficiaries of the project; and

[1] This refers to the overall project area which may have direct or indirect impacts due to project activities in these locations.

[2] Vulnerable status may stem from an individual's or group's race, national, ethnic or social origin, color, gender, language, religion, political or other opinion, property, age, culture, literacy, sickness, physical or mental disability, poverty or economic disadvantage, and dependence on unique natural resources.

- People as well as entities (such as industrial units, etc.) affected by environmental and social impacts such as livelihood loss, social and cultural issues, noise, dust and increased vehicular traffic.

Other Interested Parties

There may be broader stakeholders who may be interested in the project because it indirectly affects their work or has some bearing on it. While these groups may not be directly affected by the project, they may have a role in the project preparation or have a broader concern including for, but not limited to, information dissemination, awareness raising, community mobilization, and feedback. Interested parties under this category may be identified as:

- Sindh Environmental Protection Agency (SEPA);
- Sindh Solid Waste Management Board (SSWMB);
- Karachi Water and Sewage Board (KWSB);
- Revenue Department;
- KMC and DMCs;
- Local Councils;
- Civil Society Organizations (CSO) and Community Based Organizations (CBO);
- Academia and Subject Specialists;
- Labor and Human Resource department;
- Social Welfare Department;
- Women Development Department;
- Donor Agencies;
- Supervision consultants;
- Contractors;
- Workers organizations;
- Workers Unions;
- Service providers;
- Suppliers; and
- Press and Media.

The SEP process will include conducting consultations with representatives of these groups and defining a strategy for continual engagement with each of them throughout the project life as relevant.

Disadvantaged / Vulnerable Individuals or Groups

It is particularly important to understand whether project impacts may disproportionately fall on disadvantaged or vulnerable individuals or groups, who often do not have a voice to express their concerns or understand the impact of a project. It would also be critical to ensure that awareness raising and stakeholder engagement

with disadvantaged or vulnerable individuals or groups be adapted to take into account particular sensitivities, concerns and cultural sensitivities of such individuals or groups and to ensure a full understanding of project activities and benefits. The vulnerability may stem from person's origin, gender, age, health condition, literacy levels, economic deficiency and financial insecurity, disadvantaged status in the community (e.g. religious and ethnic minorities or fringe groups), dependence on other individuals or natural resources, especially those living in remote, and insecure or inaccessible areas. Engagement with the vulnerable groups and individuals often requires the application of specific measures and assistance aimed at the facilitation of their participation in the project-related decision making so that their awareness of and input to the overall process are commensurate to those of the other stakeholders.

In this project, the vulnerable or disadvantaged groups may include, but are not limited to the following:

- Women worker;
- Elderly employees and citizens;
- Disabled employees and citizens;
- Minorities (ethnic, religious);
- Low-income households;
- Women/child headed households; and
- Transgender persons.

Vulnerable groups within the communities affected by the project will be further confirmed and consulted through dedicated means, as appropriate.

4. Summary of Project Stakeholder Requirements

Stakeholders most commonly characterized in the context of Pakistan's operating environment are defined in the table below and will be mandated as part of the ESMS to be incorporated at each project's respective SEP for consideration:

Table 1: Stakeholder Overview and Communication Guidelines

Stakeholder group	Key characteristics	Language Req.	Preferred notification means (e-mail, phone, radio, letter)	Specific needs (accessibility, large print, child care, daytime meetings)
Low-income Communities	Low income, below or close to poverty line.	Local languages (Urdu, Sindhi, Balochi Punjabi and Pashto)	•Radio, Television (TV), media and text messages •In person through social organizers or NGOs	•Available at specific times of day, probably in evening. •May only be willing to talk to NGO workers and community organizers who have been in contact with them.
Middle income communities	Range of livelihoods	As above, but probably comfortable with local languages as applicable	Phone, television, social media, community leaders may be available on email or by telephone	•Available at specific times of day, probably in evening
Academics	Often employed in research organizations and Universities	English or Urdu	Email and phone	•Meetings during working hours preferably
CSO and CBO	Often exercise influence in local communities and can be. Important in social mobilization and awareness raising	•Local languages as applicable (English and Urdu with larger NGOs and CBOs at the provincial level) •Local languages as	•Email and phone •In person meetings	•Meetings during working hours preferably

Table 1: Stakeholder Overview and Communication Guidelines				
Stakeholder group	**Key characteristics**	**Language Req.**	**Preferred notification means (e-mail, phone, radio, letter)**	**Specific needs (accessibility, large print, child care, daytime meetings)**
		applicable (Urdu, Sindhi, Balochi Punjabi and Pashto) at district level when engaging with CSOs		
Women	May not have much freedom of association or movement	Local languages as applicable (Urdu, Sindhi, Balochi Punjabi and Pashto)	•Phone, social media or radio •Community meetings organized by local CSOs working in rural areas	•Accessible mainly to other women. •Times of availability will vary for different groups •Younger married women may need child-care during the consultation meetings
Vulnerable groups such as differently abled citizens, minorities, elderly people and transgender people	Often excluded from voicing concerns and/or marginalized in society	Local languages as applicable (Urdu, Sindhi and Pashto)	•In person through social organizers or NGOs	•Times of availability will vary for different groups •Accessibility for differently abled citizens will be considered.

It will be advised for the ESMS team to ensure Covid-19 precautions are adhered to at all time during the engagement process.

5. Stakeholder Consultation

A process led by the Head of ESG and the Company's EIA consultant, it will be critical for the Company to ensure all primary and secondary consultations are properly recorded and maintained at all times.

It is advisable for the initial survey to be carried out in 2 stages:

Stage 1: Initial survey of the project's vicinity and that may directly be impacted of the project during its life cycle. The team will carry out with an initial site visit to identify all stakeholders that either residents or commercial operators and public / private institutions.

Stage 2: Team to prepare a structured template to engage the stakeholders identified. When key stakeholders are unavailable on a particular day, it will be mandatory for the team to record the absence and ensure they visit on another day to ensure maximum participations.

Key issues identified as a precedence in the local context of the real estate development in urban areas across Pakistan include:

- Lack of facilities of safe drinking water;
- Poor sewerage and drainage system;
- In adequate pipe water supply or no supply in some areas
- Poor quality of water;
- Health concerns for self and children;
- Water borne diseases such as diarrhea, etc.;
- Unreliable water supply;
- Lack of privacy;
- Issues of harassment;
- Traffic and Transportation problems.

Foremost preferred needs are livelihood clean drinking water, improved health facilities, better public transport, facilities of training and employment opportunities.

The team will ensure to provide as much information to the stakeholders via a Project Brief, share relevant contact information and record all concerns raised in a transparent manner. The Questionnaire may either be structured with no open ended questions or preferably semi-structured that may allow greater flexibility to generate concerns and address queries. This will also enable the team to gather primary data that may be useful for the project's design elements including utilities, security and other nuances pertaining to the specific project.

Table 2: Template to record Stakeholder Engagement

S.No	Date and Time	Consultation Type	Primary Stakeholders
1	[dd-mm-yyyy] Time: [24 hour format]	[Structured / Semi-structured]	Name of stakeholder [Individual, Nature of Activity (Residential / Commercial], (Primary / Secondary Stakeholder)

Table 2: Template to record Stakeholder Engagement			
S.No	**Date and Time**	**Consultation Type**	**Primary Stakeholders**
2	[dd-mm-yyyy] Time: [24 hour format]	[Structured / Semi-structured]	Name of stakeholder [Individual, Nature of Activity (Residential / Commercial], (Primary / Secondary Stakeholder)

Table 3: Template to record summary findings of the consultation			
S.No	**Type of Consultation**	**Key findings from consultation**	**Actions to be taken by the Proponent**
1	Primary / Secondary	[Detailed brief on the concerns of the stakeholders]	[Related corrective action initiative against each concern raised]
2	Primary / Secondary	[Detailed brief on the concerns of the stakeholders]	[Related corrective action initiative against each concern raised]

Diversity and Inclusion

As part of TPL's stance on gender diversity and inclusion, the engagement team will ensure, where possible keeping in mind cultural sensitivity will identify and seek feedback from as many women as part of the sample group.

Institutional Consultation (Other Interested Parties)

It will be advised that sessions are held with other interested parties including government agencies, academia, utility agencies, NGOs, CBOs, etc.

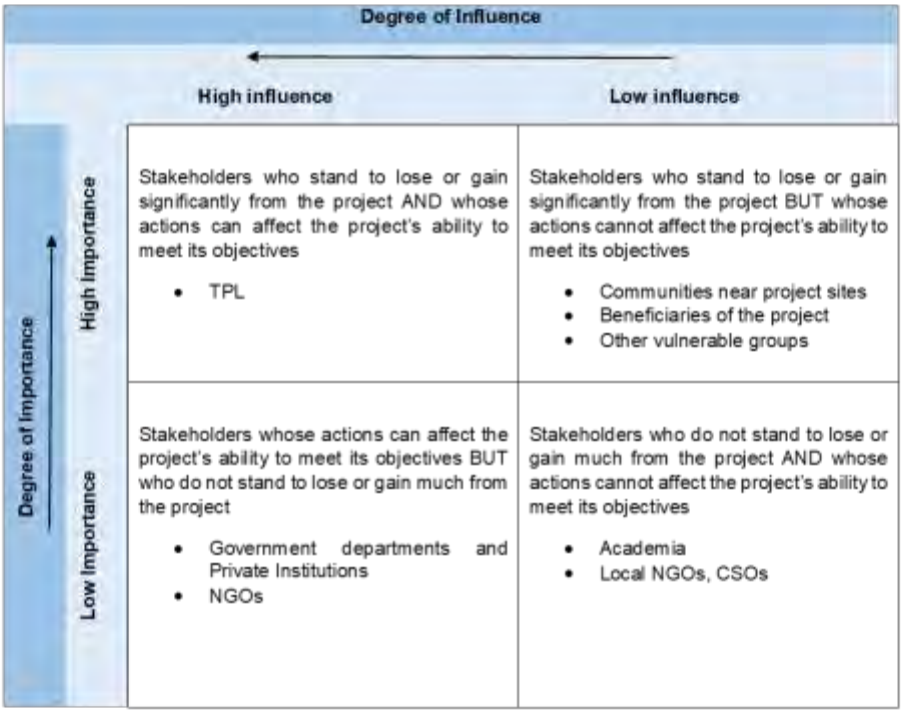
6. Stakeholder Engagement Program

The approach for the stakeholder engagement analysis will be underscored by three elements: (i) belief in the primacy of qualitative data; (ii) commitment to participatory methods; and (iii) flexible responsive methods. An inclusive and participatory approach has been followed taking the main characteristics and interests of the stakeholders into account, as well as the different levels of engagement and consultation that will be appropriate for different stakeholders.

In general, engagement is directly proportional to the impact and influence of a stakeholders. As the extent of impact of a project on a stakeholder group increases, or the extent of influence of a particular stakeholder on a project increases, engagement with that particular stakeholder group will intensify and deepen in terms of the frequency and the intensity of the engagement method used.

The different combinations of influence and importance that a stakeholder may exercise are elucidated in the diagram below. The table may be populated as more interviews and group consultations are conducted throughout the project cycle.

Figure 2.0: SEP Mapping Guideline



The stakeholder engagement program aims to: establish a systematic and inclusive approach to stakeholder engagement; build and maintain a constructive relationship with stakeholders; incorporate stakeholders' views and concerns into project design/implementation; mitigate negative social and environmental impacts of the project; and, enhance project acceptance and socio-environmental sustainability. Stakeholder engagement has been divided into two phases:

- **Phase I (Project Preparation):** The purpose of stakeholder engagement during this phase has been to: ascertain institutional needs; apprise all stakeholders about planned activities; improve project design; create synergies; and, enhance the socio-environmental sustainability of the project activities envisaged under the different project components. Details of these consultations for the proposed project has been discussed in the previous chapter.
- **Phase II (Project Implementation):** Extensive stakeholder engagement will be carried out during this phase with nearby communities, disadvantaged/vulnerable groups and other interested parties. An exhaustive list of topics for stakeholder engagement during this phase along with the corresponding tools and techniques for conducting them is provided later in the Annexure.

Proposed Strategy for Information Disclosure

Based on consultations with the project management and following World Bank disclosure protocol, the following table provides an initial outline of the information to be disclosed at the preparation and implementation stages.

Table 4: Strategy for Information Disclosure			
Project stage/ Components	**Target stakeholders**	**List of information to be disclosed**	**Methods and timing proposed**
Preparation	PM, affected parties, interested groups, public at large, vulnerable groups, Government entities	• Project Documents, • E&S instruments	• Project website before project effectiveness • Print and electronic media • One-on-one meetings, • Consultation meetings
Implementation	PM and other relevant Government departments and Private Institutions	• Consultation process/SEP, • Other E&S instruments, • GRM procedures and project information	• Project website • One-on-one meetings Consultation meetings
	Local communities (Communities around project areas) and Vulnerable groups (including local labor, disabled people, minorities and women)	• Regular updates on project activities and specific interventions for vulnerable groups • SEP and GRM procedures. • Consultations as per E&S instruments	• Outreach through local community organizations • Public notices • Press releases in the local media and on the project website • Mobile loudspeakers, announcements in local mosques and communities in local languages • Dissemination of information through social media
	International donor agencies (IFC)	• Scope of Project, opportunities for collaboration • regular updates on project progress • Project EIAs • Other E&S instruments, • SEP and its implementation	• Bi Annual Consultative sessions with agencies to create synergies in the work undertaken and avoid duplication of efforts • Virtual meetings.
	NGOs, Media representatives Academia	• Scope of Project,	• Project website • Bi-Annual Project Dissemination Workshops

Table 4: Strategy for Information Disclosure			
Project stage/ Components	**Target stakeholders**	**List of information to be disclosed**	**Methods and timing proposed**
		opportunities for collaboration • Project EIA • Other E&S instruments, • SEP and GRM procedures.	
	General public	• Frequently asked questions (FAQs), • SEP and GRM procedures	• Project website • Short Message Service (SMS) • Mosque announcements in sub-urban areas • Local influential (councilors, community workers etc.)

For the implementation stage, appropriate modes of communication and frequency of future engagements will be determined for each type of stakeholders, based on the outcomes of preparation stage consultations.

Proposed Strategy for Consultations

The proposed strategy of consultations during the subsequent phases of the project is presented **in the table below**.

Table 5: Strategy for Consultants			
Topic of consultation / message	**Method used**	**Target stakeholders**	**Responsibilities**
Preparation Phase			
• Need of the project • Planned activities • E&S principles, risk and impact, management • GRM	• Virtual meetings providing background information • Phone • Emails • Appropriate adjustments were made to take into account the need for social distancing (use of audio-visual materials, technologies such as telephone calls, WebEx, Microsoft Meetings, SMS, emails, etc.)	Project management	Head of ESG, E&S Consultant and GRM focal points

Table 5: Strategy for Consultants			
Topic of consultation / message	**Method used**	**Target stakeholders**	**Responsibilities**
• Proposed project components • Environmental and Social Risks and any other concerns stakeholders may have	• Phone • Emails • Individual meetings in person and virtually • Virtual Consultative workshops providing background information and discussing environmental and social risks • Appropriate adjustments were made to take into account the need for social distancing (use of audio-visual materials, technologies such as telephone calls, WebEx, Microsoft Meetings, SMS, emails, etc.)	• Communities • Relevant Government departments and organizations • Academia • NGOs' working in communities	Head of ESG, E&S Consultant
Implementation Phase			
• Project progress on ongoing activities/targets and outputs • Implementation of EIA • SEP and its implementation • GRM Processes • OHS concerns • E&S concerns • Monitoring and Evaluation Plan	• Review of Project progress Reports • Emails • Meetings • Electronic publications as well as dissemination of hard copies of E&S Frameworks • Monitoring reports and reviews • Outcome of Gender Assessment (if carried out on need basis) • GRM Reports	Project Officials	Project Occupational Health and Safety (OHS) staff GRM Focal Points on GRM issues TPL ESMS Team – Project progress, implementation of the SEP, and E&S concerns
• Project ongoing and planned activities	• Information resource portal on the project website with district data pertaining to	• General public, • Project area Beneficiaries	GRM Focal Points - GRM Procedures

Table 5: Strategy for Consultants			
Topic of consultation / message	**Method used**	**Target stakeholders**	**Responsibilities**
• SEP and its implementation • GRM for public • E&S concerns	project activities and GRM information • Social media platforms (e.g. Facebook and twitter) of Project • Outreach programs on radio and television where the public can call-in		TPL ESMS Team Project progress, implementation of the SEP, and E&S concerns
• Project progress on activities. • Opportunities for collaboration • E&S Instruments • SEP and its implementation • GRM Procedures • OHS concerns • E&S concerns	• Bi Annual Provincial consultative meetings • Review of Project progress Reports • Information resource portal on the project website with district data pertaining to project activities and GRM information • Print, electronic and social media	• Other ministries and public bodies, • Universities and research organizations • Print and Electronic Media, • NGOs and CSOs in each province/area • International Organizations such as ILO	GRM Focal Points Project E&S Staff
• Information on safety and prevention measures • Implementation of EIA • SEP and its implementation • GRM Procedures • E&S concerns	• Community meetings in disadvantaged/ vulnerable areas through local CSOs • Project Brochures, posters	• Affected individuals and their families • Local communities • Vulnerable groups	GRM Focal Points Head of ESG, E&S Consultant

The frequency for consultations and reporting during the implementation stage will be determined within a month of the project effectiveness date.

Proposed Strategy to Incorporate the View of Vulnerable Groups

Consultations will be carried out with vulnerable groups near or in the vicinity of the project sites using Focus Group Discussion (FGD) as a tool. Engagement mechanisms and frequencies, will accordingly be designed and customized for vulnerable people. This will continue throughout the Project life. A few such consultations have been held with communities in the project area in the preparation

phase, which will continue in the implementation of the project.

Timelines

The frequency of stakeholder engagement will vary across the Project activities (quarterly, bi-annual or annual), depending on the nature/pace of activity design/implementation, its social and environmental risk and impact and its relevance to the stakeholders. As consultations are held with stakeholders these timelines will be ascertained accordingly during implementation.

The project will review its stakeholder engagement against the SEP annually, and this review will be a part of the progress report that will be shared with the project management.

Review of Comments

All stakeholder engagement activities (FGDs, Key Informant Interviews (KIIs) and consultations) will be recorded and transcribed. Comments provided by stakeholders will be collated and reviewed following each engagement activity. These comments will be analyzed and formulated into a report which will be shared with all relevant entities.

Future Phases of the Project

Stakeholders will be kept informed as the project develops, including reporting on project environmental and social performance and implementation of the stakeholder engagement plan and grievance mechanism which will be conducted biannually. The **table below** presents a tentative plan for future consultations; this plan will be updated while updating the SEP during the project implementation phase.

Table 6: Future Consultants

Description	Target Stakeholders	Timing	Responsibility
• Public awareness campaigns/ information sharing sessions to share the EIA with the communities and other stakeholders. • Location: various places in project area	• Communities within project area, general public; and line departments/ agencies.	At the start of the site activities	Head of ESG, E&S Consultant
• Establishment of GRM and Grievance Redress Committees (GRCs) • Location: various places in project area	• Communities at/around project area	Before commencement of project activities.	Head of ESG, E&S Consultant
• Consultations with the communities during ESIAs, ESMPs and RPs implementation • Location: various places in project area	• Communities at/around project area	During project implementation	Head of ESG, E&S Consultant

• Grievance redress • Location: various places in project area	• PIU staff; consultants; relevant line departments; and communities.	Project implementation Stage	Head of ESG, E&S Consultant
• Informal consultations and discussions. • Location: various places in project area	• Communities at/around project area	Project implementation Stage	Head of ESG, E&S Consultant
• Consultations with the communities during internal monitoring • Location: various places in project area	• Communities at/around project area	Construction Stage	Head of ESG, E&S Consultant
• Consultations with the Communities during the Independent Monitoring • Location: various places in project area	• Communities at/around project area	Construction Stage	Head of ESG, E&S Consultant
• Consultation workshops to review ESIAs, ESMPs and RPs implementation, any outstanding issues and grievances, views and concerns of communities; and actions needed to address them. • Location: site offices in project area.	• Communities at/around project area; relevant line department; relevant NGOs	Six-monthly during implementation phase	Head of ESG, E&S Consultant
• Consultations with the communities during the site visits by the review missions • Location: various places in project area.	• PM; Communities at/around project area	Construction/ Operation Stage	Head of ESG, E&S Consultant

7. Monitoring and Reporting

Involvement of Stakeholders in Monitoring Activities

A monitoring and evaluation plan to ensure transparency and accountability will be concomitantly strengthened and updated on an ongoing basis, with national and provincial partners to monitor the implementation process of the SEP based on the performance indicators for the project.

Ongoing Reporting to Affected Communities

It is critical to follow-up with stakeholders at different stages of the project cycle. Once consultations have taken place, stakeholders will want to know which of their suggestions will be used, what risk or impact mitigation measures will be put in place

to address their concerns, and how, for example, project impacts are being monitored.

Often the same methods used in information disclosure are applied to reporting back to stakeholders. This follow-up can include large-scale forums, brochures, targeted meetings, and consultative committees. Given the current context and the need for social distancing, alternate means such as SMS, radio, television, social media handles, and project website will also be employed to share updated information with stakeholders.

The SEP will be periodically revised and updated annually during the course of project implementation in order to ensure that the information presented herein is consistent and is the most recent, and that the identified methods of engagement remain appropriate and effective in relation to the project context and specific phases of the development. Any major changes to the project related activities and to its schedule will be duly reflected in the SEP. Monthly summaries and internal reports on public grievances, enquiries and related incidents, together with the status of implementation of associated corrective/preventative actions will be collated by responsible staff and referred to the senior management of the project. The monthly summaries will provide a mechanism for assessing both the number and the nature of complaints and requests for information, along with the Project's ability to address those in a timely and effective manner. Information on public engagement activities undertaken by the Project during the year may be conveyed to the stakeholders in two possible ways:

- A number of Key Performance Indicators (KPIs) will also be monitored by the project on a regular basis. Based on the data collected regularly, these indicators include:
    - Number of consultation meetings (virtual) and other public discussions/forums conducted monthly, quarterly, and annually;
    - Frequency of public engagement activities.

Annex – X:
Environment, Health and Safety Guidelines (EHS)

Annexure 3

Environment, Health and Safety Guidelines (EHS)

Last updated on: 30th March 2023

Document Type: Annexure

Version: 1.1

Date: 30th March 2023

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1.0	14th Mar 2023	First Publication	Khalil Shahab	Sitvat Jamal	Jamil Akbar
1.1	30th Mar 2023	Second Publication	Khalil Shahab	Sitvat Jamal	Jamil Akbar

1. Introduction

The Environement, Health and Safety Gudilines (EHS) in its entirety will be implemented and monitored across all of TPL RMC's projects from construction to operation / management

This document, serving as a fundamental part of the Company's ESMS will also be embedded to the tender documents for each respective General Contractor (single / multiple) and will the Company will expect the General Contractor, its sub-contractors and all other third parties involved directly or indirectly towards any process in the development of the projects on-site.

As part of its ESG Policy, TPL has committed to the highest standards of managing EHS risks in line with the IFC Performance Standards and its supplementary policies including the IFC EHS Guidelines of 2007.

Elements of these provisions will be accounted for within the Design Brief of each project and will duly inform each project's Environment Impact Assessment reports. As per Pakistan regulatory requirements, the EIA Report requires a formal approval in addition to other approvals required from other agencies including the the Sindh Building Control Authroity, Survey of Pakistan, Utility Agencies as well as the Civial Aviation Authority. The designs are vetted through a stringent process. As per its design philosopy, TPL intends to develop sustaintable develops and achieve an internationally recognized sustainable certification for each project including LEED, IFC Edge, Bream or Well.

Where permissable and feasible, TPL intends to adhere to international standards in its design and construction processes in addition to complying with local regulatory requirements.

For simplicity, OHS guidelines are captured in tandem to other environmental risks within this document.

2.1 Communication and Training (Construction and O&M Phase)

OHS Training

- Provisions should be made to provide OHS orientation training to all new employees to ensure they are apprised of the basic site rules of work at / on the site and of personal protection and preventing injury to fellow employees.
- Training should consist of basic hazard awareness, sites pecific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. Any site-specific hazard or color coding in use should be thoroughly reviewed as part of orientation training.
- A basic occupational training program and specialty courses should be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments. Training should generally be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards.

- Workers with rescue and first-aid duties should receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their coworkers. Training would include the risks of becoming infected with blood–borne pathogens through contact with bodily fluids and tissue.
- Through appropriate contract specifications and monitoring, the employer should ensure that service providers, as well as contracted and subcontracted labor, are trained adequately before assignments begin.

Visitor Orientation ·

- If visitors to the site can gain access to areas where hazardous conditions or substances may be present, a visitor orientation and control program should be established to ensure visitors do not enter hazard areas unescorted.

New Task Employee and Contractor Training

- The employer should ensure that workers and contractors, prior to commencement of new assignments, have received adequate training and information enabling them to understand work hazards and to protect their health from hazardous ambient factors that may be present. The training should adequately cover:
  - Knowledge of materials, equipment, and tools
  - Known hazards in the operations and how they are controlled
  - Potential risks to health o Precautions to prevent exposure
  - Hygiene requirements
  - Wearing and use of protective equipment and clothing
  - Appropriate response to operation extremes, incidents and accidents

Area Signage

- Hazardous areas (electrical rooms, compressor rooms, etc), installations, materials, safety measures, and emergency exits, etc. should be marked appropriately.
- Signage should be in accordance with international standards and be well known to, and easily understood by workers, visitors and the general public as appropriate.

Labeling of Equipment

- Similarly, piping systems that contain hazardous substances should be labeled with the direction of flow and contents of the pipe, or color coded whenever the pipe passing through a wall or floor is interrupted by a valve or junction device.

2.2 Design and Operations Phase

Integrity of Workplace Structures

Permanent and recurrent places of work should be designed and equipped to protect OHS:

- Surfaces, structures and installations should be easy to clean and maintain, and not allow for accumulation of hazardous compounds.
- Buildings should be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions.
- Fire resistant, noise-absorbing materials should, to the extent feasible, be used for cladding on ceilings and walls.
- Floors should be level, even, and non-skid.
- Heavy oscillating, rotating or alternating equipment should be located in dedicated buildings or structurally isolated sections.

Severe Weather and Facility Shutdown

- Work place structures should be designed and constructed to withstand the expected elements for the region and have an area designated for safe refuge, if appropriate.
- Standard Operating Procedures (SOPs) should be developed for project or process shut-down, including an evacuation plan.
- Drills to practice the procedure and plan should also be undertaken annually.

Workspace and Exit

- The space provided for each worker, and in total, should be adequate for safe execution of all activities, including transport and interim storage of materials and products.
- Passages to emergency exits should be unobstructed at all times. Exits should be clearly marked to be visible in total darkness. The number and capacity of emergency exits should be sufficient for safe and orderly evacuation of the greatest number of people present at any time, and there should be a minimum two exits from any work area
- Facilities also should be designed and built taking into account the needs of disabled persons.

Fire Precautions

The workplace should be designed to prevent the start of fires through the implementation of fire codes applicable to industrial settings. Other essential measures include:

- Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises,

equipment installed, physical and chemical properties of substances present, and the maximum number of people present. ·
- Provision of manual firefighting equipment that is easily accessible and simple to use
- Fire and emergency alarm systems that are both audible and visible

Lavatories

- Adequate lavatory facilities (toilets and washing areas) should be provided for the number of people expected to work in the facility and allowances made for segregated facilities, or for indicating whether the toilet facility is "In Use" or "Vacant".
- Toilet facilities should also be provided with adequate supplies of hot and cold running water, soap, and hand drying devices.

Potable Water Supply

- Adequate supplies of potable drinking water should be provided from a fountain with an upward jet or with a sanitary means of collecting the water for the purposes of drinking
- Water supplied to areas of food preparation or for the purpose of personal hygiene (washing or bathing) should meet drinking water quality standards

Clean Eating Area

- Where there is potential for exposure to substances poisonous by ingestion, suitable arrangements are to be made for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances

Lighting

- Workplaces should, to the degree feasible, receive natural light and be supplemented with sufficient artificial illumination to promote workers' safety and health, and enable safe equipment operation. Supplemental 'task lighting' may be required where specific visual acuity requirements should be met.
- Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure safe shut-down, evacuation, etc.

Safe Access

- Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access
- Equipment and installations requiring servicing, inspection, and/or cleaning should have unobstructed, unrestricted, and ready access
- Hand, knee and foot railings should be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps, etc.

- Openings should be sealed by gates or removable chains
- Covers should, if feasible, be installed to protect against falling items
- Measures to prevent unauthorized access to dangerous areas should be in place

First Aid

- The employer should ensure that qualified first-aid can be provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work
- Eye-wash stations and/or emergency showers should be provided close to all workstations where immediate flushing with water is the recommended first-aid response
- Where the scale of work or the type of activity being carried out so requires, dedicated and appropriately equipped firstaid room(s) should be provided. First aid stations and rooms should be equipped with gloves, gowns, and masks for protection against direct contact with blood and other body fluids
- Remote sites should have written emergency procedures in place for dealing with cases of trauma or serious illness up to the point at which patient care can be transferred to an appropriate medical facility.

Air Supply

- Sufficient fresh air should be supplied for indoor and confined work spaces. Factors to be considered in ventilation design include physical activity, substances in use, and processrelated emissions. Air distribution systems should be designed so as not to expose workers to draughts
- Mechanical ventilation systems should be maintained in good working order. Point-source exhaust systems required for maintaining a safe ambient environment should have local indicators of correct functioning.
- Re-circulation of contaminated air is not acceptable. Air inlet filters should be kept clean and free of dust and microorganisms. Heating, ventilation and air conditioning (HVAC) and industrial evaporative cooling systems should be equipped, maintained and operated so as to prevent growth and spreading of disease agents (e.g. Legionnella pneumophilia) or breeding of vectors (e.g. mosquitoes and flies) of public health concern.

Work Environment Temperature

- The temperature in work, rest room and other welfare facilities should, during service hours, be maintained at a level appropriate for the purpose of the facility.

2.3 Construction Phase

During this phase, TPL is obligated to ensure that the GC is well appraised of the physical hazard risks. Physical hazards represent potential for accident or injury or illness due to repetitive exposure to mechanical action or work activity.

Single exposure to physical hazards may result in a wide range of injuries, from minor and medical aid only, to disabling, catastrophic, and/or fatal. Multiple exposures over prolonged periods can result in disabling injuries of comparable significance and consequence.

As per its ESG Policy, the General Contractor for the Company is required to comply with its ESMS Manual including the EHS Guidelines. The following provisions would be incorporated in to the GC Tender documents for compliance at all times.

Rotating and Moving Equipment

- Where a machine or equipment has an exposed moving part or exposed pinch point that may endanger the safety of any worker, the machine or equipment should be equipped with, and protected by, a guard or other device that prevents access to the moving part or pinch point
- Guards should be designed and installed in conformance with appropriate machine safety standards
- Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts, or in which energy can be stored (e.g. compressed air, electrical components) during servicing or maintenance
- Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms

Noise

- No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection.
- In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).
- The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85 dB(A).
- Although hearing protection is preferred for any period of noise exposure in excess of 85 dB(A), an equivalent level of protection can be obtained, but less easily managed, by limiting the duration of noise exposure. For every 3 dB(A) increase in sound levels, the 'allowed' exposure period or duration should be reduced by 50 percent.
- Prior to the issuance of hearing protective devices as the final control mechanism, use of acoustic insulating materials, isolation of the noise source, and other engineering controls should be investigated and implemented, where feasible
- Periodic medical hearing checks should be performed on workers exposed to high noise levels

Vibration

- Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration dampening pads or devices, and limiting the duration of exposure

Electrical

- Exposed or faulty electrical devices, such as circuit breakers, panels, cables, cords and hand tools, can pose a serious risk to workers. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into close proximity with overhead wires can result in arcing between the wires and the object, without actual contact. Recommended actions include:
  - Marking all energized electrical devices and lines with warning signs · Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance
  - Checking all electrical cords, cables, and hand power tools for frayed or exposed cords and following manufacturer recommendations for maximum permitted operating voltage of the portable hand tools
  - Double insulating / grounding all electrical equipment used in environments that are, or may become, wet; using equipment with ground fault interrupter (GFI) protected circuits
  - Protecting power cords and extension cords against damage from traffic by shielding or suspending above traffic areas
  - Appropriate labeling of service rooms housing high voltage equipment ('electrical hazard') and where entry is controlled or prohibited (see also Section 3 on Planning, Siting, and Design); · Establishing "No Approach" zones around or under high voltage power lines in conformance with Table below

Nominal phase to phase voltage rating	Minimum distance
750 or more volts, but no more than 150,000 volts	3 meters
More than 150,000 volts, but no more than 250,000 volts	4.5 meters
More than 250,000 volts	6 meters

  - Rubber tired construction or other vehicles that come into direct contact with, or arcing between, high voltage wires may need to be taken out of service for periods of 48 hours and have the tires replaced to prevent catastrophic tire and wheel assembly failure, potentially causing serious injury or death;
  - Conducting detailed identification and marking of all buried electrical wiring prior to any excavation work

Eye Hazards

- Use of machine guards or splash shields and/or face and eye protection devices, such as safety glasses with side shields, goggles, and/or a full face shield.
- Specific Safe Operating Procedures (SOPs) may be required for use of sanding and grinding tools and/or when working around liquid chemicals.
- Frequent checks of these types of equipment prior to use to ensure mechanical integrity is also good practice. Machine and equipment guarding should conform to standards published by organizations such as CSA, ANSI and ISO
- Moving areas where the discharge of solid fragments, liquid, or gaseous emissions can reasonably be predicted (e.g. discharge of sparks from a metal cutting station, pressure relief valve discharge) away from places expected to be occupied or transited by workers or visitors. Where machine or work fragments could present a hazard to transient workers or passers-by, extra area guarding or proximity restricting systems should be implemented, or PPE required for transients and visitors
- Provisions should be made for persons who have to wear prescription glasses either through the use over glasses or prescription hardened glasses.

Welding / Hot Work

- Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required.
- Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for hot work on tanks or vessels that have contained flammable materials.

Industrial Vehicle Driving and Site Traffic

- Poorly trained or inexperienced industrial vehicle drivers have increased risk of accident with other vehicles, pedestrians, and equipment. Industrial vehicles and delivery vehicles, as well as private vehicles on-site, also represent potential collision scenarios.
- Industrial vehicle driving and site traffic safety practices include:
  - Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits
  - Ensuring drivers undergo medical surveillance
  - Ensuring moving equipment with restricted rear visibility is outfitted with audible back-up alarms
  - Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures (e.g. prohibiting operation of forklifts with forks in down position), and control of traffic patterns or direction
  - Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to 'one-way' circulation, where appropriate

Working Environment Temperature

- Monitoring weather forecasts for outdoor work to provide advance warning of extreme weather and scheduling work accordingly
- Providing temporary shelters to protect against the elements during working activities or for use as rest areas
- Use of protective clothing
- Providing easy access to adequate hydration such as drinking water or electrolyte drinks, and avoiding consumption of alcoholic beverages

Ergonomics, Repetitive Motion, Manual Handling

- Facility and workstation design with 5th to 95th percentile operational and maintenance workers in mind
- Use of mechanical assists to eliminate or reduce exertions required to lift materials, hold tools and work objects, and requiring multi-person lifts if weights exceed thresholds
- Selecting and designing tools that reduce force requirements and holding times, and improve postures
- Providing user adjustable work stations
- Incorporating rest and stretch breaks into work processes, and conducting job rotation
- Implementing quality control and maintenance programs that reduce unnecessary forces and exertions
- Taking into consideration additional special conditions such as left handed persons

Working at Heights

- Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area · Proper use of ladders and scaffolds by trained employees

- Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines
- Appropriate training in use, serviceability, and integrity of the necessary PPE
- Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall

Illumination

- Use of energy efficient light sources with minimum heat emission · Undertaking measures to eliminate glare / reflections and flickering of lights
- Taking precautions to minimize and control optical radiation including direct sunlight. Exposure to high intensity UV and IR radiation and high intensity visible light should also be controlled
- Controlling laser hazards in accordance with equipment specifications, certifications, and recognized safety standards. The lowest feasible class Laser should be applied to minimize risks.

Location / Activity	Light Intensity
Emergency Light	10 lux
Outdoor non-working areas	20 lux
Simple orientation and temporary visits (machine storage, garage, warehouse)	50 lux
Workspace with occasional visual tasks only (corridors, stairways, lobby, elevator, auditorium, etc.)	100 lux
Medium precision work (simple assembly, rough machine works, welding, packing, etc.)	200 lux
Precision work (reading, moderately difficult assembly, sorting, checking, medium bench and machine works, etc.), office	500 lux
High precision work (difficult assembly, sewing, color inspection, fine sorting etc.)	1,000 – 3,000 lux

Chemical Hazards

- Replacement of the hazardous substance with a less hazardous substitute
- Implementation of engineering and administrative control measures to avoid or minimize the release of hazardous substances into the work environment keeping the level of exposure below internationally established or recognized limits
- Keeping the number of employees exposed, or likely to become exposed, to a minimum
- Training workers in the use of the available information, safe work practices, and appropriate use of PPE

Air Quality

- Maintaining levels of contaminant dusts, vapors and gases in the work environment at concentrations as per SEQS recommendations (review EMP)
- Developing and implementing work practices to minimize release of contaminants into the work environment including:
  - Direct piping of liquid and gaseous materials
  - Minimized handling of dry powdered materials; o Enclosed operations
  - Local exhaust ventilation at emission / release points o Vacuum transfer of dry material rather than mechanical or pneumatic conveyance
  - Indoor secure storage, and sealed containers rather than loose storage

Fires and Explosions

- Storing flammables away from ignition sources and oxidizing materials. Further, flammables storage area should be:
  - Remote from entry and exit points into buildings
  - Away from facility ventilation intakes or vents
  - Have natural or passive floor and ceiling level ventilation and explosion venting
  - Use spark-proof fixtures
  - Be equipped with fire extinguishing devices and self-closing doors, and constructed of materials made to withstand flame impingement for a moderate period of time
- Providing bonding and grounding of, and between, containers and additional mechanical floor level ventilation if materials are being, or could be, dispensed in the storage area
- Where the flammable material is mainly comprised of dust, providing electrical grounding, spark detection, and, if needed, quenching systems
- Defining and labeling fire hazards areas to warn of special rules (e.g. prohibition in use of smoking materials, cellular phones, or other potential spark generating equipment)
- Providing specific worker training in handling of flammable materials, and in fire prevention or suppression

Corrosive, oxidizing, and reactive chemicals

- Corrosive, oxidizing and reactive chemicals should be segregated from flammable materials and from other chemicals of incompatible class (acids vs. bases, oxidizers vs. reducers, water sensitive vs. water based, etc.), stored in ventilated areas and in containers with appropriate secondary containment to minimize intermixing during spills
- Workers who are required to handle corrosive, oxidizing, or reactive chemicals should be provided with specialized training and provided with, and wear, appropriate PPE (gloves, apron, splash suits, face shield or goggles, etc.).
- Where corrosive, oxidizing, or reactive chemicals are used, handled, or stored, qualified first-aid should be ensured at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work, and eye-wash stations and/or emergency showers should be provided close to all workstations where the recommended first-aid response is immediate flushing with water

Asbestos Containing Materials (ACM)

- The use of asbestos containing materials (ACM) should be avoided in new buildings or as a new material in remodeling or renovation activities. Existing facilities with ACM should develop an asbestos management plan which clearly identifies the locations where the ACM is present, its condition (e.g. whether it is in friable form with the potential to release fibers), procedures for monitoring its condition, procedures to access the locations where ACM is present to avoid damage, and training of staff who can potentially come into contact with the material to avoid damage and prevent exposure.
- The plan should be made available to all persons involved in operations and maintenance activities. Repair or removal and disposal of existing ACM in buildings should only be performed by specially trained personnel following host country requirements, or in their absence, internationally recognized procedures

Personal Protective Equipment (PPE)

- Active use of PPE if alternative technologies, work plans or procedures cannot eliminate, or sufficiently reduce, a hazard or exposure
- Identification and provision of appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors, without incurring unnecessary inconvenience to the individual
- Proper maintenance of PPE, including cleaning when dirty and replacement when damaged or worn out. Proper use of PPE should be part of the recurrent training programs for employees

- Selection of PPE should be based on the hazard and risk ranking described earlier in this section, and selected according to criteria on performance and testing established

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, vapor Oxygen deficiency	Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapors and gases). Single or multi-gas personal monitors, if available. 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.

Confined Space

- Engineering measures should be implemented to eliminate, to the degree feasible, the existence and adverse character of confined spaces.
- Permit-required confined spaces should be provided with permanent safety measures for venting, monitoring, and rescue operations, to the extent possible. The area adjoining an access to a confined space should provide ample room for emergency and rescue operations.
- Access hatches should accommodate 90% of the worker population with adjustments for tools and protective clothing.
-

Lone and Isolated Workers

- Where workers may be required to perform work under lone or isolated circumstances, Standard Operating Procedures (SOPs) should be developed and implemented to ensure all PPE and safety measures are in place before the worker starts work. SOPs should establish, at a minimum, verbal contact with the worker at least once every hour, and ensure the worker has a capability for summoning emergency aid.
- If the worker is potentially exposed to highly toxic or corrosive chemicals, emergency eye-wash and shower facilities should be equipped with audible and visible alarms to summon aid

whenever the eye-wash or shower is activated by the worker and without intervention by the worker.

3. Monitoring

Safety inspection, testing and calibration: This should include regular inspection and testing of all safety features and hazard control measures focusing on engineering and personal protective features, work procedures, places of work, installations, equipment, and tools used.

The inspection should verify that issued PPE continues to provide adequate protection and is being worn as required. All instruments installed or used for monitoring and recording of working environment parameters should be regularly tested and calibrated, and the respective records maintained. ·

Surveillance of the working environment: Employers should document compliance using an appropriate combination of portable and stationary sampling and monitoring instruments. Monitoring and analyses should be conducted according to internationally recognized methods and standards. Monitoring methodology, locations, frequencies, and parameters should be established individually for each project following a review of the hazards. Generally, monitoring should be performed during commissioning of facilities or equipment and at the end of the defect and liability period, and otherwise repeated according to the monitoring plan.

Training: Training activities for employees and visitors should be adequately monitored and documented (curriculum, duration, and participants). Emergency exercises, including fire drills, should be documented adequately. Service providers and contractors should be contractually required to submit to the employer adequate training documentation before start of their assignment.

4. Additional Policies

HVAC Systems Policy

Background:

Ozone Depleting Substances are compounds that contribute to stratospheric ozone depletion and are listed by the Montreal Protocol. For heating, ventilation and air conditioning (HVACR) systems, these include Chlorofluorocarbons ("CFCs:), Hydrochlorofluorocarbons ("HCFCs"), Halons, Methyl Bromide, Carbon Tetrachloride, Hydrobromofluorocarbons ("HBFCs"), Chlorobromomethane, and Methyl Chloroform.

TPL Policy:

It is important to note that no new HVACR equipment for TPL projects shall use any of the above listed refrigerants. Small HVAC&R units (defined as containing less than 0.5 pound [225 grams] of refrigerant) and other equipment, such as standard refrigerators etc. equipment that contains less than 0.5 pound (225 grams) of refrigerant, are exempt as per the provisions of the relevant codes of practice.

Though (HFCs) are not Ozone Depleting Substances, they pose a risk with regards to global warming potential (GWP) refrigerants that contribute to climate change and

whose control and phase out plan is under the Kigali Amendment. TPL projects shall strive to minimize its impact on climate change by considering alternate low GWP refrigerants by either:

1. specifying refrigerants that have an ozone depleting potential (ODP) of zero and a global warming potential (GWP) of less than 50 or;
2. ensuring the system combined refrigerant Lifecycle Ozone Depletion Potential and Lifecycle Direct Global Warming Potential impact of the HVACR System is <= 100 (IP units) or <+ 13(SI units).

All refrigeration equipment installed in the project shall be in compliance with ASHRAE Standard 15-2019: **Safety Standard for Refrigeration Systems and ASHRAE Standard 34-2019 Designation and Safety Classification of Refrigerants.**

Management plan post fit-out

A comprehensive refrigerant management plan will be in place that holistically addresses leak detection, system retrofit, and end of life disposal for all HVAC&R systems containing more than 0.5 pound (225 grams) of refrigerant.

- The plan will identify the team that will be responsible for the care and maintenance of refrigerant systems, regular leak detection and monitoring, record-keeping and training of personnel necessary to execute the plan. Leak Rate for the system must not exceed 2%.
- All contractors or service technicians performing work on any HVAC&R systems shall have access to the refrigerant management plan and, upon completion of the work, provide documentation that confirms continued compliance with the plan.
- Reference Guidance on maintenance for HVACR system to ensure minimizing emissions from ODS and their substitutes like HFCs can be found in EPA regulations, Section 608.
- The frequency of maintenance including leak detection checks must be made between 3 months for systems greater than 500 lb of refrigerant to one year for smaller systems with repairs carried out within 30 days of detection.

HVAC Noise Control Policy

Background:

Detailed information regarding the HVAC systems and related measures / equipment in place to keep noise parameters within acceptable standards that will be incorporated into the technical documents for shortlisted contractor:

TPL Policy:

The Contractor will ensure that any equipment supplied by him shall have vibration and acoustic characteristics that post implementation of the vibration and noise control mechanisms, the reverberation time will be limited to 0.5-0.75 and the noise rating level will be NR 35 to the extent possible or provide an alternative solution that can achieve the minimum standards.

- **Volume Control Air Dampers:**
  - Volumes control dampers will be placed in ducts at each branch supply or return air duct connection.
  - Contractor to provide necessary blank-off plates required to install dampers that are smaller than duct size.
  - Provide necessary transitions required to install dampers larger than duct size
  - Install all damper control / adjustment devices on stand-offs to allow complete coverage.

- **Fire and Smoke Dampers**
  - Silencers will be installed when required to achieve the specified noise thresholds.
  - The shop drawings from the contractor will have detailed calculations for every unit and are to determine the insertion loss required to meet the stated noise criterion. Supply and return duct noise will be considered including breakout noise.
  - 2 materials of construction including galvanized sheet metal and mineral fiber acoustic mill which comprises of inorganic, inert, moisture and is also resistant to vermin. Silencers will be constructed to prevent any risk of erosion and printability of the acoustic device.
  - Locally manufactured silencers will be shortlisted with an international certified / affiliated company that will be required to perform periodic testing and inspection on the manufacturers products.
  - Static pressure loss of any required silencer will be considered when procuring the air handling equipment.

- **HVAC Fans**
  - Each fan shall be statically and dynamically balanced at the factory and shall operate quietly and without pulsation.

- Published performance fan ratings will be provided to the Project Engineer for approval in accordance with procedures as set forth by the AMCA test code for air movements and fans shall be rated as per AMCA Standard 210-74 or ASHRAE 51-75 or equivalent.
- Axial flow fans performance shall be approved / certified by AMCA, and established in accordance with ISO 5801:1997 or BS848: Part 11 1997 installation type 'D' method of testing air performance and BS 848 Part 2 1985 for noise testing.

- **Air Handling Units ("AHUs"):**
  - Noise Attenuation Characteristics

Frequency (Hz)	63	125	250	500	1K	2K	4K	8K	Overall
SPL (dB)	11	11	15	25	26	27	27	27	<30

  - Outdoor Units
    - **Sound Pressure Level**: As specified, the design is measured at 3 feet from the front of the unit; night setback sound control mechanism will be provided as a standard feature; 3 selectable sound level steps of 55 dB, 50 dB and 45 dB will be set as the maximum threshold.

- **Diffusers and Grills**
  - Sound pressure levels shall be determined by using AHRI Standard 885-2008 "Procedure for estimating occupied space sound levels in the application of Air Terminals and Outlets".
  - For Jet flow nozzles, actual pressure drop calculation and noise generation in terms of NC / dB must be provided by the Contractor to gauge compliance.
  - Noise generated by diffusers at peak volume shall be such that room noise level at occupant floors does not exceed noise criterion specified in Section 134800 (Vibration Noise and Seismic Controls).

- **Duct works Noise Control Methodology**
  - The supply and return and fresh air supply ductworks shall be attenuated to limit the noise level to the values specified in the design criteria;
    - Duct section with sheet metal outer casing. Sound absorbing fill material and inner casing of perforated sheet metal; incorporating interior baffles of similar construction.
    - Fabricate in Accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible or BS 4718 for dynamic insertion loss; self-generated noise and aerodynamic performance.
    - The method of fabrication and supporting ducts should be such as to avoid generation of noise because of air movements or drumming of sheet metal.

- All silencers shall be completely pre-fabricated of noncombustible materials and shall have a
- Minimum insertion loss to suit equipment and required terminal noise levels and a minimum air pressure drop of 62 Pa. externally.
- The silencers: shall be insulated in the same manner as the adjoining air ducting. The Contractor shall cony out sound absorption calculations with respect to the characteristics and the duct system to ensure the proper selection of silencers.
- Silencers with internal air velocities above 22.86 m/s shall have acoustic media additionally protected from erosion by glass fiber cloth.
- The silencers shall be complete with flanges to facilitate their removal for inspection.
- Silencers shall have 50 mm slip connections unless specified otherwise.
- Silencers shall be painted with anti-rust prime coat

Anti-Termite Policy

TPL Policy

By applying this at the sub-terrain level, there will be no risks arising in line with IFC Performance Standard 4 *(Resource Efficiency and Pollution Prevention)* and IFC Performance Standard 6 *(Biodiversity Conservation and Sustainable Management of Living Natural Resources)* as there will be no flora and fauna in contact with the treatment. Also, the development is flanked on two sides by roads which do not have any plantation, nor do the other two sides which are flanked by commercial construction with concrete apron surrounds. Additionally, it is pertinent to note that all high standard residential and commercial developments across Karachi employ the same treatment based on the prevalence of termites existing at sub-soil level.

Method of Application:

The methodology for applying the treatment is developed in line with IFC Performance Standard 2 *(Labor and Working Conditions)* with no compromise on the health, safety and wellbeing of the contracted trained specialists and supervisors that will apply the treatment.

The products shortlisted by the management will keep in mind its biodegradability, toxicity to mammals and fish, OHS risks and cost.

As mentioned previously, the anti-termite treatment will take place below natural ground level, underneath foundations and shall be performed under trained professionals with appropriate equipment and PPEs. The mandatory PPEs are; Respiration Mask, Goggles, Rubber boots and gloves, coverall suit, first aid kit.

Illustration of PPE equipment during the application process

All methods to be performed for anti-termite treatment shall be complying with **National Pest Management Association USA standards.**

Application Process:

1. The excavation is completed up to the bottom of foundation/trench/pit level whilst simultaneously stabilizing the cut face.

2. After the soil is compacted and levelled at the base level, the mixture of anti-termite agent and water is sprayed adequately as per manufacturer's specifications.
3. The mixture is allowed to be soaked in soil and checked for proper penetration up to required depth.
4. The vertical areas of excavation which will be in contact with concrete or structural members shall also applied with anti-termite agents thus providing complete protection from termites.
5. The backfill material from outside (if required) shall be treated with the same method as prescribed above after completion of backfilling activity.
6. Contractor will ensure that no outdated materials will be applied at the time of application. Application process will be as per manufacturer recommendations at all times.

The horizontal and vertical application annihilates the termites and creates an envelope around the base of the structure, therefore, no further intrusion or growth is caused in future.

Material/Chemical Used:

Anti-termite Agents are used in the application. The main ingredient of the anti-termite agent is Bifenthrin/Permethrin. It is applied after mixing with water in 1:250 ratio (1L Anti termite agent: 250 L Water) or as specified by manufacturer.

As part of the technical specifications, the HKC management will aim to avoid products that include the following chemical compounds if readily available considering the difficulty in imports based on current macro-economic challenges in Pakistan. In the case that suitable alternatives are not available, HKC management will work closely with the contractor and manage this process under strict supervision:

Pesticide / Chemical Compound	
Aramite	Kepone
Benomyl	Lindane
BHC	Merphos
Cadmium Compounds	Monourea
Carbaryl	PCP
Chloranil	Peperonyl Butoxide
Chlorobenzilate	Promide
Chloroform	Rotenone
Creosote	Safrole
DDVP	(SST) DFF
DECP	Strobane
Diallates	Strychnine
Dimethoate	Toxaphene
Endrin	Triallates
EPN	1080
Ethylene Oxide	

The recommended manufacturers for the projects are, Biflex by FMC, Agenda 25EC by Jaffer Brothers and Mirage by Ali Akbar Group. All the manufacturers are complying with international standards and are subject to availability in the local market.

Chemical Toxicity and Effects:

- Bifenthrin/permethrin are highly toxic to termites, however, when applied diluted with water, the agent is bound tightly with soil particles and does not contaminate the soil further to contact with it.
- The vapors are highly volatile and evaporates immediately in air.
- The treated soil does not come in contact once the concrete structure has been casted and works as external protection against termite.

General Health and Well-Being:

- Any specialist who becomes ill during or within 24 hours of using the pesticide will be required to notify the supervisor
- Eating area will be separate from work areas where pesticides are stored and applied; adequate washing area will be provided during the application phase.
- When the daily job is finished, all workers will be required to wash themselves and their hands thoroughly with soap and water before engaging in such activities.

Training:

- Employees should be trained on the hazards, precautions and procedures for the safe storage, handling and use of all potentially harmful materials relevant to each employee's task and work area.
- Personnel should be trained in EHS matters including accident prevention, safe lifting practices and equipment maintenance.
- All newly trained employees must work initially under supervision of trained and experienced applicators.

Handling:

- All products must be shipped and stored in adequate containers with clear identifiable labels, in local language (subject to availability) showing content, expiration date, health hazards and where possible, first aid measures in case of accidental exposure or ingestion.
- Material will be stored in a locked and posted area.
- Contractor to ensure that the hazardous material will not be transported or stored in common with food or beverages (including potable water)

Disposal:

- Metal and plastic product containers will be triple rinsed and the rinse water used for application. The containers will be returned to the manufacturer for recycling and safe disposal at its designated site.

Annex – XI:
Contractor Management System
(CMS)

Annexure 5

TPL Contractor Management System (CMS)

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1.0	14th Mar 2023	First Publication	Khalil Shahab	Sitvat Jamal	Jamil Akbar
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1. Introduction

The Contractor Management System (CMS) in its entirety will be implemented and monitored across all of TPL RMC's construction projects. This CMS is developed in line with IFC's Performance Standards and also takes its relevent inputs from IFC's Good Practice Note on Managing Contractor's Enviornmental and Social Performance 2017.

The key responsible team, led by the Head of ESG will remain the custodian of this document and ensure its full compliance on all projects at all times. It will be the responsibilty of the TPL Projects Team to ensure the full implementation of the CMS on all TPL development projects.

With TPL's commitment towards implementing the IFC Performance Standards, this CMS is a direct requirement of IFC Performance Standard 1: Assessment and management of Enviornmental and Social Risks. TPL also commits to ensure to manage the general contractor's E&S performance. With reference to Paras 2 and 14 of IFC PS 1, " Contractors retained by, or acting on behalf of the client(s), are considered to be under director control of the client and not considered third parties…" and the E&S management"…programs may apply broadly across the client's organization, including contractors and primary suppliers over which the organization has control or influence…"

"It is the Client's responsibility to comply with IFC Performance Standards (PSs); relevant World Bank Group (WBG) Environemntal, Health, and Safety (EHS) Guidelines requirements; loan agreement commitments; Envionmental Impact Assessment (EIA) requirements; local laws and regulations; and permits and standards; and to ensure that all contractors providing any type of services to the client duly follow these requirements throughtout the duration of the Contract".

2. Document Purpose

As per IFC performance standard requirements, TPL is required to identify E&S risks and impacts, typically through a project specific Environment Impact Assessment (EIA). As per Sindh Environmental Protection Agency (SEPA) requirements, all development projects, at scale, have to develop an EIA report for a development project and seek the relevant approval from SEPA as an condition precedent prior to construction.

This document will be embedded into TPL's over-arching Environment and Social Management System (ESMS) and will provide a guideline for TPL Company representatives to ensure that they mitigate all E&S risks during the qualification of the General Contractor through assessing the competency and capability of the Contractor's past experience and general understanding of the IFC PS. As the ESMS and its annexures will outline all E&S requirements to be fulfilled by the General Contracotor and its sub-contractor, these have not been outlined in this document. TPL also must ensure to keep the General Contractor updated on the Company's EIA requirements from the Sindh Environemntal Protection Agency at all times.

3. Contractor Selection

The contractor selection process should involve a multidisciplinary team, with one or more qualified E&S professionals with primary responsibility for the project's E&S matters, including E&S performance, worker and community health, safety and security, and human resources

(HR). The participation and engagement of the E&S professional in the contractor selection process is aimed at providing an early consideration of E&S matters and variables when selecting a contractor.

As described in the ESMS, the ESG committee has due representation from all the relevant department who will work with the Head of ESG to ensure that contractors are contractually bound to manage E&S risks in line with the Company's ESG policy and E&S performance.

As intended, the primary step in engaging a General Contractor would involve the preperation of an RFP. The RFP will be prepared by the TPL Head of Projects, with due inputs sought from the project's architects and engineering consultants. It is the responsibility of the TPL Head of Projects to ensure all participating contractors receive a due copy of the the following:

- TPL ESMS Manual
- Annex 1: TPL HR Policies
- Annex 2: TPL Waste Management Policy
- Annex 3: TPL Enviornment Monitoring Plan
- Annex 4: TPL EHS Guidelines
- Annex 7: Communities SEP and GRM
- Annex 8: Labor SEP and GRM

All contractors participating during the bidding process will represent that they understand ther requirements of TPL's ESMS and its management programs. Under a General Contractor hiearchy, it will be the sole responsibility of the General Contractor to implement and monitor E&S related risks amongst its sub-contractors.

3.1 Prequalification

It will be highly advisable for all participating contractors to provide details on past EHS performance, number and qualifications of ESHS personnel, occupational health and safety procedures and controls and related action plan as per the Company's ESMS requirements.

It will be essential for the Head of ESG to conduct a workshop as and when required by the Head of Projects to provide further information and clarity on TPL's E&S requirements and to address any alternative solutions on a case by case basis. Minutes of this meeting should be maintained.

3.2 Proposal Evaluation and Contractor Selection

It is recommended that the evaluation criteria be established alongside the bid packages and that these are included with the package so that prospective bidders can see early on the relative weightings of the environmental, social, and health and safety aspects of their proposal.

The contractor's existing systems, its capacity to implement E&S requirements, and the contractor-supplied information on past E&S performance should be among the key criteria used to evaluate contractors. Capacity may be judged by past performance, existing or projected management, technical ability, and resources. The latter can include solutions or options proposed by the contractor to implement the mitigations described in the E&S documentation, such as management plans that are contained in the bid package

While the evaluation methodology will vary according to the project, scope of work of the activity, and any project-specific feature, it will need to be agreed on by the project team. It is recommended that the following be considered grounds for disqualification:

- Failure to provide information on past E&S performance, including health and safety records;
- Reports of past performance deemed unacceptable for the current project;
- Notices of material labor issues between workers and management;
- Fines and sanctions imposed by E&S and labor regulators and authorities;
- Poor security management records from previous projects; and
- Material community grievances and high profile adverse press reports on E&S matters.

Should interviews with key personnel be part of the evaluation of prospective contractors, TPL is encouraged to require that prospective contractor E&S personnel be interviewed by client E&S personnel. As this will be a contractor expense, it should be made clear early on that this is a requirement.

At the end of the evaluation and selection process, clients should issue a letter of intention to place a contract subject to certain conditions, including E&S requirements and conditions, which should be listed. These could be over and above those in the solicitation, but they must have been discussed with the contractor during the selection process.

4. Contracting

Althought the types of contracts for construction works varies from organization to organization and on a case basis, In Pakistan, the FIDIC contract templates are oftenly uses but may include variations due to local operating nuances. For reference, please refer to the table below for the types and definitions of FIDIC Contracts.

Table 1: FIDIC Contracts Overview

Type of Contract Template	Description
FIDIC Red Book *The Construction Contract*	Recommended for Construction for Building and Engineering Works Designed by the Employer.
FIDIC Yellow Book *The Plant and Design / Build Contract*	Recommended for Plant and Design-Build for Electrical and Mechanical Plant and for Building and Engineering Works, Designed by the Contractor.
FIDIC Silver Book *The EPC Turnkey Contract*	Recommended for EPC/Turnkey Projects.
FIDIC Green Book *A short form of contract*	Recommended for small works.

FIDIC White Book *Client / Consultant Model Services*	Recommended for the appointment of consultants to provide services such as studies, design, contract administration, and project management.

Model international contracts and many companies' model contracts have conditions relevant to E&S performance, but these are general in nature and vary between the various types of contracts. These contracts also allow for inclusion of project-specific special conditions, although in the past most special conditions have been related to engineering and payment for work completion.

Requirements in the model contracts may require international good practice or a variant for some E&S requirements, such as on footprint management, erosion control, hazardous materials and hazardous waste management, site restoration, general pollution prevention, biodiversity management, and other general controls. They also may include requirements for worker safety and worker accommodation. Only rarely do these include requirements for stakeholder communication or community protection, and they do not include project-specific requirements needed to control site-specific impacts as described in the preceding paragraphs. To ensure full compliance, the Company's ESMS will be a core component in the official contract in addition to the FIDIC template.

Regardless of whether a contract is based on an international model, the client's E&S manager or other qualified person should review the contract to assess any general E&S requirements present and determine how such requirements need to be modified to fit the client's needs.

An organization chart illustrating reporting lines on E&S to the client and subcontractors is a key aspect of the contract negotiations and may be included with the contract documentation. The ESMS will list all the management plans and associated documents that must be taken into account by the General Contractor and all required documents not limited to site reports, E&S metrics etc.

As mentioned above, TPL will vet all E&S representatives of the General Contractor and must be approved prior by TPL.

5. Approving Invoices for Payment

If the contractor does not take timely action to reach compliance with E&S requirements, TPL Head of Projects and Head of ESG should continue to take appropriate action to encourage compliance, which could include orders to stop work, withholding of further payments, and/or escalation of the issue to higher management. If significant impacts are occurring or imminent, the client may notify the contractor that another party will be brought in to deal with the issue and the payment to the contractor will be reduced by the amount paid to the other party, as would be specified in the contract.