KWSSIP
Karachi Water & Sewerage Services Improvement Project

Final Report

APRIL 2024

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT REPORT

MALIR BASIN WASTEWATER INTERCEPTORS AND TREATMENT PLANT

Second Karachi Water & Sewerage Services

Improvement Project [KWSSIP-2]

Environmental & Social Impact Assessment Report of Malir Basin Wastewater Interceptors and Treatment Plant

April 2024

KWSSIP
Karachi Water & Sewerage Services Improvement Project

Project Implementation Unit (PIU)
Karachi Water & Sewerage Services Improvement Project (KWSSIP)

Sponsored by:
- Asian Infrastructure Investment Bank (AIIB) / World Bank (WB)
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Abbreviations and Acronyms

AIIB	Asian Infrastructure Investment Bank
AOI	Area of Influence
BOD	Biochemical Oxygen Demand
CBOs	Community Based Organizations
CHS	Community Health and Safety
CO	Carbon Monoxide
COC	Code Of Conduct
COD	Chemical Oxygen Demand
COVID-19	Coronavirus Disease
CSC	Construction Supervision Consultant
CV	Curriculum Vitae
dB	Decibel
DP	Distribution Pit
EC	Environmental Conditions
ECP	Environment Code of Practices
EHS	Environment, Health, and Safety
EHSS	Environmental Health Safety and Social
EHSG	Environmental, Health, and Safety Guidelines
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Engineering Procurement and Construction
ES	Environmental and Social
E&S	Environmental and Social
ESA	Environmental and Social Assessment
ESCP	Environmental and Social Commitment Plan
ESF	Environmental and Social Framework
EHSG	Environmental Health and Safety Guidelines
ESMP	Environmental and Social Management Plan
ESMU	Environmental and Social Management Unit
ESP	Environmental and Social Policy
ESS	Environmental and Social Standards
FGD	Focus Group Discussion
GAP	Gender Action Plan
GBV	Gender Issues including Gender-Based Violence
GFI	Ground Fault Interrupter
GIIP	Good International Industry Practice
GIS	Geographic Information System
GoS	Government of Sindh
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GTS	Garbage Transfer Station

HDPE	High Density Polyethylene
HIV/AIDS	Human Immunodeficiency Virus / Acquired immunodeficiency syndrome
HRRP	Habitat Removal and Restoration Plan
HSE	Health, Safety and Environment
IECs	Important Environmental and Social Components
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IGC	International General Certificate
ILO	International Labour Organization
INGOs	International Non-Governmental Organization
ISO	International Standards Organization
IOSH	Institution of Occupational Safety and Health
JHA	Job Hazard Analysis
JICA	Japan International Cooperation Agency
JP	Junction Pit
JV	Joint Venture
KII	Key Informant Interview
KW&SB	Karachi Water & Sewerage Board
KWSSIP	Karachi Water & Sewerage Services Improvement Project
LGD	Local Government Department
LTI	Loss Time Injuries
MGD	Million Gallon Per Day
MMP	MM Pakistan (Pvt.) Ltd.
NEBOSH	National Examination Board in Occupational Safety and Health
NCS	National Conservation Strategy
NEQS	National Environmental Quality Standards
NESPAK	National Engineering Services Pakistan
NFP	National Forest Policy
NGOs	Non-Governmental Organization
NO_2	Nitrogen dioxide
NRW	Non-Revenue Water
OH&S	Occupational Health and Safety
OHS	Occupational Health and Safety
OWMP	Operational Waste Management Plan
PAF	Pakistan Air Force
PAPs	Project Affected Persons
PARCO	Pak-Arab Refinery Company
PD	Project Director
PESMU	Project Environmental and Social Management Unit
PFD	Personal Flotation Device
PGRC	Public Grievance Redressal Cell
PIU	Project Implementation Unit
PKR	Pakistan Rupees

PM_{10}	Particulate Matter 10 micron and smaller
$PM_{2.5}$	Particulate Matter 2.5 micron and smaller
PRCC	Pre-stressed Reinforced Concrete Cement
PSN	Priority Sewer Network
PVC	Polyvinyl chloride
QMS	Quality Management Systems
RAP	Resettlement Action Plan
RCC	Roller-Compacted Concrete
RoW	Right-of-Way
RP	Resettlement Plan
RPF	Resettlement Policy Framework
RFI	Request for Inspection
SCADA	Supervisory Control and Data Acquisition
SEA	Sexual Exploitation and Abuse
SEPA	Sindh Environmental Protection Agency
SEQS	Sindh Environmental Quality Standards, 2016
SFD	Sindh Forest Department
SH	Sexual Harassment
SKAA	Sindh Katchi Abadi Authority
SMF	Social Management Framework
SO_2	Sulfur dioxide
SOP	Standard Operating Procedures
SOPs	Series of Projects
SPs	Safeguard Policies
SSEMPs	Site Specific Environmental Management Plans
SSWMB	Sindh Solid Waste Management Board
STIs	Sexually Transmitted Infections
STP	Sewerage Treatment Plant
TFs	Trickling Filters
TLV	Threshold Limit Value
ToR	Terms of Reference
TP	Treatment Plant
TSS	Total Suspended Solids
TWA	Time Weighted Average
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
USEPA	United State Environmental Protection Agency
VECs	Valued Environmental Components
VSD	Vision of Sustainable Development
VU	Vulnerable
WB	World Bank
WBG	World Bank Group
WMP	Waste Management Plan

Executive Summary

1. The Government of Sindh (GoS) through Karachi Water and Sewerage Corporation (KWSC) is planning to implement the second phase of the Karachi Water & Sewerage Services Improvement Project (KWSSIP-2) in various parts of Karachi. One of the planned KWSSIP-2 interventions comprises of laying interceptors to collect domestic sewage from the heavily settled banks of the Malir River and construction of a 180 million Gallon Per Day (MGD) sewage treatment plant (TP-IV) to treat the collected sewage. This Environmental and Social Impact Assessment (ESIA) of the proposed project has been carried out to address the potential environmental and social (E&S) impacts of the project in compliance with the Sindh regulatory requirements and the WB Environmental and Social Framework (ESF).

2. The overall E&S risk of SOP-2 is high, based on the internal E&S risk classification of World Bank (WB), considering that the environmental risk is substantial while the social risk is high. An ESIA was prepared for Malir Basin Wastewater Interceptors and Treatment Plant to assess the E&S risks associated with the construction and operation of this subcomponent and to develop a corresponding Environmental and Social Management Plan (ESMP) that will help avoid or minimize the adverse impacts of the project to the environment and stakeholders.

3. The scope of the ESIA includes (i) review of the applicable national E&S legislative and policies, (ii) assess the existing physical, biological, and socio-economic baseline conditions, (iii) identify potential adverse and positive E&S impacts from all stages of the project, (iv) assess and compare different subproject alternatives in terms of E&S impacts, (v) identify stakeholders that are likely to be affected or have interest or a stake in the project, with emphasis on disadvantaged and vulnerable groups, and carry out consultation to solicit their concerns regarding the project, and (vi) provide ESMP for all stages of the project as a tool for the implementation of the suggested measures, along with monitoring and evaluation mechanism with adequate resources including capacity building of implementing agencies.

4. The proposed project comprises of the following key components:

   - About 22 km long wastewater Interceptors along the Malir River with chambers for receiving sewage from 20 Sewer Connections. The proposed interceptor will start at the left bank of Malir River and will pass through the districts of Malir and Korangi and the cantonment areas in Faisal and Korangi Creek.
   - Connection of TP-II bypass line and pump room (a non-operational Sewage Treatment Plant at Mahmoudabad) with the Malir Interceptors through a 2.5 km long pipeline;
   - Manholes for access and cleaning; and
   - Sewage Treatment Plant (TP-IV) with a capacity of 180 MGD located within the Korangi Creek Cantonment Area

5. The proposed interceptor will be installed in mostly agricultural, residential and commercial areas. The location of TP-IV is currently being used for livestock grazing. Water bodies that are near the proposed project include the Malri River, Thaddo Nala, Chakora Nala, Chakkra Nala, Korangi Creek and the Arabian Sea. There are about 57 trees that will be removed along the proposed interceptor alignment, all of which are not ecologically important as per IUCN. At present, dust emissions are

evident along the interceptor alignment due to the passing of vehicles in the unpaved roads. The measured $PM_{2.5}$ concentrations in all the selected monitoring stations exceeded the SEQS/WBG limits while one station exceeded the limit for PM_{10}.

6. The identified sensitive receptors near the proposed project include the Salim Habib University (Korangi Creek), Karachi Public School (Bhittai Colony), Mohammadi Masjid and M.Y. Clinic (Sidra Street).

Impacts during Construction Phase

7. The following are the potential environmental and social risks and impacts during the construction phase of the project.

Impacts related to ESS 2: Labor and Work Conditions

8. Construction workers will face occupational health and safety risks from hazards related to construction activities. To guarantee proper safety precautions are followed during construction, contractors must formulate and execute an occupational safety and health program.

9. Furthermore, workers will also be exposed to the following labor risks:

- Child labour impact might arise during construction stage, as large number of skilled and unskilled labour will be required by the contractor for the construction activities of the proposed project.
- Forced labour and/or human trafficking.
- GBV might arise due to discrimination made against women by unequal work distribution and unequal pay structure among others.
- SEA/SH against women might occur as a consequence of mixing of men and women at the construction site and camps.
- Labour exploitation such as unpaid and/or incorrect payment of wages by employer, poor working conditions

10. A Labor Management Procedure was developed for KWSSIP-2 to manage the identified labor risks. The key highlights of the LMP on how to address the issues of child and forced labor, labor influx, GBV, SEA/SH, occupational health and safety, and trafficking will be included in the bid documents of the contractors.

Impacts related to ESS 3: Resource Efficiency and Pollution Prevention Management

11. Oil or chemical spills and leaks can contaminate nearby water bodies and soil. Proper containment measures and equipment maintenance should be implemented to address leaks appropriately.

12. Wastewater from workers and construction activities, along with storm water runoff from excavated areas transporting higher suspended solids, could adversely affect water quality if discharged untreated. Temporary silt traps will be installed in the drainage system within the construction sites and temporary sedimentation basins will be installed to catch the surface run-off. Sufficient sanitary toilet facilities with septic tanks will be provided in the camp sites and construction sites. The septic tanks will discharge to the existing sewerage system with prior approval from KWSC.

13. Poor management of domestic and hazardous waste could lead to pollution of soil and water sources. Contractors need to develop and execute a comprehensive Waste Management Plan.

14. Excavation works can generate substantial dust emissions that pose health risks, especially to vulnerable groups like children and elders. Mitigation through regular water sprinkling at sites, covering excavated heaps, and other dust suppression steps should be pursued.

15. Vehicles and heavy machinery emit air pollutants during operation. Maintaining equipment in sound working order through inspections and preventive maintenance helps minimize exhaust emissions and associated impacts.

16. The use of heavy machinery and equipment during operations can produce disruptive noise levels, creating nuisance and irritation for surrounding communities and disturb the daily activities of the sensitive receptors. Regular maintenance checks on all generators, compressors, and high noise tools should be conducted to minimize noise output. As far as feasible, any unavoidably noisy construction activities should be restricted to daytime hours alone to lower disturbance.

Impacts related to ESS 4: Community Health and Safety

17. The project construction will boost economic activity in the area, generating employment for around 600 skilled and unskilled workers. Hiring locally qualified laborers should be prioritized where possible. Influx of workers also presents business opportunities for locals to meet daily demands for food, lodging, etc.

18. The intersection of the interceptor sewer with key roadways including Korangi Link Road, EBM Causeway, Korangi Crossing Road and Baloch Colony Road could create major traffic disruption during the excavations and pipe jacking operations. Lengthy road detours or complete closures would severely impact commuters and transport in the vicinity. Additionally, trucks delivering construction materials to work sites would further congest local roads. The Contractor shall develop and implement a Traffic Management Plan.

19. Open excavations could pose safety risks to pedestrians and vehicles, especially at night if left un-barricaded. Warning signs and safety signage will be erected and proper lighting at night will be provided to prevent accidental falls.

20. Influx of workers could introduce communicable and vector-borne diseases into the community warranting worker training, public health awareness drives and disease surveillance efforts.

21. Probable rise in crimes like theft, gender-based violence, substance abuse requires enforcement outlined in Labor Management Procedures to maintain community security. Labor-community social conflicts will be mediated through an operational Grievance Redress Mechanism to resolve issues.

Impacts related to ESS 5: Land Acquisition, Restriction on Land Use and Involuntary Resettlement

22. Disturbance to livelihoods is the foremost potential socio-economic impact from the construction of the project, mainly associated with the agriculture being performed in the riverbed. The project will temporarily affect the livelihood of 38 Project Affected Persons (PAPs). The crops cultivated along the alignment of the interceptor could be directly affected due to construction activities. Consulted

PAPs recognized that all the land they cultivate belongs to the GoS. Since they are non-title holders, no land acquisition will be required; however, as per WB ESS5, compensation will be paid for standing crops within the alignment and for other temporary structures such as cattle farms. Measures to address these livelihood impacts have been included in the Resettlement Plan (RP) – a stand-alone document prepared in accordance with the WB ESS5.

Impacts related to ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

23. Approximately 57 trees located within the right-of-way corridor are anticipated to be cleared during project construction. A provisional tree replanting sub-plan has been formulated specifying that tree removal activity will be restricted only to vegetation directly within this corridor. Further, compensatory replanting of trees will be mandated to replace trees removed.

Impacts related to ESS 7: Indigenous People

24. There are no know tribal or indigenous people within CoI.

Impacts related to ESS 8: Cultural Heritage

25. There are no cultural sites within the CoI. However, shrine, graveyards and mosques are located within the CoI that may be exposed to the environmental and social impacts of the project.

Impacts during Operation Phase

Impacts related to ESS 2: Labor and Working Condition

26. Workers are exposed to occupational health and safety hazards related to the operation and maintenance of the interceptor and STP. An OSH program should also be developed and implemented.

27. Workers and staff at TP-IV can be exposed to pathogens in sewage. Vectors for sewage pathogens include insects (e.g., mosquitoes, flies), rodents (e.g., rats), and birds (e.g., gulls). A comprehensive plan will be developed and implemented to manage and avoid vector-borne diseases, also considering the seasonality of the issue.

28. Labor risks such as labor exploitation, child and forced labor, GBV and SEA/SH are also a potential risk due to the influx of labor during the O&M. The LMP developed for KWSSIP should also be implemented during operation phase.

Impacts related to ESS 3: Resource Efficiency and Pollution Prevention Management

29. The following may contaminate the soil and water sources if not properly managed.

- Solid wastes and hazardous wastes will be generated during operations. A Waste Management Plan will be strictly implemented.
- Inadequately treated effluent, leaks and overflows from the interceptor and STP. KWSC will ensure that the STP is properly operated and maintained. The quality of the treated effluent shall be regularly monitored.

- Sludge generated from STP. Dried sludge from the STP will be reused for horticultural activities. Prior to transport of the sludge to the end-users, sludge quality in terms of pathogens and heavy metals will be monitored.

30. The operation of the STP is expected to improve the water quality in Malir River, Korangi Creek and Arabian Sea by treating wastewater. The proposed interceptor line will redirect sewage presently discharged untreated into Malir River towards TP-IV for treatment, thereby decreasing pollutant loads to the river. Additionally, the properly treated plant discharged to Korangi Creek will lessen contamination volumes as compared to the present situation with raw sewage outfalls.

31. As Korangi Creek drains into the Arabian Sea, enhanced water quality within the creek from the proposed wastewater treatment is expected to produce secondary benefits for connected waters. The reduction in pollution and contaminants discharged to the creek will translate into lower effluent loads flowing downstream into the Arabian Sea. Declining pollutant exposure from this project may aid in preserving adjacent mangrove areas and aquatic ecosystems which are presently impacted by high wastewater contamination emanating from the city.

Impacts related to ESS 4: Community Health and Safety

32. The operation of Malir Basin and TP-IV will need 193 workers, which provides employment opportunities to the local community.

33. The local community may face health and safety risks from the following O&M related activities. An OSH program shall be strictly implemented during O&M activities.

- Screenings from interceptor and TSP may attract rodents and vectors which may cause the spread of vector-borne diseases. A solid waste management plan shall be implemented. Waste material removed from the interceptor and STP shall be disposed of through SEPA-certified hazardous waste handlers.
- Maintenance of the interceptor will require opening of manholes which may pose falling hazard. Barricades and warning signages will be provided onsite.
- Methane gas from the anaerobic digestion of sludge may cause fire and explosion. Flaring of methane will be done and monitored daily.
- Odor generation from TP-IV could be expected during operational phase. Proper maintenance of the STP components will be ensured during operation to ensure that it will not emit foul odors.

34. The large inflow of laborers and outside contractors into the local communities may escalate crime rates and the sense of insecurity among residents. Such unlawful conduct could encompass offenses like theft, gender-based violence, narcotics use, sexual assault, and human trafficking. Addressing these risks through enforcement and oversight is necessary to safeguard vulnerable groups from potential exploitation.

35. The end-users of the dried sludge in horticulture and the consumers of the products are also at risk from the excreta-related pathogens and heavy metals that the sludge may contain. A Sanitation Safety Planning shall be conducted to systematically identify and manage health risk along the sanitation chain and to maximize the potential benefits of reusing the sludge while minimizing the health risks.

36. Removal of raw sewage from the Malir River will improve the overall hygienic condition of the area thereby reducing the incidence of water-borne diseases and positively affecting the health of the population. This in turn will reduce their expenditure associated with healthcare.

Environmental and Social Management Plan

37. In addition to the ESMP developed to mitigate the identified environmental and social risks, a Stakeholder Engagement Plan, a Labor Management Procedure, and a Resettlement Action Plan were developed for this project.

38. A CESMP should also be developed by the contractors to demonstrate their approach to how to comply with the ESMP.

39. An Environmental and Social Monitoring Plan was also developed to monitor and verify the effectiveness of the implementation of mitigating measures in terms of minimizing the negative impacts. The main E&S monitoring parameters during construction include monitoring of excavation works with disposal, environmental quality monitoring (air, noise and drinking water), occupational and community health and, safety etc.

40. The Operational Phase Monitoring Plan incorporates a comprehensive set of monitoring parameters designed to validate the positive impacts of the project. These parameters include treated effluent disposal, where the quality of discharged effluent will be regularly assessed to ensure compliance with environmental standards. Sludge management will be monitored to track the recycling and utilization of nutrient-rich sludge as a fertilizer and soil improver. Odour generation, pathogens, and vectors will be continuously evaluated to mitigate potential environmental and health risks. Moreover, the plan focuses on improvement in ground water quality within the interceptor AoI, with regular testing and analysis of groundwater parameters. The Health Profile in the Interceptor's AoI will be closely monitored, tracking changes in public health indicators to validate the project's positive impact on the community's well-being. Additionally, Mangrove Health will be assessed through periodic surveys and measurements of mangrove density, biodiversity, and overall ecosystem health, ensuring the protection and enhancement of the Korangi Creek mangroves. These monitoring efforts underscore the project's commitment to sustainability, environmental responsibility, and community welfare throughout its operational phase.

41. The total estimated cost for the environmental and social management, monitoring, and auditing during pre-construction, construction, and O&M (annual cost and will be updated for next upcoming years accordingly) comes to about **PKR 45.471 Million**, excluding resettlement and compensation cost.

Institutional Arrangement

42. The proposed project is under the PIU of KWSSIP-2 during the pre-construction and design phase. The Project Director (PD) has the overall responsibility for the design and pre-construction requirements. During construction, the ESC will be responsible for the overall implementation of the ESMP, RP, and other related requirements. The operation of the project will be under the direct jurisdiction of Engineers and Plant Managers, who shall also be responsible for the monitoring and compliance with the ESMP.

Grievance Redress Mechanism

43. A Grievance Redress Mechanism (GRM) was developed to address any complaints or grievances that may arise during the implementation of the project. Complaints will include, but not limited to, E&S issues (dust, noise, air pollution, social and cultural issues), damage and blockage of public utilities, traffic inconvenience, gender-based violence (GBV) and harassment, resettlement issues including loss of livelihood; and issues related to compensation of resettlement impacts. Separate Grievance Redress Committees (GRC) are to be formed for the community, subproject and at the PUI level. A GRC dedicated to resolve GBV-related issues will also be formed. The objectives of the GRM are (i) establish an organizational structure to resolve any grievances from individuals and communities fairly and equitably, (ii) provide a platform for the aggrieved individual or community to deliver their grievances, (iii) ensure that affected communities and individuals are treated fairly at all times, (iv) identify flaws in the operational functions of the project and suggest corrective measures; and (v) ensure the sustainability of the project. Complainants may lodge their grievances through several channels, including online, mail, phone, WhatsApp, e-mail, and complaint boxes. Moreover, PIU has established an e-Portal for filing and tracking progress of complaints lodged online.

44. This ESIA report should be updated as needed due to changes in the project design, changes in the baseline conditions, or identification of potential new impacts.

1 Introduction

1.1 Background

1. The Government of Sindh (GoS), through the Karachi Water and Sewerage Corporation (KSWB), will be implementing the Second Karachi Water and Sewerage Improvement Project (KWSSIP-2) to improve the access to safe water supply and sewerage services in Karachi, Pakistan. This is the second series of projects (SOP-2) of the KWSSIP, which will deepen the reforms commenced under the SOP-1.

2. The SOP-2 has three (3) project components: Component 1 will finance reform and capacity building measures; Component 2 will undertake selected infrastructure investments, thereby ameliorating water and sewer services in Karachi and increasing the city's resilience to water shortages, floods, and saltwater intrusion; and Component 3 will fund project management and associated studies.

3. Under Component 2 of SOP-2 is the subcomponent Malir Basin Wastewater Interceptors and Treatment Plant (the "Project"). This subcomponent involves the construction of interceptor drains along Malir River and a 180 million gallons per day (MGD) Sewage Treatment Plant (TP-IV). The Project aims to collect and treat the sewage generated from the left and right bank settlements of Malir River, specifically in the entire District Korangi (Korangi, Landhi and Shah Faisal Towns), part of District Malir (Malir Town), part of District East (Jamshed Town) and Cantonment Areas, including Faisal Cantonment and Korangi Creek Cantonment.

1.2 Purpose of the ESIA

4. The overall risk of KWSSIP SOP-2 has been classified as substantial for environment and high for social, which includes the risk for gender-based violence (GBV), sexual exploitation and abuse or sexual harassment (SEA/SH). The Project's overall environmental and social (E&S) risk is therefore categorized as high. Thus, an Environmental and Social Impact Assessment (ESIA) should be prepared.

5. This report is the ESIA for the Malir Basin Wastewater Interceptors and Treatment Plant, a subcomponent of KWSSIP SOP-2. The objective of this ESIA is to assess the environmental and social risks associated with the activities of this subcomponent and to develop an Environmental and Social Management Plan (ESMP) to minimize the impacts of the identified risks.

1.3 Scope of the ESIA

6. This ESIA has the following scope:

- Facilitate PIU of KWSSIP in ensuring environmental and social sustainability of the project;
- Establish a baseline of existing E&S conditions prior to project initiation by collecting secondary and primary data/information on physical, biological, and socio-economic environment of the project area;
- Identify potentially significant E&S impacts (both positive and negative) during all stages of the project;

- Avoid, minimize, and suggest mitigation and compensation measures for significant adverse impacts;
- Conduct, record, and report public consultation and participation with major stakeholders; and
- Provide ESMP for all stages of the project as a tool for the implementation of the suggested measures, along with monitoring and evaluation mechanism with adequate resources including capacity building of implementing agencies.

7. Besides this ESIA, a separate Resettlement Plan (RP) has also been developed for this Project. Furthermore, the following documents prepared for the whole KWSSIP-2 Project[1], also apply to the proposed project:

- Environmental and Social Commitment Plan (ESCP);
- Stakeholder Engagement Plan (SEP); and
- Labor Management Procedures (LMP).

1.4 ESIA Methodology

8. The study has been conducted in accordance with the applicable environmental and social policies, laws, guidelines, acts and legislations of the Government of Pakistan (GoP) and Sindh (GoS) and the World Bank (WB) Environmental and Social Framework (ESF) and its relevant Environmental and Social Standards (ESSs).

9. The ESIA study was conducted based on field level primary data collection, review of secondary information, discussions with experts of various disciplines and consultations with the affected communities and institutional stakeholders. The methodology employed for the ESIA is discussed below.

1.4.1 ESIA Study Area

10. The area of influence (AoI) covers the areas that are likely to be directly or indirectly impacted by the Project. The direct impact area (DIA) includes the construction sites of the interceptors and the treatment plant. The indirect impact area (IIA) includes the areas adjacent to the project construction sites that may experience the impacts of the construction or operation of the Project.

11. **Table 1-1** defines the AoI considered for the assessment of impacts. The extent of the IIA has been determined by the reach of impacts such as noise and air pollution.

1 For other sub-projects under KWSSIP-2, a number of relevant E&S studies have been carried out including Ecological Assessment and Biodiversity Action Plan (BAP); ESIA for K-IV Augmentation Works; ESMPs and RPs for Water Supply and Sewerage in Additional Low-Income Communities (Katchi Abadis), Priority Sewer Network Rehabilitation and Extension and Rehabilitation of Wastewater Pumping Stations, Priority Water Network Rehabilitation and Extension, Reducing Energy Consumption, and Rehabilitation of Existing and Construction of New Filtration Plants.

Table 1-1: Project Study Area –Area of Influence (AoI)

No.	Project Components / Sites	Direct Impact Area (DIA)	Indirect Impact Area (IIA)
1-	Interceptor spanning over 22 km stretch, starting from Afridi Colony Area - Bin Qasim Town and terminating at TP-IV along with 20 Sewer Connections through Intake Structures	Main construction / trenching area, space for the movement of machinery / dumper trucks and spaces for temporarily stocking the excavated material along excavated trenches.	500 m (250 m from the center line on both sides)
2-	TP-II bypass line and Pump room Connection with Interceptor spanning over 2.5 km stretch, starting from TP-II Pump Room and terminating at the Interceptor opposite Manzoor Colony Fire Station	Main construction area: ◆ 210 m from TP-II Pump Room to Mahmudabad No. 04 Main Road; ◆ 300 m along Mahmudabad No. 04 Main Road till Street No. 17/D – Mahmoudabad and from there 380 m along the street till Manzoor Colony Drain; ◆ 1.2 km along Manzoor Colony Drain till Manzoor Colony Fire Station; and ◆ 410 m from fire station to across the Shaheed e Millat Road and Malir Expressway to Interceptor.	60 m (30 m from center line on both sides)[2]
3-	TP-IV Site	Main Construction Area spanning over approximately 0.429 Sq. km (106 acres)	100 m from the proposed treatment plant boundary wall on all sides
4-	Access roads	Three (3) access roads leading to the project area that may face increased traffic, dust, noise, and safety impacts due to the movement of heavy equipment, vehicles, and materials to and from the project site during construction.	50 m (25 m from the center line on both sides)

2 Due to narrow façade to façade width of the TP-II to Interceptor corridor

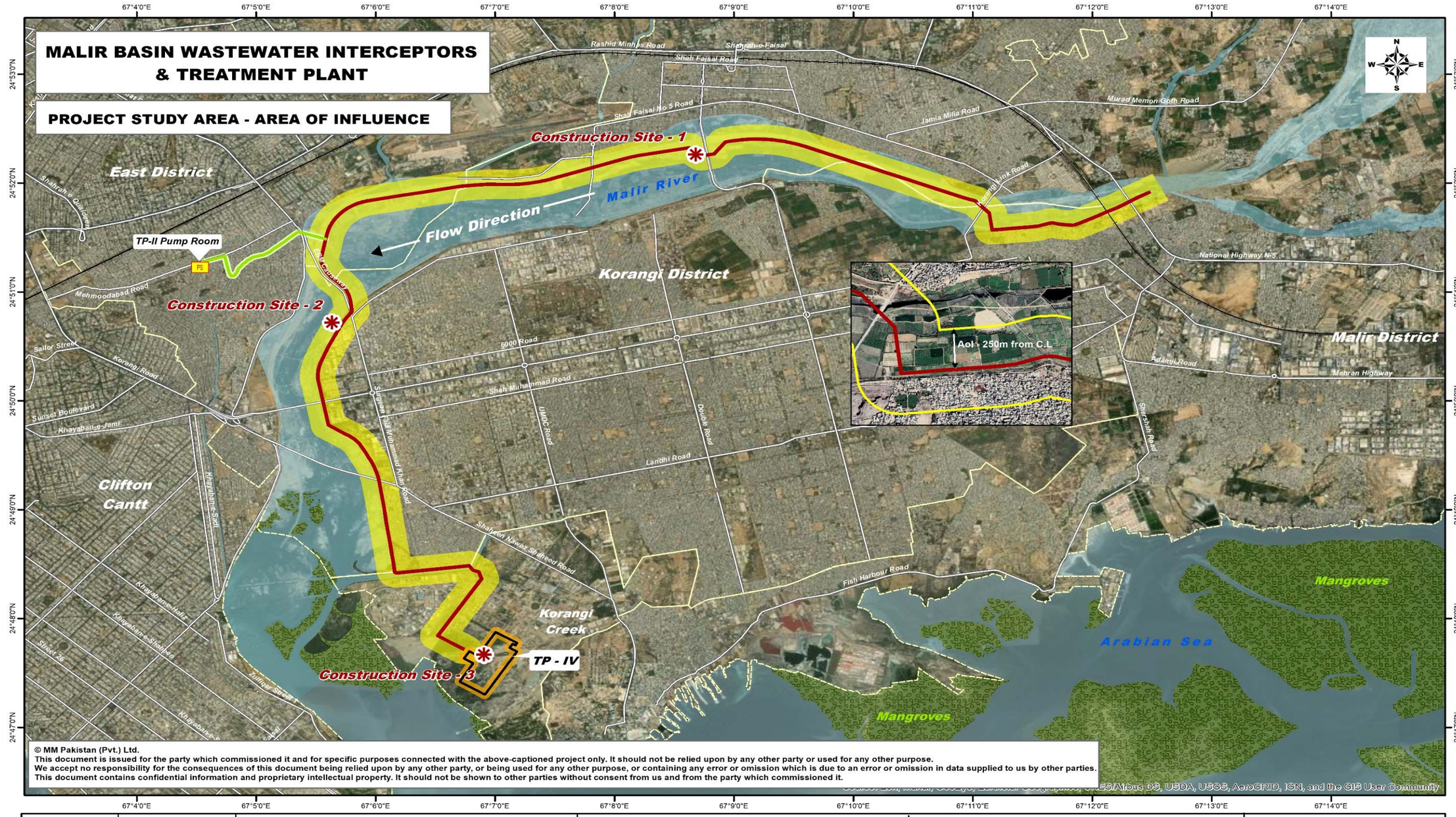


Figure 1-1: Project Study Area – AoI

1.4.2 Primary Data Collection (Baseline Surveys)

12. Field surveys were carried out for the collection of primary environmental and social baseline data within the AoI from December 2021 and July 2022.

13. The environment surveys focused on the collection of site-specific baseline information of water quality, air quality, noise, traffic situation, land-use, sensitive receptors, and presence of any historical / cultural / archaeological sites, etc.

14. The ecological survey focused on the collection of baseline information on floral and faunal species. Detailed inventory has been prepared by the ecology team for the trees growing within the main construction areas and are required to be cut. Other vegetation growing in the AoI but will not be affected by the construction activities has also been recorded. The unidentified plants were photographed and identified using "PlantNet[3]" software. Data on the fauna was gathered through random sampling and observations along the alignments, visual encounters, incidental observations, and indirect methods such as recording pug marks.

15. Socio-economic baseline information has been obtained mainly through focused group discussions (FGDs) with male and female groups of the communities in the AoI. Social surveys were focused on aspects related to households, education, health situation, diseases, income, gender-related problems, businesses, presence of social organizations, and political patterns.

16. During the social surveys, FGDs and Key Informant Interviews (KIIs) were conducted with sample population representing project-affected parties and other interested groups along with extensive desktop data review. Women surveys have also been conducted and gender responses have been recorded to assess the socio-economic status of women in the project's AoI.

1.4.3 Secondary Data Collection and Analysis

17. This involved collecting information from the PIU KWSSIP and Technical Consultants regarding the proposed project activities. The design documents and feasibility reports have been thoroughly reviewed to understand the extent of construction works and their potential outcomes on the existing environment and social conditions.

18. Literature review has been conducted of the available environmental and social baseline information of the project area. The applicable provincial policies, guidelines, legislations, and WB ESS were also thoroughly studied. Secondary data sources have been used to study the aspects including; climate, rainfall, temperatures, geology, soils; flora and fauna profiles, critical habitats / vegetation, any sites / structures / natural features having archaeological / historical / architectural / religious or cultural significance; and socio-economic and livelihood conditions in the project area.

1.4.4 Reconnaissance Surveys, Delineation of the AoI, and E&S Screening

19. Reconnaissance surveys have been carried out to assess the existing environmental and social conditions in the project area that may potentially be affected by the proposed project interventions.

3 PlantNet is an application that allows to identify plants simply by photographing them with smartphone. It allows to identify and better understand all kinds of plants living in nature: flowering plants, trees, grasses etc. PlantNet claims 99% accuracy identifying common species and overall 95% rate with a database of more than 10,000 plant species.

AoI has been decided by the consultant team based upon the assessment on possible reach of impacts and consultants past similar field experience. Screening has been performed to determine the significance of impacts, and the appropriate ESA instrument required for the project.

20. Applicable national and provincial legislation, international agreements, environmental guidelines of both SEPA and WB, and best industry practices have been reviewed to set environmental standards that PIU KWSSIP as the executing agency will adhere to during implementation of the project.

1.4.5 Stakeholder Consultations

21. At the outset of the project a process of stakeholder identification and analysis was undertaken in line with the KWSSIP-2 SEP guidelines to identify the range of affected and interested stakeholders and the most appropriate means of engaging with them. According to the SEP, consultations with Primary Stakeholders - Project Affected Parties (i.e., local communities, community members and other parties that may be subject to direct impacts from the Project) and Secondary Stakeholders - Other Interested Parties (i.e., Government Departments / Organizations) have been required for the ESIA in a detailed manner.

22. Stakeholder identification and consultation were done as per the SEP of KWSSIP-2. The project stakeholders were identified during inception/scoping stage and meetings and digital communication were held with them during the field surveys to receive feedback on the anticipated E&S issues related to the project impacts and suggested mitigation measures. KWSSIP also wrote letters to the concerned departments for communicating project related information and soliciting their feedback. Outcomes of stakeholder consultations are detailed in the SEP.

23. A stakeholder consultation workshop was also conducted to engage the concerned primary and secondary stakeholders including KWSC, PIU – KWSSIP, citizen groups, representatives of Non-Government Organizations (NGOs), Community Based Organizations (CBOs), civil society, Karachi Metropolitan Corporation (KMC), District Municipal Corporations, provincial Government Departments, and representatives from the academia and Subject Specialists. The workshop was arranged on July 28, 2022 at the Regent Plaza Karachi. About 70 representatives (of 47 entities) took part in the workshop. The consultation workshop was conducted in relation to information disclosure and stakeholder's engagement on KWSSIP-2 Project.

1.4.6 Impact Identification and Risk Assessment

24. Potential impacts arising from each phase of the proposed project have been identified and assessed based on field data, secondary data, expert opinions and examining previous similar projects in Pakistan. These include effects on physical, biological, and socio-economic environment.

25. The methodology for assessing the risk level associated with each potential impact is presented below. Risk is assessed as the likelihood that the activity will have an effect on the environment as well as the consequence of the effect occurring:

Risk = Likelihood × Consequence

Table 1-2: Likelihood Scale

Likelihood	Definition	Scale
Certain	Will certainly occur during the activity at a frequency greater than every week if preventative measures are not applied	5
Likely	Will occur more than once or twice during the activity but less than weekly if preventive measures are not applied	3
Unlikely	May occur once or twice during the activity if preventive measures are not applied	2
Rare	Unlikely to occur during the project	1
Adapted from: EPA Victoria, 2004. Site EMP Kit- Guidance Notes		

Table 1-3: Consequence Scale

Consequence	Definition	Score
Catastrophic	The action will cause unprecedented damage or impacts on the environment or surrounding communities. Occurrence will almost certainly result in the work being halted and a significant fine.	5
Major	The action will cause major adverse damage on the environment or surrounding communities. Occurrence may result in work being halted and a fine.	3
Moderate	The action will cause limited adverse impacts on the environment or surrounding communities, work is unlikely to be halted, fines unlikely.	2
Minor	No or minimal adverse environmental or social impacts; no likelihood of being fined.	1
Adapted from: Environmental Management for Construction Handbook-Safeguards Unit Central & West Asia Department - ADB)		

Table 1-4:Risk Score Table

		Consequence			
		Catastrophic	**Major**	**Moderate**	**Minor**
Likelihood	Certain	**25**	**15**	**10**	5
	Likely	**15**	**9**	6	3
	Unlikely	**10**	**6**	4	2
	Rare	5	3	2	1
Risk	**Significant**	**15-25**			
	Medium	**6-10**			
	Low	**1-5**			

1.4.7 Recommendations for Mitigation Measures

26. Mitigation measures to minimize, eliminate, or compensate for the potential E&S impacts have been recommended based on past experiences, best industry practices, legislative requirements, and professional judgment.

1.4.8 Environmental and Social Management Plan (ESMP)

27. An Environmental and Social Management Plan (ESMP) has been developed for effective implementation of the recommended mitigation measures. The ESMP includes controls to minimize the identified impacts and a monitoring program to monitor effects of mitigation measures implemented and residual impacts, if any, during implementation. The ESMP has identified roles and responsibilities of all concerned parties during the implementation of the project. It defines prequalification criteria and obligation of the contractors, institutional arrangements of all stakeholders, monitoring mechanism, and capacity building arrangements to effectively implement the mitigation measures and preventive actions identified during the ESIA study.

2 Policy, Legal and Administrative Framework

2.1 General

28. This Chapter summarizes the national and provincial legislation, the World Bank (WB) and other international environmental and social standards, and treaties relevant to this ESIA. The footprint of the Project is located in the administrative boundaries of Sindh Province of Pakistan; therefore, the rules, regulations, and standards applicable in Sindh are applicable to this project. The World Bank Group (WBG) EHS Guidelines shall also be followed during the project implementation.

2.2 Review of the National and Provincial Environmental Requirements

29. The applicable E&S legislations and regulations are briefly described in **Table 2-1**.

Table 2-1: Applicable National and Provincial Acts

National/Provincial Acts (Year of implementation)	Relevance / Applicability
Sindh Environment Protection Act, 2014	Sindh Environmental Protection Act 2014 is relevant to the proposed project, requiring an Environmental Impact Assessment (EIA) to be prepared and submitted for this project for approval.
Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021	Environmental Assessment Regulations -- 2021 are applicable to the proposed intervention for Review of EIA and General Environment Approval, as the project falls under Schedule-III.
Sindh Environmental Quality Standards 2016	Standards set out in SEQS and relevant to the Project include: ◆ Municipal and liquid industrial effluents (32 parameters) ◆ Industrial gaseous emissions (16 parameters) ◆ Motor vehicle exhaust and noise (used and new vehicles) ◆ Ambient air quality (9 parameters) ◆ Noise (four zones during day and night). These standards are applicable for both construction and operational phases of the project.
Pakistan Climate Change Act 2017	Under the Pakistan Climate Change Act 2017, any intervention in the country must take measures for comprehensive climate change mitigations and adaptations in line with country level commitments to United Nations Framework Convention on Climate Change (UNFCCC) and therefore this is relevant.
Forest Act (1927) and the Forest Act (Sindh amendment) Act, 2012	The Forest Act of 1927 and its Sindh Amendment 2012 establishes the right of GoP and GoS to designate areas of reserved forest, village forest and protected forest. The act also restricts cutting of any trees that are the property of forest department. It has been confirmed through the site surveys that no protected forests are present within the Project AoI, however the act shall be applicable as the project shall require cutting of 37 nos. trees and the Contractor shall be required to take prior permissions and approvals from the forest department for cutting of trees
Sindh Plantation, Maintenance of Trees and Public Parks Ordinance, 2002	Under this Ordinance, prior permission from the Local Government Department (LGD - GoS) shall be needed for any tree cutting activity during the project construction. Since the project involves cutting trees, prior permission and consent of the LGD – GoS shall be sought. Implementation of this law shall be mandatory at the project.
Antiquity Act (1975) and the Sindh Cultural Heritage (Preservation) Act, 1994	These Acts areas are applicable to the project and the Office of the Director General – Antiquities & Archaeology – GoS shall be informed in case of any resource found. As for now, there are no

National/Provincial Acts (Year of implementation)	Relevance / Applicability
	known antiquities in the project area; however, in case of chance find this act shall become relevant.
Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020	This act is relevant to the project as the faunal species detailed could be encountered during construction activities, hence implementation of this law shall be mandatory during the construction phase of the project.
Factories Act, 1934 and The Sindh Factories (Second Amendment) Act, 2021	This is an act to consolidate and amend laws on labor rights and for matters connected to their safety, basic welfare facilities including living, food, occupational health including infectious diseases and protection from those infectious diseases; it also covers the work-related hazards and protection from those hazards, shelters facilities during rest time, restriction of working hours and holidays rules etc. The Sindh amended law is for the rights of labor working in the province of Sindh and shall be applicable to the proposed works.
The Sindh Occupational Safety and Health Act, 2017	This is a consolidated law for the OHS of the persons at workplace and to protect them against risks arising out of the occupational hazards; to promote safe and healthy working environment catering to the physiological and psychological needs of the employees at workplace and is relevant to the project
The Sindh Bonded Labour System (Abolition) Act, 2015	The Bonded Labour System (Abolition) Act defines the `Bonded Labour System' as a system of forced, or partly forced, labor under which a debtor enters, or is presumed to have entered into an agreement with the creditor. Adherence to the act shall be mandatory.
Sindh Minimum Wages Act, 2015 (Sindh Act No. VIII of 2016)	The Act provides for the regulation of minimum rates of wages and various allowances for different categories of workers employed in the project; various types of workers employed for the project will be paid accordingly.
Sindh Workers Compensation Act, 2015	This act is expedient to provide for the payment by certain classes of employers to their workers or their legal heirs of compensation for injury or death by accident. Implementation of the act at the project shall be mandatory.
Fatal Accidents Act 1855	This is an Act to provide compensation to families for loss occasioned by the death of a person caused by actionable wrong. For community related accidents, this law shall be applicable.
The Sindh Prohibition of Employment of Children Act, 2017	The Act prohibit and regulate employment of children less than 14 years and is applicable to the project and the Contractors and sub-contractors will have to comply with this Act.
The Protection Against Harassment of Women at the Workplace Act, 2010	The Protection Against Harassment of Women at the Workplace Act, 2010 is a legislative act in Pakistan that seeks to protect women from sexual harassment at their place of work, and equally applicable to this project.
Land Acquisition Act 1894 and The Land Acquisition (Sindh Amendment) Ordinance, 1992	Empowers the provincial government to acquire private land, from its legal owners, for projects in the national interest. The project does not require private land acquisition; however, it will cause disturbance of livelihood to the communities utilizing patches of Malir riverbed for agriculture and cattle farming purposes. This act is however not applicable as the communities utilizing this land for their livelihood do not possess legal land ownership. They will however be compensated as per ESS5 guidelines and an RP has been prepared for this purpose. **(Annexure 2-1)**
The Sindh Local Government (Amendment) Act, 2021	The LGA empowers the provincial governments to enforce laws for: ◆ Land use ◆ Conservation of natural vegetation

National/Provincial Acts (Year of implementation)	Relevance / Applicability
	◆ Air, water, and land pollution ◆ Disposal of solid waste and wastewater effluents ◆ Public health and safety, including some provisions for environmental protection. Under the act, the local councils are authorized to restrict activities causing pollution. The Project will be required to follow the provisions of the Act to ensure prevention of air, water and land pollution, safe disposal of waste and implementation of safe work practices
Hazardous Substances Rules, 2014	The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. General safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are also described in these rules. The proposed project might generate hazardous waste in the form of sludge from the wastewater treatment plan, fuel, or chemical spills. Hence, the set Rules are applicable to the proposed project. Accordingly, the guideline for a Waste Management Plan has been developed aligned with these rules **(see Annexure 7-2)**
Building Code of Pakistan, 2007	The provision of Building Code of Pakistan shall apply for engineering design of building like structure and related components. The construction in violation of the Building Code shall be deemed as violation of professional engineering work. Moreover, a certificate for the proposed action will be obtained from Provincial Building Control Authority.

2.3 Comparison of International and Local Environmental Quality Standards

Effluent Quality

30. Design basis of TP-IV is provided as **Table 2-2.** Considering that the WBG EHS Guidelines are more stringent than SEPA, the same will be followed for treated effluent discharge into the sea.

Table 2-2: Design Basis of TP-IV (all values are in mg/l)

	Inflow (untreated)	Outflow (treated)	SEQS	WBG EHS Guidelines
Total Suspended Solids	200	50	200	50
Biochemical Oxygen Demand $(BOD)_5$	200	30	80	30
Chemical Oxygen Demand (COD)	500	125	400	125

Sludge Disposal and/or Reuse

31. Since local regulations or regulatory guidelines are absent for establishing standards governing the use or disposal of sewage sludge, the project's executing agency must adhere to the US EPA Standards (40 CFR Part 503) outlined in this section when designing and implementing the sewage sludge recycling or reuse process.

32. If bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site, the project must adhere to either of the following conditions:

33. The cumulative loading rate for each pollutant must not exceed the cumulative pollutant loading rate specified in **Table 2-3** below:

Table 2-3: Cumulative Pollutant Loading Rates

Pollutant	Cumulative Pollutant Loading Rate (kg/ha)
Arsenic	41
Cadmium	39
Copper	1,500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2,800

34. When bulk sewage sludge is applied to a lawn or a home garden, the concentration of each pollutant in the sewage sludge should not exceed the concentration limits outlined in **Table 2-4** below:

Table 2-4: Monthly Average Pollutant Concentrations

Pollutant	Monthly Average Concentration (mg/kg) - Dry Weight Basis
Arsenic	41
Cadmium	39
Copper	1,500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2,800

35. Table 2-5 presents WHO's guideline if sludge will be reused in agricultural activities.

Table 2-5: WHO guidelines for Sludge Reuse in Agriculture

Pollutant	Guideline Value
Helminth Eggs	<1 /grams total solid
E. Coli	<1000/grams total solid

Ambient Air Quality

36. Comparison of local and international air quality standards is provided as **Table 2-6**. The more stringent of the two shall be followed during the project construction and implementation. The stringent of the two are highlighted with green, which are applicable at the project.

Table 2-6: Comparison of Local and International Air Quality Standards

Pollutants	SEPA		WHO / WBG	
	Avg. Time	Standard	Avg. Time	Standard
SO_2	24 hrs	120 ug/m^3	24 hr 10 min	40 ug/m^3 500 ug/m^3
CO	8 hrs 1 hr	5 mg/m^3 10 mg/m^3	8 hrs	4 ug/m^3
NO_2	24 hrs	80 ug/m^3	24 hr	25 ug/m^3
O_3	1 hr	130 ug/m^3	-	-
SPM	24 hrs	500 ug/m^3	-	-
PM_{10}	24 hrs	150 ug/m^3	24 hr	45 ug/m^3
$PM_{2.5}$	24 hrs	75 ug/m^3	24 hr	15 ug/m^3

Noise Level

37. Comparison of local and international noise standards is provided as **Table 2-7**. The more stringent of the two shall be followed during the project construction and implementation. The stringent of the two are highlighted with green, while the similar values are highlighted with yellow, and these highlighted values are applicable at the project.

Table 2-7: Comparison of Local and International Noise Standards

Category of Area/Zone	Limit in dB(A) Leq			
	SEPA		WHO/WBG	
	Day Time	Night Time	Day Time	Night Time
Residential area (A)	55	45	55	45
Commercial area (B)	65	55	70	70
Industrial area (C)	75	65	70	70
Silence zone (D	50	45	55	45

2.4 International Treaties and Conventions

38. The relevant international treaties and conventions to the project to which Pakistan is a party are as follows:

2.4.1 International Labour Organization (ILO) Fundamental Conventions – Ratified by Pakistan

39. The following ILO's fundamental conventions shall be applicable:

- Forced Labour Convention, 1930 (Convention No. 29)
- Freedom of Association and Protection of the Right to Organize Convention, 1948 (Convention No. 87)
- Right to Organize and Collective Bargaining Convention, 1949 (Convention No. 98)
- Equal Remuneration Convention, 1951 (Convention No. 100)
- Abolition of Forced Labour Convention, 1957 (Convention No. 105)
- Discrimination (Employment and Occupation) Convention, 1958 (Convention No. 111)
- Minimum Age Convention, 1973 (Convention No. 138) Minimum age specified: 14 years
- Worst Forms of Child Labour Convention, 1999 (Convention No. 182)

2.5 World Bank Environmental, Health and Safety Guidelines

40. World Bank Group's Environmental, Health, and Safety (WBG EHS) Guidelines are applicable to the proposed project. In particular, the applicable guidelines for construction and operational phases of the project include the General EHS Guidelines (2007), the EHS Guidelines for Waste Management Facilities (2007), and the EHS Guidelines for Water and Sanitation (2007).

2.6 World Bank Environmental and Social Framework

41. The World Bank Environmental and Social Framework (WB ESF) sets out the WB commitment to sustainable development, through a Bank Policy and a set of ten (10) Environmental and Social

Standards (ESS) designed for environmental and social sustainability. The applicability of each ESS to the project is given in **Table 2-8.**

Table 2-8: World Bank Environmental and Social Standards Applicable to the Project

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
ESS-1 Assessment and Management of Environmental and Social Risks and Impacts	• Identify, evaluate and manage the environment and social risks and impacts of the project in a manner consistent with the ESSs. • Adopt a mitigation hierarchy approach to: (a) Anticipate and avoid risks and impacts; (b) Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels; (c) Once risks and impacts have been minimized or reduced, mitigate; and (d) Where significant residual impacts remain, compensate for or offset them, where technically and financially feasible. • Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and they are not disadvantaged in sharing development benefits and opportunities resulting from the project. • Utilize national environmental and social institutions, systems, laws, regulations and procedures in the assessment, development and implementation of projects, whenever appropriate. • Promote improved environmental and social performance, in ways which recognize and enhance Borrower capacity	Conduct an environmental and social assessment of the proposed project, including stakeholder engagement. Undertake stakeholder engagement and disclose appropriate information in accordance with ESS10. Develop an ESCP, and implement all measures and actions set out in the legal agreement including the ESCP. Conduct monitoring and reporting on the environmental and social performance of the project against the ESSs.	The overall risk of KWSSIP SOP-2 has been classified as substantial for environment, and high for social which includes the risk for sexual exploitation and abuse and sexual harassment (SEA/SH). The overall E&S risk is categorized as high thus, Environmental and Social Impact Assessment (ESIA) should be prepared.	Sindh Environmental Protection Act 2014 SEPA (Review of IEE and EIA) Regulations, 2014. • The Provincial Act and the Review of IEE/EIA Regulations contain procedures and guidelines for the assessment, evaluation and mitigation of impacts for development projects. However, it categorizes the risk level of a project indirectly – mostly by project type and size. • Furthermore, it does require commitment from the proponents for E&S measures implementation but not in the form of a separate environmental and social commitment plan Also, while ESS-1 specifically mentions disadvantaged or vulnerable groups, the Act does not touch upon this theme directly.	◆ This ESIA has been conducted in compliance with this ESS. ◆ Project components were thoroughly screened to ensure that they are covered by and meet the requirements of ESS and Government laws and regulation ◆ E&S risks and Impacts have been identified in the ESIA based on surveys and consultations with primary stakeholders including communities and implementing agency ◆ Environmental and Social Management Plan (ESMP) has been prepared based on the screening outcome and impact and risk assessment in the ESIA. ◆ The ESIA will be disclosed both at the KWSSIP and at Bank's websites. ◆ PIU - KWSSIP shall implement an Environment and Social Commitment Plan (ESCP) and comply with its conditions during the project implementation. ♦ Monitoring and reporting on E&S performance will be carried out during implementation.
ESS-2 Labor and Working Conditions	• Promote safety and health at work. • Promote fair treatment, non-discrimination, and equal opportunity of project workers. • Protect project workers, with particular emphasis on vulnerable workers. • Prevent the use of all forms of forced labor and child labor. • Support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law. • Provide project workers with accessible means to raise workplace concerns.	• Develop and implement written labor management procedures applicable to the project. The procedures will clearly identify the terms and conditions on which community labor will be engaged. • Provided workers with information and documentation that is clear and understandable regarding their terms and conditions of employment. Labor and working conditions should be compliant with the national labor law. • Observe nondiscrimination and equal opportunity of workers.	The ESS2 is applicable as the project will involve direct workers; contracted workers engaged in construction work and consultancy services for the project, and primary supply workers	The Sindh Factories Act 2015 The Sindh Workers Welfare Fund Act, 2014 The Sindh Workers Compensation Act, 2015 The Sindh Minimum Wages Act, 2015 The Sindh Payment of Wages Act, 2015. The Sindh Prohibition of Employment of Children Act, 2017 The Sindh Employees Social Security Act, 2016 The Sindh Occupational Safety and Health Act, 2017	◆ Project will recruit direct (project managers and supervisors, who are employees of KWSSIP / KWSC), and contracted workers (All workforce deployed by the Contractors including any sub-contractors, and the Project Supervision Consultant).). ◆ Influx of migrant labor from other districts for construction works will be minimized by employing local workers. ♦ Labor Management Procedures (LMP) for KWSSIP-2 have been prepared to regulate working conditions and management of workers relation including worker specific Grievance Redress

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
		• Protecting the workforce against child labor and forced labor. • Provision of grievance mechanism for all direct workers and contracted workers. • Implement occupational health and safety measures. • Establish procedures for managing and monitoring the performance of contractors and subcontractors in relation to the requirements of this ESS. • Identify potential risks of child labor, forced labor and serious safety issues which may arise in relation to primary suppliers.		The Protection against Harassment of Women at the Workplace Act, 2010 ♦ The local labor laws fulfill all of the requirements of ESS-2 for direct workers and labor but not primary supplier worker and community workers in the project.	Mechanism (GRM), terms and conditions of employment, non-discrimination and equal opportunity, Sexual Exploitation and Abuse / Sexual Harassments (SEA/SH), protection of workforce, the prohibition of child / forced labor (including in source country and supply chain) and provision of OHS management
ESS-3 Resource Efficiency and Pollution Prevention and Management	• Promote the sustainable use of resources, including energy, water, and raw materials. • Avoid or minimize adverse impacts on human health and the environment caused by pollution from project activities. • Avoid or minimize project-related emissions of short and long-lived climate pollutants. • Avoid or minimize generation of hazardous and non-hazardous waste. • Minimize and manage the risks and impacts associated with pesticide use.	• Implement technically and financially feasible measures for improving efficient consumption of energy, water and raw materials, as well as other resources. • Avoid the release of pollutants or, when avoidance is not feasible, minimize and control the concentration and mass flow of their release using the performance levels and measures specified in national law or the EHSGs, whichever is most stringent • Requires the implementation of management measures for air pollution, hazardous and non-hazardous wastes, chemical and hazardous materials, and contains provisions to address historical pollution.	The construction of the proposed project will utilize resources such as water, energy and raw materials. The construction activities may also emit air pollution, generate wastes (hazardous and non-hazardous) and wastewater.	SEQS 2016 Hazardous Substances Rules 2014 The local laws fulfill the requirements of ESS-3 associated with pollution prevention and management. However, national quality standards are restricted to the pollution control only. Energy efficiency, water efficiency and non-hazardous waste management are not adequately discussed under local laws.	◆ With respect to Resource Efficiency, the project preparation and the ESIA process have identified feasible measures for efficient (a) energy use; (b) water usage management to minimize water usage during construction and maintain balance for demand of water resources; and (c) raw materials use by exploring use of local materials, recycled construction materials, use of innovative design to minimize project's footprints on finite water bodies. ◆ With respect to Pollution Management, as part of the ESIA process, prevention and management measures have been devised to offset risks and impacts of pollution from potential sources such as sludge from TP-IVIV; dust and emissions from operation of construction equipment, material haulage vehicles; wastewater from labor camps, construction camp; spillage or leakage during handling of hazardous materials like petroleum fuel, battery wastes etc.; and disposal of wastes generated during project implementation period.

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
					Guidelines to Contractor / KWSC for preparing various construction / operational phase pollution prevention plans are provided in Annexure 7-2.
ESS-4 Community Health and Safety	• Anticipate or avoid adverse impacts on the health and safety of project-affected communities during project life cycle from routine and non-routine circumstances. • Promote quality, safety, and climate change considerations in infrastructure design and construction, including dams. • Avoid or minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials. • Have in place effective measures to address emergency events. • Ensure that safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.	Evaluate the risks and impacts of the project on the health and safety of the affected communities during the project life cycle in terms of infrastructure and equipment design and safety, traffic and road safety, ecosystem services, community exposure to health issues, emergency preparedness and response, management and safety of hazardous materials and security.	The proposed interceptor and STP will be installed within populated areas in Karachi City. This exposes the community to health and safety hazards of the construction activities.	Sindh Occupational Safety and Health Act, 2017 National Policy on Ending Violence Against Women and Girls Constitution of Pakistan, Articles 25, 26, 27, 37 • Sindh Occupational Safety and Health Act 2017 is more focused on workers' H&S and does not contain adequate provisions for the H&S of the nearby communities. • The Constitution of Islamic Republic of Pakistan provides equal rights and the chapter on Principles of Policy underlines the principle of equal rights and equal treatment to all citizens/ persons, without any distinction including on the basis of sex.	◆ The project construction phase will involve (i) excavation work, construction debris handling and disposal; (ii) likelihood of increased construction related traffic and equipment at the three (3) access roads near to settlements (iii) high dust levels from earthworks, high noise, and emission level from traffic congestion; and (iv) sludge from the existing Manzoor Colony drain while laying the pipeline connecting TP-II bypass line and Pump room with the interceptor ◆ These impacts will be mitigated through suitable measures as incorporated in the ESMP and they will also be made an integral part of the Contractor's obligation as part of the Contractor's Site Specific Environmental and Social Management Plan (SSESMP) for Community Health and Safety. Contractor's SSESMP will also include an OHS plan, influx management plan, workers camp management plan, traffic management plan. ◆ The Contractor during construction phase and KWSC during operational phase shall use security arrangements and personnel to safeguard the installations, sites and personnel with major site being the TP-IV during operations. ◆ The Contractor and KWSC shall be guided by the principal of proportionality and GIIP and the relevant laws related to hiring, rules of conduct, training and equipping such workers. The use of force in providing security shall not be permitted. ◆ During operations of TP-IV, KWSC will attempt to ensure that government security personnel are deployed, and they act in the manner already described.

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
					Security Management Guidelines for Contractors and KWSC are included as Section
ESS-5 Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	• Avoid or minimize involuntary resettlement by exploring project design alternatives. • Avoid forced eviction. • Mitigate unavoidable adverse impacts from land acquisition or restrictions on land use by providing compensation at replacement cost and assisting displaced persons in their efforts to improve, or at least restore, livelihoods and living standards to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher. • Improve living conditions of poor or vulnerable persons who are physically displaced, through provision of adequate housing, access to services and facilities, and security of tenure. • Conceive and execute resettlement activities as sustainable development programs • Ensure that resettlement activities are planned and implemented with appropriate disclosure of information, meaningful consultation, and the informed participation of those affected.	Applies to permanent or temporary physical and economic displacement resulting from different types of land acquisition and restrictions on access. Does not apply to voluntary market transactions, except where these affects third parties. Provides criteria for “voluntary” land donations, sale of community land, and parties obtaining income from illegal rentals. Prohibits forced eviction (removal against the will of affected people, without legal and other protection including all applicable procedures and principles in ESS5). Requires that acquisition of land and assets is initiated only after payment of compensation and resettlement has occurred. Requires community engagement and consultation, disclosure of information and a grievance mechanism.	The construction of interceptor will affect 38 PAPs.	LAA, 1894 In general, the institutional framework for land expropriation in Pakistan is not completely in compliance with the ESS5, and the most evident differences relate to the requirements to compensate at replacement cost for land vis-à-vis the national requirement of compensating land at market value without payment of taxes and fees as part of compensation package. Additionally, the national law does not recognize informal users, occupiers and settlements. Similarly, livelihood losses are not considered for compensation. It does not require a project specific GRM, a social impact assessment, gender segregated data and assistance to vulnerable persons.	The project requires temporary land for the construction of interceptor, which will cause disturbance of livelihood to the communities utilizing patches of interceptor land for agricultural and cattle farming purposes. These people are non-title holders and do not possess any legal documentation of land ownership. An RP has been prepared to address these livelihood losses. (**Annexure 2-1**)
ESS-6 Biodiversity Conservation and Sustainable Management of Living Natural Resources	• Protect and conserve biodiversity and habitats. • Apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity. T • Promote the sustainable management of living natural resources.	Avoid adverse impacts on biodiversity and habitats. When avoidance of adverse impacts is not possible, the Borrower will implement measures to minimize adverse impacts and restore biodiversity in accordance with the mitigation hierarchy provided in ESS1 and with the requirements of this ESS.	ESS6 is relevant as the project activities are anticipated to have E&S impacts on the natural habitats due to loss of vegetation along the routes of the proposed Malir Basin interceptor.	Sindh Forest Act, 2012 Cutting of Trees (Prohibition) Act, 1992 Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020 The local laws fulfill the requirements of ESS-6 except categorization of modified, natural and critical habitats, invasive alien species	◆ For project’s construction phase, site clearance will involve removal of vegetation and trees. Compensatory tree plantation will be performed with the ratio of 10:1. ◆ While clearing vegetation and excavation works, it shall be ensured that no wildlife is injured or killed. ◆ ESMP Cost includes provision for hiring of 02 nos. Ecologists in the Supervision Consultant’s teams, who will identify project sites with the assistance of Contractor’s EHS Site Staff where disturbance to wildlife could be expected. Both will devise the site-specific strategy for the protection of wildlife, provide awareness to the workers on work practices that ensure wildlife protection and monitor the work activities throughout.

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
					◆ For the operational phase, the project will have positive impacts on Korangi Creek Mangroves Forests that will receive treated sewage from the TP-IV. The construction of the treatment plant has been designed in a way that it will not result in any cutting or disturbance to the mangroves. KWSSIP will engage Sindh Forest Department representative during construction phase monitoring.
ESS-7 Indigenous-Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	• Ensure that the development process fosters full respect for affected parties' human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods. • Promote sustainable development benefits and opportunities in a manner that is accessible, culturally appropriate, and inclusive. • Improve project design and promote local support by establishing and maintaining an ongoing relationship based on meaningful consultation with affected parties. • Obtain the Free, Prior, and Informed Consent (FPIC) of affected parties in three circumstances. Recognize, respect, and preserve the culture, knowledge, and practices of Indigenous Peoples, and to provide them with an opportunity to adapt to changing conditions in a manner and in a timeframe acceptable to them.	Applies when the Indigenous Peoples are present or have a collective attachment to the land, whether they are affected positively or negatively and regardless of economic, political, or social vulnerability. The option to use different terminologies for groups that meet the criteria set out in the Standard. The use of national screening processes, providing these meet World Bank criteria and requirements. Coverage of forest dwellers, hunter gatherers, pastoralists and other nomadic groups. Requirements for meaningful consultation tailored to affected parties and a grievance mechanism. Requirements for a process of free, prior, and informed consent in three circumstances.	ESS 7 is not relevant since there are no indigenous peoples that will be affected by the proposed project.		
ESS-8 Cultural Heritage	• Protect cultural heritage from the adverse impacts of project activities and support its preservation. • Address cultural heritage as an integral aspect of sustainable development. • Promote meaningful consultation with stakeholders regarding cultural heritage. • Promote the equitable sharing of benefits from the use of cultural heritage.	• Requires a chance finds procedure to be established. • Recognition of the need to ensure peoples' continued access to culturally important sites, as well as the need for confidentiality when revealing information about cultural heritage assets that would compromise or jeopardize their safety or integrity. • Requirement for fair and equitable sharing of benefits from commercial use of cultural resources. • Provisions of archaeological sites and material-built heritage, natural features with cultural significance, and moveable cultural heritage.	ESS8 is not relevant as there is no known cultural heritage present in the project.	The Sindh Cultural (Protection) Act 1994 The local laws fulfill the requirements of ESS-8. However, there are no provisions for commercial use of cultural heritage in local laws.	

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance to the Project	Relevant National / Provincial Regulations / Laws and Gaps	Actions undertaken to fill the gap and/or to comply with ESS
ESS-9 Financial Intermediaries	Sets out how Financial Intermediaries (FI) will assess and manage environmental and social risks and impacts associated with the subprojects it finances. Promote good environmental and social management practices in the subprojects the FI finance. Promote good environmental and sound human resources management within the FI.	Financial Intermediaries (FIs) to have an Environmental and Social Management System (ESMS) - a system for identifying, assessing, managing, and monitoring the environmental and social risks and impacts of FI subprojects on an ongoing basis. FI to develop a categorization system for all subprojects; with special provisions for subprojects categorized as high or substantial risk. FI borrowers to conduct stakeholder engagement in a manner proportionate to the risks and impacts of the FI subprojects.	Not relevant as there is no financial intermediary involved.		
ESS-10 Stakeholder Engagement and Information Disclosure	• Establish a systematic approach to stakeholder engagement that helps Borrowers identify stakeholders and maintain a constructive relationship with them. • Assess stakeholder interest and support for the project and enable stakeholders' views to be considered in project design. • Promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle. • Ensure that appropriate project information is disclosed to stakeholders in a timely, understandable, accessible, and appropriate manner.	• Requires stakeholder engagement throughout the project life cycle, and preparation and implementation of a Stakeholder Engagement Plan (SEP). • Requires early identification of stakeholders, both project-affected parties and other interested parties, and clarification on how effective engagement takes place. Stakeholder engagement to be conducted in a manner proportionate to the nature, scale, risks and impacts of the project, and appropriate to stakeholders' interests. • Specifies what is required for information disclosure and to achieve meaningful consultation.	The ESS10 is applicable as the project involves diverse stakeholders.	Review of IEE and EIA Regulations 2014 Guideline for Public Consultation, 1997 The regulations and guidelines fulfill most requirements of this ESS during the design and construction phases up to the grant of EPA NOC, except the nomenclature for the types of stakeholders such as Primary Stakeholder (named as project Affected Parties including Vulnerable / disadvantaged Group) and Secondary Stakeholders (Other Interested Parties). However, the regulations do not demand continued stakeholder engagement after the NOC has been granted, leading to a potential disconnect between the project and the affected people during construction and operations phases. Moreover. these regulations do not require specific SEP for a project, neither do these require a GRM to be put in place.	◆ Extensive consultations with a wide range of stakeholders have been carried out following KWSSIP-2 Stakeholders Engagement Plan (SEP) guidelines while conducting this ESIA. ◆ SEP has been prepared for the entire KWSSIP-2 (including Malir Basin Interceptors and TP-IV Project) to comply with the ESS-10 requirements and it shall be followed throughout the project life-cycle.

2.7 Environment and Social Regulatory Authorities

42. A summary of the key E&S regulatory institutions and their relationship with the project in accordance with national, provincial, and international requirements is provided in **Table 2-9.**

Table 2-9: Roles of statutory organizations

Organization	Functions / Role
Sindh Environmental Protection Agency (SEPA)	◆ Regulating the environmental issues ◆ Reviewing and checking environmental assessment report prepared as per the legal requirements. ◆ Environmental approvals of the Project. ◆ Ensuring the implementation of government policies, during the project implementation. ◆ Ensuring compliance and reviewing the performance of Environmental Management Plans (EMP) implementation.
Labour & Human Resources Department, Sindh	◆ Guaranteeing the rights of the workers like the right to organize, the right to collective bargaining, participation in the affairs of the implementing agency, health & safety, minimum wages, compensation, etc., are followed in the project.
Social Welfare Department and Women Development Department – Sindh	◆ Transformation of the government into an organization that actively practices and promotes gender equality and women empowerment. ◆ Mainstreaming gender equality perspective across public policies, laws, programs, and projects by departments and agencies of the government with a focus on women empowerment. ◆ Looking after various marginalized segments of population such as poor, persons with disabilities, orphans, victims of violence and specifically women to ensure the welfare and support the marginalized group of society.
Workers Welfare Board -Sindh	◆ Provision of housing, education, health and other welfare facilities to the workers and their families. ◆ Promoting the same through projects.
Employees' Old Age Benefit Institute (EOBI)	◆ Making sure that workers are benefitted after retirement from the collected/raised funds.

3 Project Description

3.1 Project Background

43. Karachi is Pakistan's largest city along with its economic and financial hub, and main port[4]. It contributes the largest share of national tax revenues, industrial employment, manufacturing, and high-end services[5]. However, the water supply and sanitation facilities currently available to the city are inadequate.

44. The Malir Basin Interceptor and Sewage Treatment Plant (TP-IV) Project is part of the KWSSIP-2 which aims to collect and treat sewage within Malir Basin in Karachi. The project was designed to consider the increase of population for the next 30 years.

45. The project will serve the entire District Korangi (Korangi, Landhi and Shah Faisal Towns), part of District Malir (Malir Town), part of District East (Jamshed Town) and Cantonment Areas including Faisal Cantonment and Korangi Creek Cantonment. The Project will include the following components:

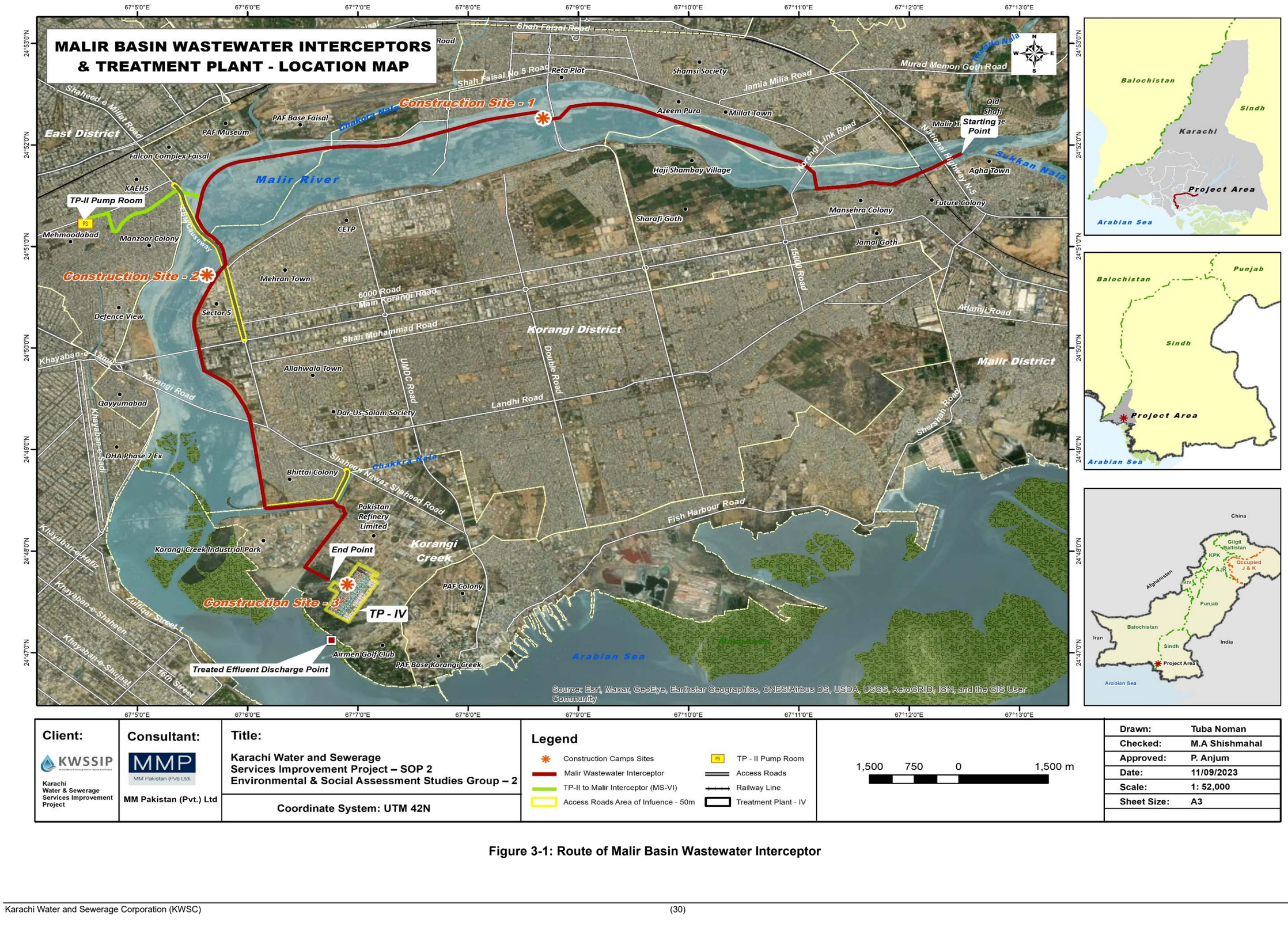
- 22 km sewer interceptor along Malir River to receive sewage from 20 sewer connections;
- Connection of the pumping station of the non-operational Sewage Treatment Plant in Mahmoudabad (TP-II) to Malir interceptor via 2.5 km sewer line; and
- 180 MGD Sewage Treatment Plant (TP-IV).

3.2 Project Location and Area

46. As shown in **Figure 3-1**, the proposed Malir Basin interceptor will start at the left bank of Malir River near Afridi Colony Area - Bin Qasim Town in District Malir and will pass through the districts of Malir and Korangi and the cantonment areas in Faisal and Korangi Creek. The sewer pipe that will connect TP-II to the proposed Malir Basin interceptor is at the right bank of Malir River and will start at UC 05 Mahmoudabad, Jamshed Town, District East and will cross Shaheed e Millat Road and the under construction Malir Expressway.

47. The interceptor will convey the sewage in TP-IV for treatment. The proposed STP is located within the Korangi Creek Cantonment Area, nearly 2.5 km downstream of the Malir River junction with the Korangi/Gizri Creeks. The proposed STP site has a total land area of 121 hectares (including buffer zone), but the STP footprint will only occupy about 42.9 hectares. The treated effluent from TP-IV will be discharged in Korangi Creek.

[4] Pakistan Bureau of Statistics, 2017 census, provisional summary
[5] World Bank, Transforming Karachi into a livable and Competitive Megacity – A City Diagnostic and Transformation Strategy, Washington DC, 2018; p.2



Client: KWSSIP — Karachi Water & Sewerage Services Improvement Project	**Consultant:** MMP (MM Pakistan (Pvt) Ltd.) — MM Pakistan (Pvt.) Ltd	**Title:** Karachi Water and Sewerage Services Improvement Project – SOP 2 Environmental & Social Assessment Studies Group – 2 **Coordinate System: UTM 42N**	**Legend:** Construction Camps Sites; Malir Wastewater Interceptor; TP-II to Malir Interceptor (MS-VI); Access Roads Area of Infuence - 50m; TP - II Pump Room; Access Roads; Railway Line; Treatment Plant - IV	1,500 750 0 1,500 m	**Drawn:** Tuba Noman **Checked:** M.A Shishmahal **Approved:** P. Anjum **Date:** 11/09/2023 **Scale:** 1: 52,000 **Sheet Size:** A3

Figure 3-1: Route of Malir Basin Wastewater Interceptor

3.3 Project Components

3.3.1 Malir Basin Interceptor

48. The proposed Malir Basin interceptor will be a rectangular cement concrete (RCC) box type with cast in-situ conduit and polyvinyl chloride (PVC) lining. It will have single and dual cell sections. Isometric View of a section of Proposed Interceptor is shown as **Figure 3-2**.

49. The width of the interceptor will vary between 2.1 m to 7.15 m, while the depth shall be 1.6 m (minimum) from ground level at the starting point in Afridi Colony and 4.6 m (maximum) at its termination point at TP-IV. The sewage flow in the interceptor is through gravity with velocities ranging between 0.60 m/s to 0.30 m/s, depending on the flow of the incoming sewage. These velocities will be self-cleansing, which will restrict settling of suspended organic solids, as well as ensuring continuous flush-out of any settled organic matter.

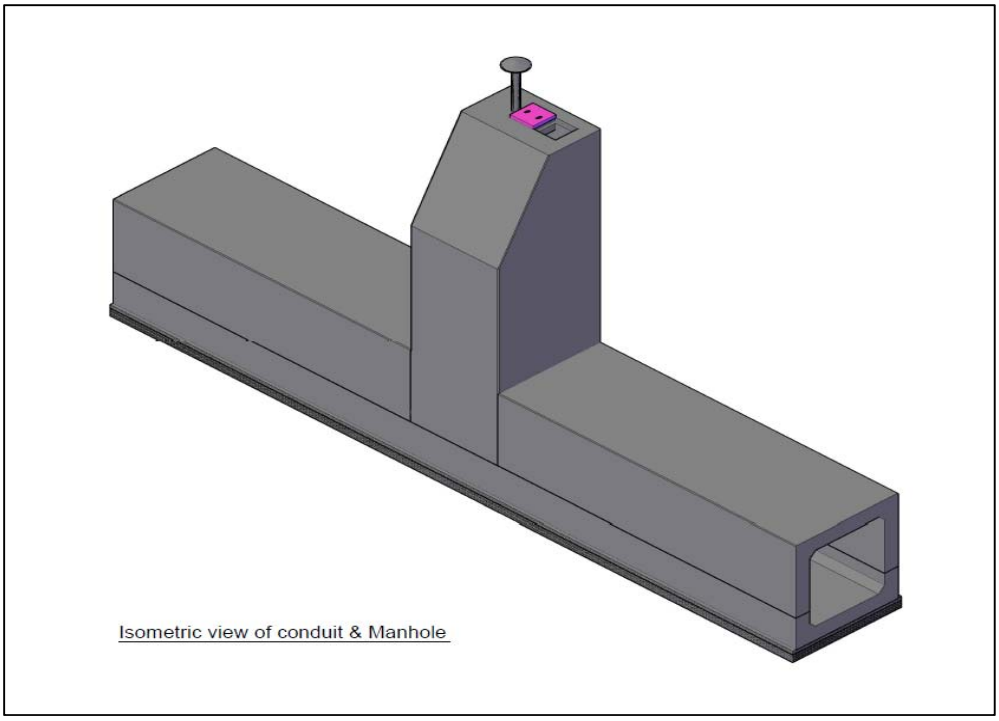


Figure 3-2: Isometric View of Malir Wastewater Interceptor with Manhole
Source: Process and Hydraulic Design Report – TP – IV

50. A total of 20 sewer pipes will be connected to the proposed interceptor through intake chambers. The proposed Malir Basin interceptor will collect sewage from the 18 existing sewer pipes along Malir River. At present, these sewer pipes collect sewage within their respective catchment areas and directly discharge the untreated sewage to Malir River. However, with the proposed interceptor, the collected sewage will be conveyed to the proposed TP-IV for proper treatment and disposal instead. Additionally, the proposed sewer line in Landhi and Korangi Areas and in proposed sewer line in Bhittai Colony will be connected to the proposed interceptor. **Table 3-1** presents the list of sewer pipes that will feed sewage to the proposed interceptor, while **Figure 3-3** shows the layout. The total catchment area of the 20 sewer pipes is about 192 km^2.

51. The intake chambers will be equipped with screens to prevent solid waste or other floating materials from entering the interceptor. The chamber will be constructed with appropriate height of approximately 3 m to accommodate peak sewage flow. Flows other than sewage from Malir River and Chakorra Nala as well as intrusion of any floodwaters will not interrupt the interceptor's sewage flow. The extra storm water during monsoon will pass over the slab of chamber to Malir river.

52. Schematic diagram of the interceptor showing main sewer inlet points is provided in **Figure 3-3**. Typical plan of proposed intake structures that will connect the sewer points to the interceptor is provided as **Figure 3-4.**

Table 3-1: List of Sewer Connections Draining into the Interceptor

No.	Name of Sewer Connection	Chainage
1.	Thaddo Nala	Near 22+500
2.	Samdhani Drain	Near 21+500
3.	Kalenjar Hujra Drain	Near 21+500
4.	Sufi Razzaq Road – Mansehra Colony Drain	21+000
5.	Future Colony – Mansehra Road Drain	Near 21+000
6.	Jumma Goth (54-inch diameter) Drain	Near 19+000
7.	Gulistan e Malir (36-inch diameter) Drain	Near 19+500
8.	Jamia Malia Road Drain (From Malir 15)	17+500
9.	Azeempura Main from Rafha- e-Aam Society Drain	17+000
10.	Drain from Malir Trunk Sewer	16+500
11.	Drain from Green Town	Near 16+500
12.	Thanna Road – Shah Faisal Drain	15+000
13.	Shah Faisal Block 05 (32-inch diameter) Drain	Near 13+500
14.	Shah Faisal Block 5 A Nullah Drain	Near 13+500
15.	Chakora Nukkah Drain	11+500
16.	Pir Bukhari Nullah Drain	10+500
17.	Dada Bhai Drain	Near 9+000
18.	Rising Main Drain (Korangi Area)	7+000
19.	Proposed Sewer Line Drain (Landhi & Korangi Areas)	Near 6+000
20.	Proposed Sewer Line Drain (Bhittai Colony)	4+000

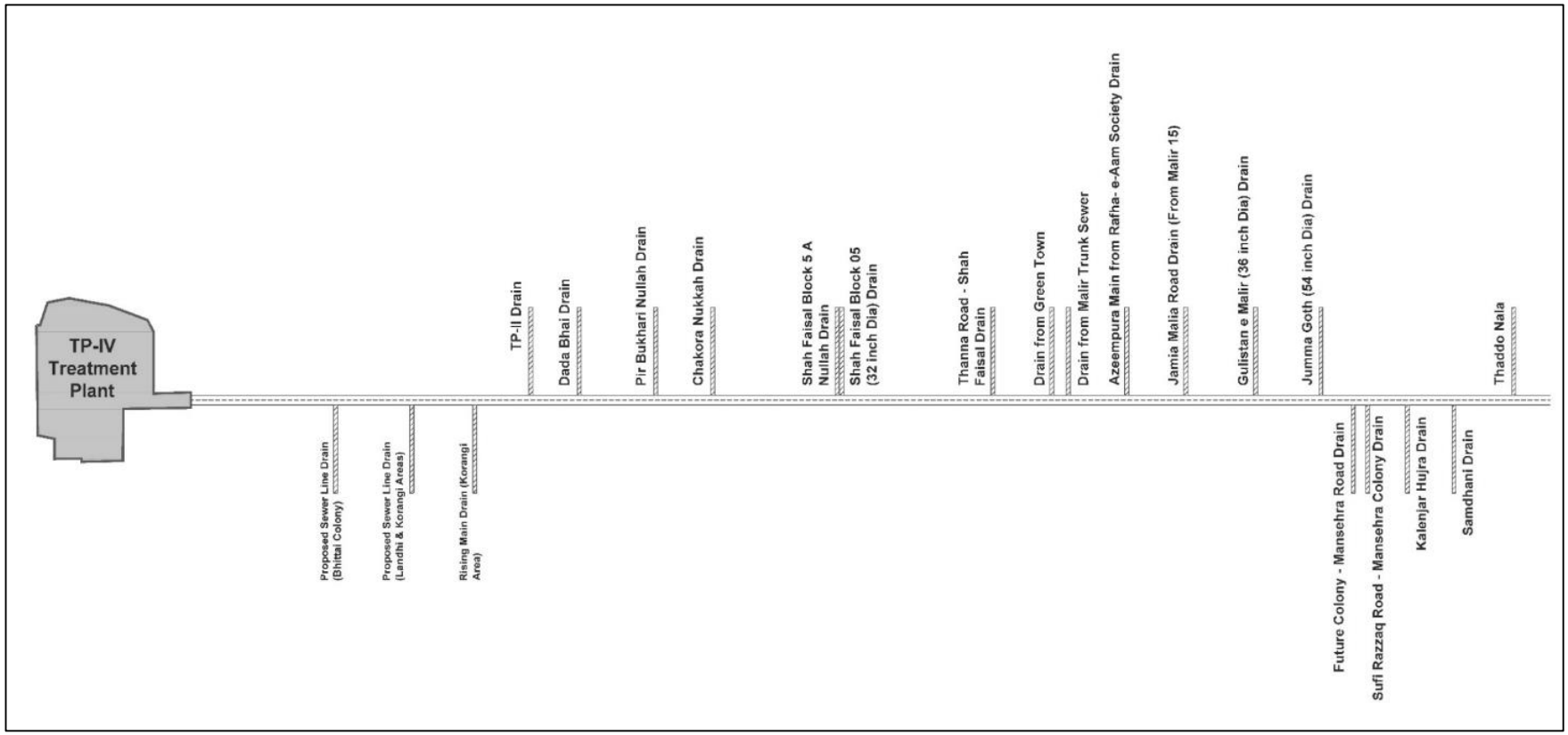


Figure 3-3: Schematic Diagram of Malir Basin Interceptor and Sewer Connection Points

Source: Process and Hydraulic Design Report – TP - IV

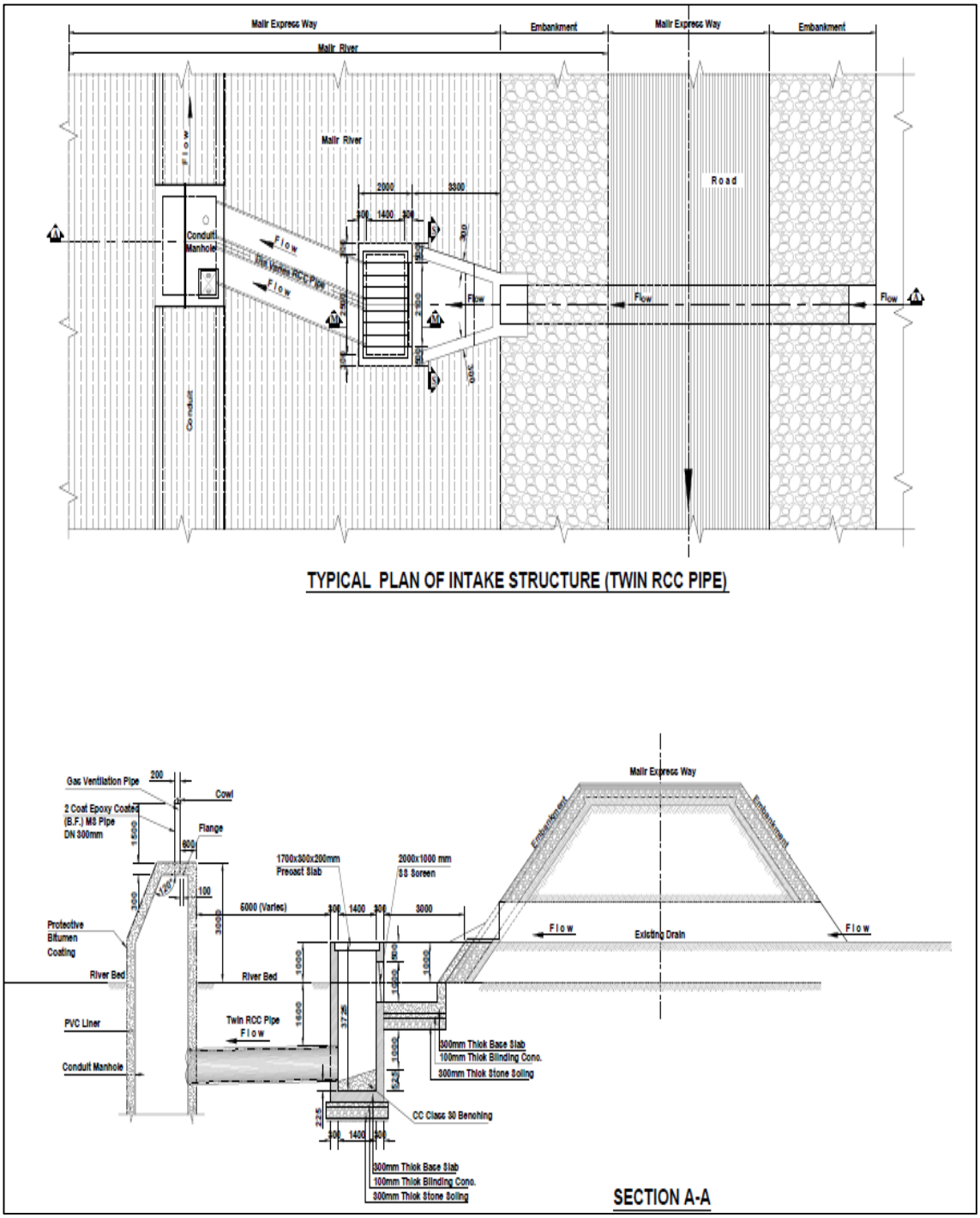


Figure 3-4: Typical Plan of proposed Sewer Connections Intake Structure

Source: Process and Hydraulic Design Report – TP - IV

53. To provide access for inspection and cleaning, around 124 manholes shall be provided at the interceptor. RCC/RCC with brickwork combination manholes shall be constructed. Typical cross section drawing of proposed RCC and Brickwork Combination Manhole is provided as **Figure 3-5**.

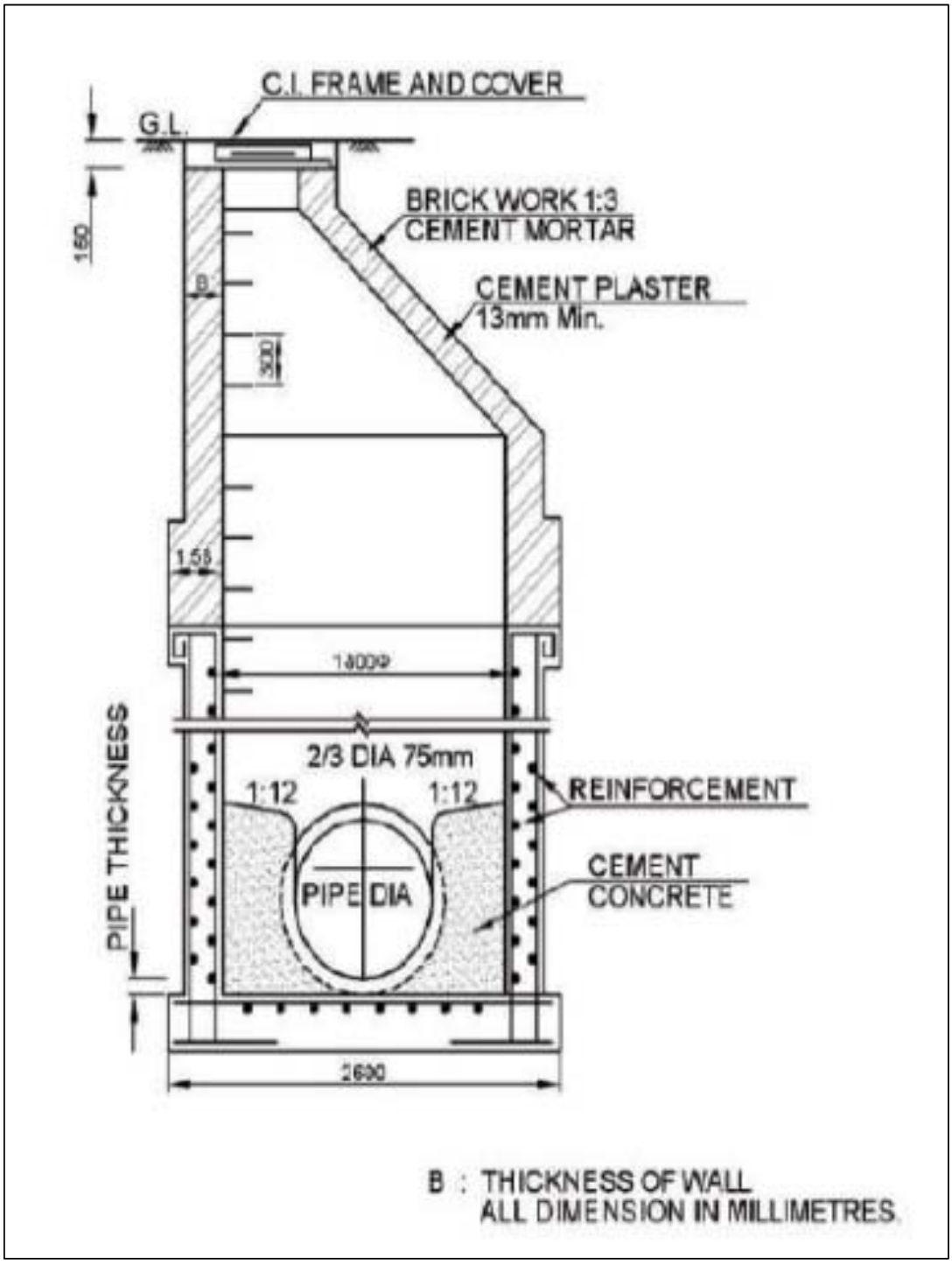


Figure 3-5: Typical Cross Section of proposed RCC and Brickwork Combination Manhole

Source: Process and Hydraulic Design Report – TP - IV

3.3.2 Sewer Connection from Sewage Treatment Plant – Mahmoudabad (TP-II)

54. The Sewage Treatment Plant – Mahmoudabad (TP-II), located at the right bank of Malir River, was constructed in 1963 with a capacity of 46 MGD. TP-II used to serve various eastern Karachi

localities on both left bank of Malir River which includes Old city area, Clifton, Mahmoudabad, Azam Basti, Dada Bhai town and Saddar and the right bank which includes parts of Korangi and Malir.

55. Sewage from the left bank of Malir River was previously pumped by the Korangi pumping station (PS-II) to TP-II on the opposite side of the river. However, this pumping operation was halted after the pipes installed in the river were damaged during a flood in 1974. Since then, the sewage from the left bank of the Malir/Korangi area, which amounts to approximately 15 to 20 MGD, has been discharged untreated into the Malir River.

56. TP-II is no longer operational for a long time due to various reasons such as lack of funds for KWSC to operate and maintain the plant. The heavy encroachments within the surrounding area of the plant site also became a challenge to KWSC in managing the treatment plant. The office buildings and treatment units are not working anymore. Only the operational pumping stations pump the untreated sewage from TP-II to Malir River.

57. Under the proposed project, the sewage received by TP-II will be diverted to the proposed Malir Basin interceptor. A sewer HDPE pipe, with thickness of 1000 mm, will be installed to connect the pumping room of TP-II to the interceptor with a total length of 2.5 km. About 26 MGD of sewage will be collected from TP-II for treatment in TP-IV.

58. The starting point of this sewer pipe is the TP-II Pump Room, located in UC 05 Mahmoudabad, Jamshed Town, District East, will cross the Shaheed e Millat Road, and the Malir Expressway that is currently being constructed and it will terminate at the Malir Interceptor – Manhole No. 49 (near Chainage 9+500 / 9+000). This manhole is located approximately 400 m away from Manzoor Colony Fire Station. For most of its length (Approximately 1.2 km), the pipeline shall run inside the existing Manzoor Colony Drain, attached to the drain wall by means of bracings.

59. Figure 3-6 shows the connection of the proposed interceptor to TP-IV. To ensure the flow of sewage through gravity, the sewer pipe will be constructed under the right bank wall of Chakkora Nala. The depth at the inlet at TP-II pump room is 1.6 m while the depth at the discharge point at TP-IV is 4.6 m. This slope will ensure gravitational flow and self-cleansing velocity.

3.3.3 Malir Basin Sewage Treatment Plant (TP–IV)

60. TP-IV has a total design capacity of 180 MGD and is capable to treat the projected volume of sewage generated within the catchment areas for up to 30 years. It is proposed that the treatment plant will have four treatment modules with capacity of 45 MGD each. The STP is designed to treat domestic wastewater only and the target effluent quality is based on the effluent standards of GoS and WBG as presented in **Table 3-2**.

Table 3-2: Design Parameters of TP – IV

Parameters	Value	Unit
Influent Flows		
Daily sewage flow (maximum day)	180	MGD
Peak Factor	1.5	-
Peak hourly flow	51,145	m^3/hr.
Influent Quality		

Parameters	Value	Unit
Total suspended solids, TSS	200	mg/L
5-day Biochemical oxygen demand, BOD5	200	mg/L
Chemical oxygen demand, COD	500	mg/L
Temperature, minimum	23	°C
Temperature, maximum	30	°C
Effluent Quality		
Total suspended solids, TSS	50	mg/L
5-day Biochemical oxygen demand, BOD5	30	mg/L
Chemical oxygen demand, COD	125	mg/L
Source: Process and Hydraulic Design Report – TP – IV		

61. To proposed treatment process that will be employed in the STP is the Trickling Filter aerobic treatment system. The following are the major components of the STP.

Table 3-3: Major Components of the Malir Basin STP (TP-IV)

Component	Specification
Coarse Screen Chamber	6 units
Fine Screen Chamber	11 units
Grit Chamber	7 units
Distribution Pit	4 units
Primary Sedimentation Tank	4 modules (4 units per module - total 16) x 45 MGD per module
Trickling Filters	4 modules (8 units per module - total 32) x 45 MGD per module
Humus/Secondary Sedimentation Tank	32 units x capacity
Combined Sludge Thickener	4 units x capacity
Anaerobic Sludge Digester	6 units x capacity
Sludge Drying Bed	16 units x capacity
Primary Sludge	

62. To following are the auxiliary equipment of the STP:

- Sewage Pumping Station
- Primary Sludge Pumping Station
- Humus Sludge Pumping Station
- Thickened Sludge Pumping Station
- Digested Sludge Pumping Station
- Distribution Pit
- Junction Pit

63. In addition, the following support facilities will be constructed within the proposed site of the STP:

- Administration Building

- Maintenance Building
- Workshop
- Powerhouse
- Sub-station
- Parking
- SCADA

64. The proposed site development plan of the proposed Malir Basin STP is presented in **Figure 3-7**.

65. A complete storm water network shall be built to convey the storm water of TP-IV to the outfall structure.

3.3.4 Temporary Facilities during Construction

66. **Table 3-4** below outlines the approximate number of major machinery and vehicles that are envisaged to be required for the project construction works:

Table 3-4: Estimated Equipment and Machinery

S. No.	Machinery / Equipment	Quantity required*
1	Excavators	20
2	Batching Plants	1 (Outsourced)
3	Loaders	10
4	Power Generators	6
5	Rollers	4
6	Tractor Trolley	10
7	Compactor / Roller	10
8	Crane	2
9	Concrete Pump	6
10	Vibro Hammer	2
11	Watering Tanks (moveable)	10
12	Haulage Trucks	30
13	Cars / Pickups	20
* Number of machinery is indicative and can be changed subject to working schedule		
Source: MMP Project Experience		

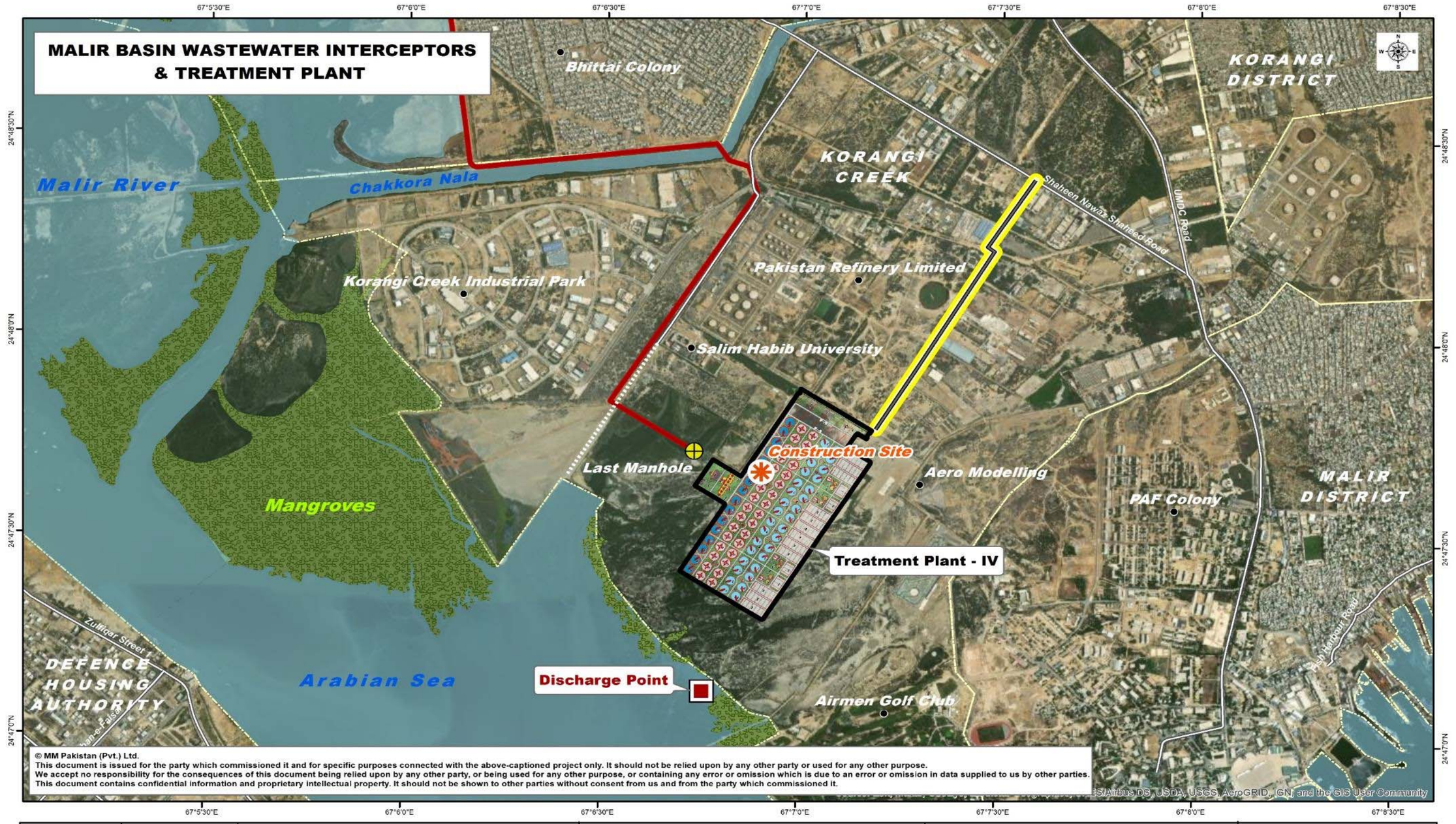
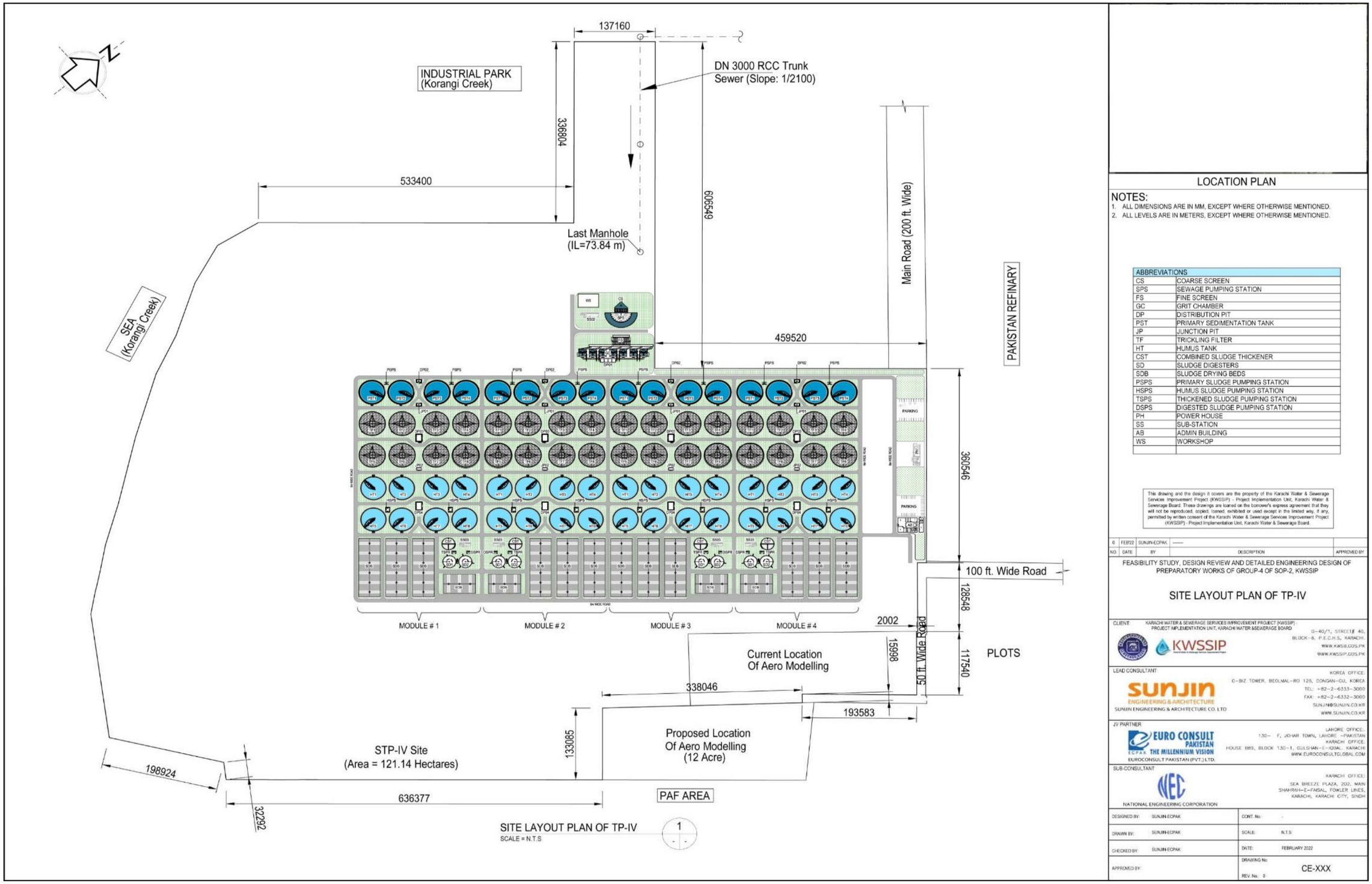


Figure 3-6: Location of Proposed TP – IV Site



LOCATION PLAN

NOTES:
1. ALL DIMENSIONS ARE IN MM, EXCEPT WHERE OTHERWISE MENTIONED.
2. ALL LEVELS ARE IN METERS, EXCEPT WHERE OTHERWISE MENTIONED.

ABBREVIATIONS	
CS	COARSE SCREEN
SPS	SEWAGE PUMPING STATION
FS	FINE SCREEN
GC	GRIT CHAMBER
DP	DISTRIBUTION PIT
PST	PRIMARY SEDIMENTATION TANK
JP	JUNCTION PIT
TF	TRICKLING FILTER
HT	HUMUS TANK
CST	COMBINED SLUDGE THICKENER
SD	SLUDGE DIGESTERS
SDB	SLUDGE DRYING BEDS
PSPS	PRIMARY SLUDGE PUMPING STATION
HSPS	HUMUS SLUDGE PUMPING STATION
TSPS	THICKENED SLUDGE PUMPING STATION
DSPS	DIGESTED SLUDGE PUMPING STATION
PH	POWER HOUSE
SS	SUB-STATION
AB	ADMIN BUILDING
WS	WORKSHOP

NO.	DATE	BY	DESCRIPTION	APPROVED BY
0	FEB'22	SUNJIN-ECPAK	-----	

FEASIBILITY STUDY, DESIGN REVIEW AND DETAILED ENGINEERING DESIGN OF PREPARATORY WORKS OF GROUP-4 OF SOP-2, KWSSIP

SITE LAYOUT PLAN OF TP-IV

CLIENT: KARACHI WATER & SEWERAGE SERVICES IMPROVEMENT PROJECT (KWSSIP)
PROJECT IMPLEMENTATION UNIT, KARACHI WATER &SEWERAGE BOARD
G-40/1, STREET# 40, BLOCK-6, P.E.C.H.S, KARACHI.
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DESIGNED BY:	SUNJIN-ECPAK	CONT. No:	-
DRAWN BY:	SUNJIN-ECPAK	SCALE:	N.T.S
CHECKED BY:	SUNJIN-ECPAK	DATE:	FEBRUARY 2022
APPROVED BY:		DRAWING No:	CE-XXX
		REV. No.	0

Figure 3-7: Proposed Site Development Plan of TP-IV

3.4 Process Design of TP-IV

67. The objective of TP-IV is to treat and ensure the safe disposal of the collected sewage of the Malir Basin interceptor to protect the public health and the environment. The proposed process flow diagram for TP-IV is presented in **Figure 3-8**.

68. As preliminary treatment, the sewage will undergo screening (coarse and fine) and grit removal. At the inlet of TP-IV, a mechanical coarse screen will be installed to remove the coarse solids found in the influent sewage. The sewage will then flow to the pumping pit then be pumped to another chamber with mechanical fine screens to further remove smaller particles then to the grit chamber. After grit removal, the sewage shall flow to the Distribution Pit (DI) to distribute the sewage to the four modules of STP.

69. In each module, the sewage will flow to the primary settling tank (PST) to remove the readily settleable solids and floating materials in the sewage. The effluent from the PST shall then enter the trickling filters for the removal of organic matters present in sewage. The oxygen shall be supplied through natural air draft.

70. From the trickling filter, the sewage will flow to the secondary settling tank to further remove suspended solids in the sewage by settling. Effluent from the secondary settling tank will flow to the outlet pit for discharge in the Korangi Creek, located approximately 400 m away from the southern boundary wall of TP-IV as shown **Figure 3-9**.

71. Sludge that settled at the bottom of the PST and secondary settling tank will be removed and pumped to the sludge thickeners. The thickened sludge shall be stabilized in the anaerobic sludge digester and will then be fed to the sludge drying beds for dewatering.

72. The dried sludge is proposed to be reused as fertilizer and soil improver for horticultural activities such as tree planting and landscaping since it contains high concentrations of valuable organic matter and nutrients such as nitrogen and phosphorus. The potential users of the sludge can be from the private sectors and/or government sectors such as the Park and Horticulture Department of Karachi Municipal Corporation (KMC).

73. Recycling of sludge shall be a condition of Public Private Partnership (PPP) arrangements for Engineering Procurement and Construction (EPC) contract of TP-IV. The sludge treatment methods will be finalized during detailed design stage to be carried out by the EPC contractor. The contractor shall finalize the modalities and procedures for the design and operation of the sludge recycling facility. The sludge quality testing shall be carried out before its utilization as fertilizer, and it shall also be tested periodically during the operational phase of the project by KWSC to ensure that the sludge generated at TP-IV is properly treated and fit for recycling.

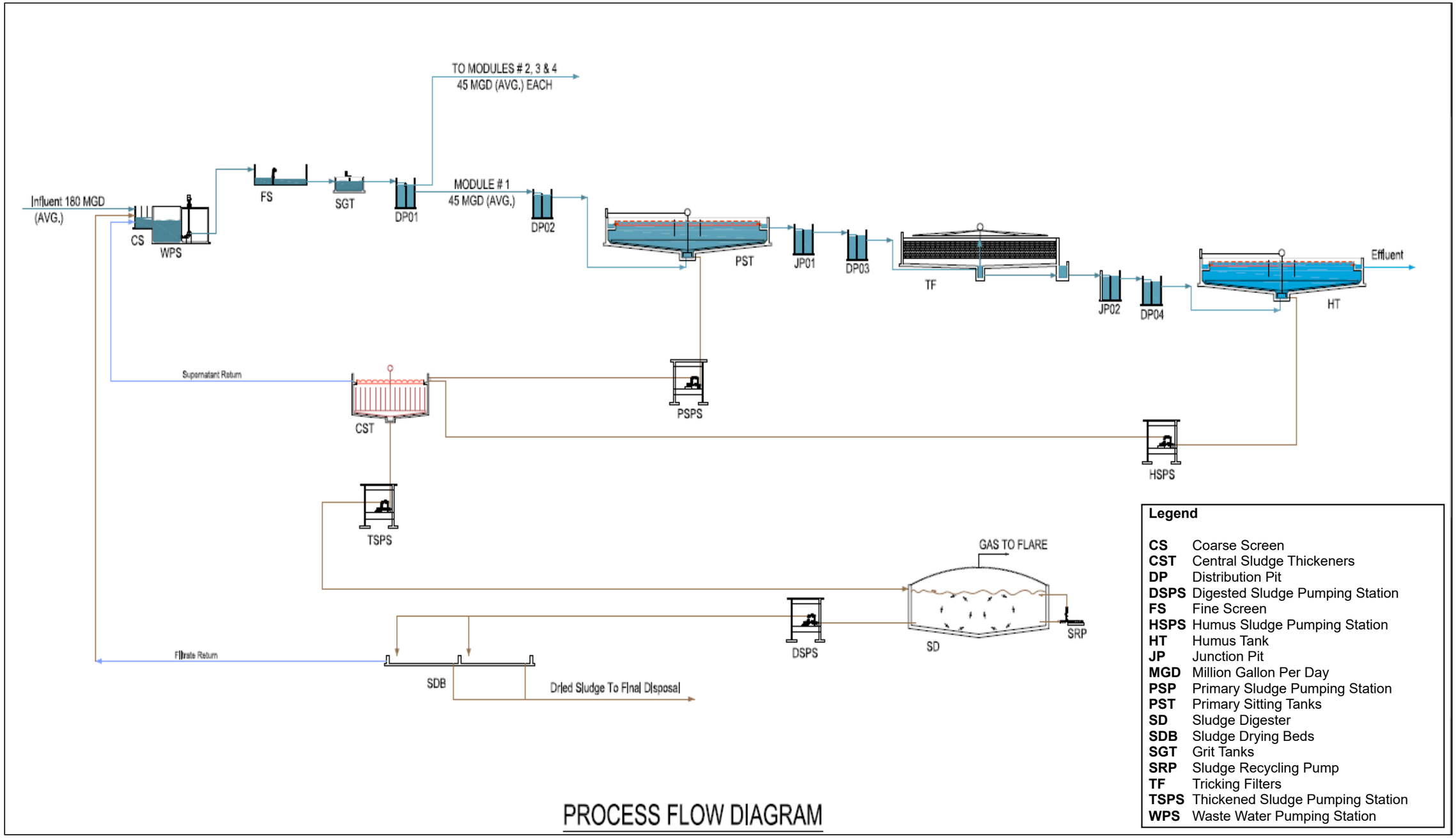


Figure 3-8: Process Flow Diagram of the proposed TP-IV

Source: Process and Hydraulic Design Report – TP - IV

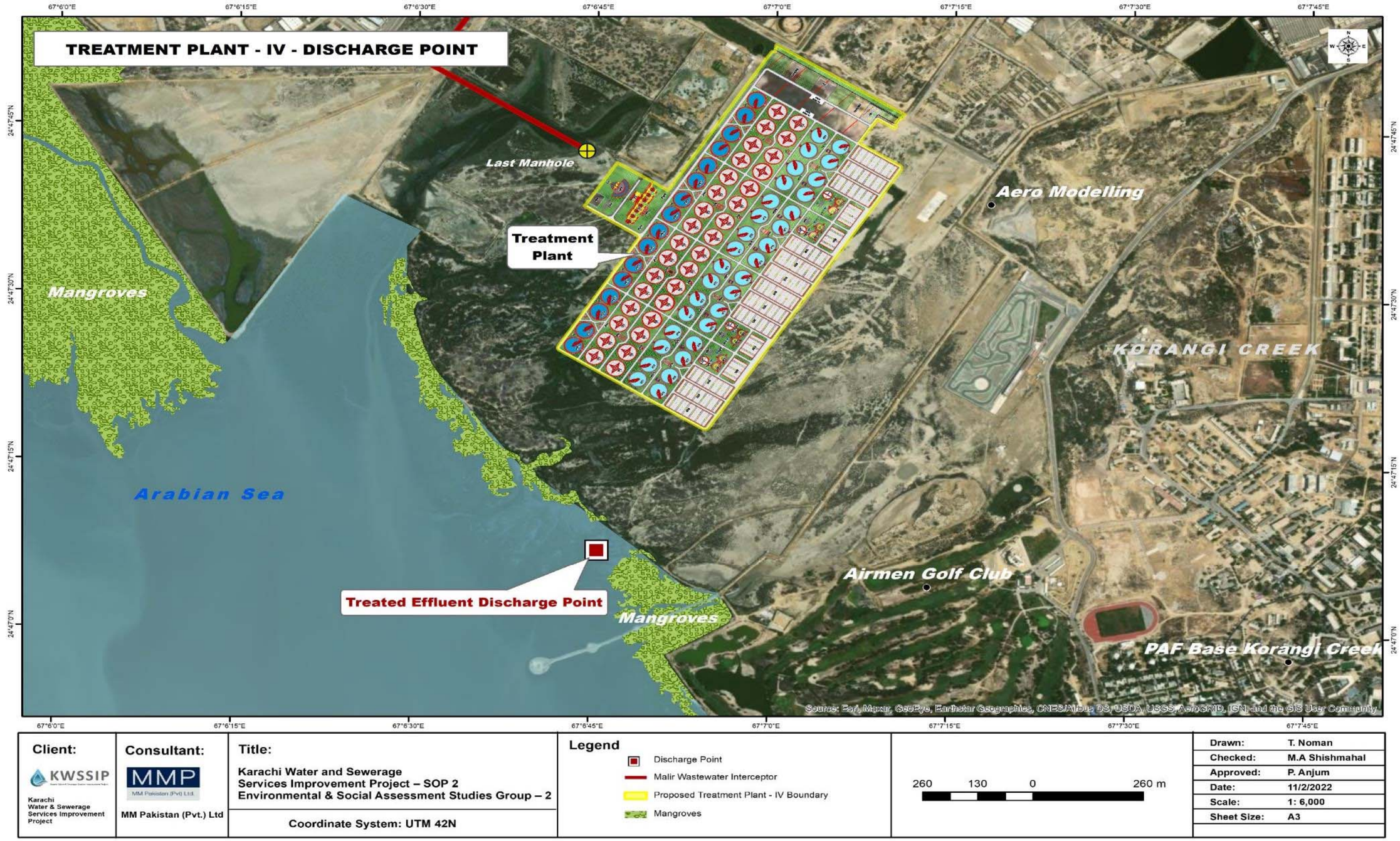


Figure 3-9: Treated Effluent Discharge Point

3.4.1 Preliminary Treatment

a) Coarse Screen Chamber

74. Mechanical coarse screens are provided at the inlet of TP-IV to remove large floating objects present in it prior to entering the wet well of raw sewage pumping station. This is to prevent clogging and damage to the subsequent process equipment that may affect the treatment process reliability and effectiveness.

75. The coarse screen chamber shall comprise of the following components:

- Influent Chamber - to dissipate the incoming sewage energy and to direct/distribute flow equally to all coarse screens.
- Screen Channels - These are provided with mechanically cleaned coarse screens. The sewage is to be screened to remove large floating objects present in it prior to entering the wet well of raw sewage pumping station.
- Effluent Chamber: This structure receives the screened sewage and directs it to the next unit.

76. Each screen chamber shall be equipped with two coarse screens with bar spacing of 75 mm in series (1 +1 standby) and two sluice gates one at inlet and other at the outlet of each channel. At the top of the screening channels, RCC platforms, of adequate space shall be provided for manual cleaning of the screens, operation of the sluice gates and other purposes. Typical view of the coarse screens is shown in below **Figure 3-10**.

77. Removed floating material shall be stored in a covered 20-yard waste skip which shall be removed on weekly basis from the site through SEPA certified hazardous waste handlers, which shall be contracted for this job by the KWSC TP-IV Management.

Figure 3-10: Typical View of Coarse Screens

a) Raw Sewage Pumping Station

78. After screening, the sewage shall enter the raw sewage pumping station. The sewage flows to the wet well where it will be pumped to the second screening chamber. The pump used is housed in the dry well of the pumping station. A sump will also be constructed to collect the sewage from

leakage of pumps and piping and/or surface runoff. Bilge pumps, installed in the sump, shall pump the sewage in the sump back to the wet wells.

79. There will be two wet wells in the pumping station and each wet well will have six transfer pumps (4 duty + 2 standby) that are vertical type and dry mounted. Each transfer pump will have capacity of 1,777 liters per second and head of 15 m.

b) Fine Screen Chamber

80. The pumped raw sewage shall flow into another screening chamber which will be provided with mechanically cleaned fine screens. Similar to coarse screen chamber, the following are the components of the fine screen chamber components:

- Influent Chamber - to receive and direct/distribute flow equally to all fine screens.
- Screen Channels - provided with mechanically cleaned fine screens.
- Effluent Chamber - receives the screened sewage and directs it to next unit.

81. The fine screens will have clear openings of 15 mm and will be mechanically cleaned. To prevent clogs, the trapped objects must be removed regularly. This will be done through a mechanism fitted with these screens that shall rake off the screens. The debris shall be moved by an attached auger/screw press that will compact them and squeeze out any remaining water.

82. From there, the screenings shall be transferred to the same 20-yard waste skip (as for coarse screen unscreened material) which shall be removed from site on weekly basis through SEPA certified hazardous waste handlers, which shall be contracted for this job by the KWSC TP-IV Management. Typical view of the fine screens is shown in below **Figure 3-11**.

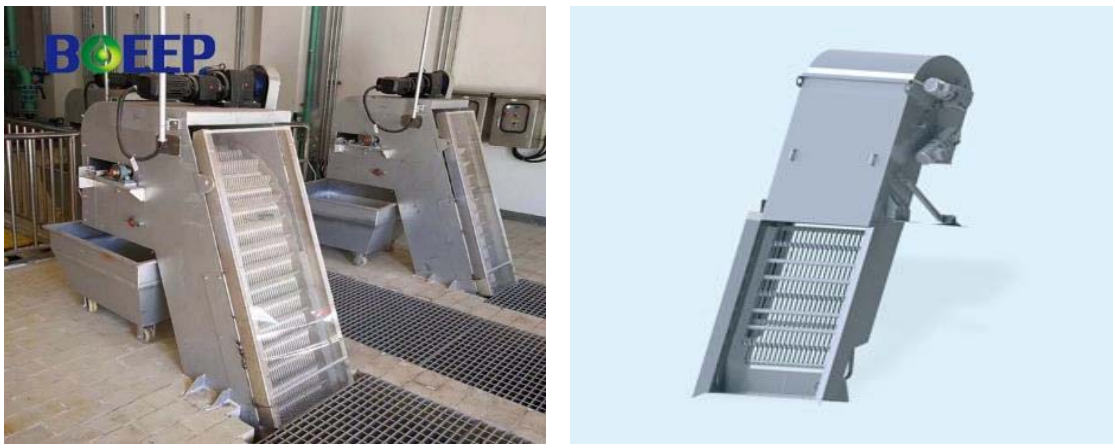


Figure 3-11: Typical View of Mechanically Cleaning Fine Screens

c) Square Grit Chamber

83. The next unit to fine screens is the grit chamber. Grits such as sand, gravel, and other organic particles such as food waste must also be removed to prevent unnecessary abrasion and wear of mechanical equipment and accumulation of grit in the succeeding treatment process. From grit

chambers, the sewage shall flow to the Distribution Pit 1 (DP1) for distribution to the four treatment modules. Typical view of the grit chamber is shown in **Figure 3-12**.

Figure 3-12: Typical View of Grit Chamber

3.4.2 Primary Treatment

a) Primary Settling Tanks (PST)

84. From DP1, the sewage will flow to DP2 to distribute the sewage to the PSTs. Each treatment module will have four PSTs. The main function of PST is to reduce the suspended solids of the sewage by allowing the solids to settle at the bottom of the tank. To remove the sludge at the bottom of the PST, a scraper will be installed to scrape the sludge to the central sludge sump and be pumped to the sludge thickeners. Typical view of primary settling tank is shown in **Figure 3-13**.

85. The clarified sewage is collected through the overflow weirs and transported the junction pit 1 (JP1) then to DP3 for distribution to the trickling filters. The PST is estimated to have 55% TSS and 30% BOD & 25% COD removal efficiencies.

Figure 3-13: Typical View of Primary Settling Tank

3.4.3 Secondary Treatment

a. Trickling Filters

86. Trickling filters (TFs) are selected for the secondary treatment process of TP-IV. TFs is a fixed-be, biological reactor that contains filter media such as rocks, gravel, or preformed plastic filter media. Organisms that are attached in the media remove the organic matter of the sewage. The sewage from the primary sedimentation tank is trickled or sprinkled on top of the tank, passes through the filter media, and comes in contact with the microorganisms that grow in the media. Typical view of trickling filter unit is shown in **Figure 3-14**. The sewage is collected in the underdrain of the TF and will flow to the into JP-2 and then to the DP4 for distribution to the secondary settling/humus tanks.

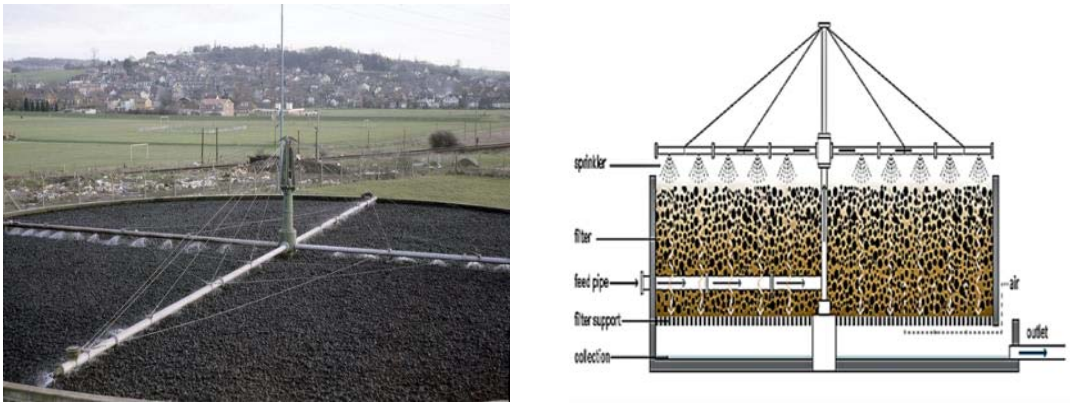


Figure 3-14: Typical View of Trickling Filter Unit

b. Humus Tanks/Secondary Settling Tank

87. The secondary settling tank/humus tank will allow the settling of the suspended solids at the bottom of the tank and produce a clarified effluent. Sludge that settled will be removed using a sludge scraper. The treated and clarified effluent will be discharged to Korangi Creek. Typical view of humus tank unit is shown in **Figure 3-15**.

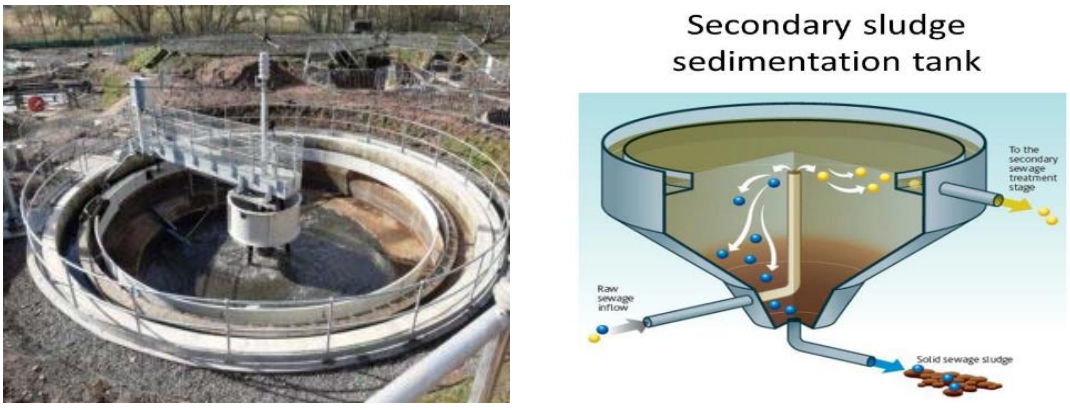


Figure 3-15: Typical View of Humus Tank Unit

3.4.4 Sludge Management and Recycling

88. About 240 m^3/day of sludge will be generated at TP-IV. Sources of sludge are from the primary and secondary settling tanks. The sludge will be partially treated onsite to reduce its water content and make it more stabilized for easier transport. Dried sludge will be removed on a daily basis and further transported for recycling as fertilizer/ soil improver in horticultural activities.

a) Sludge Thickeners

89. The operation of the PST and secondary settling tank will generate sludge. Sludge from these tanks shall be pumped to the combined sludge thickeners by means of their respective sludge pumps. The sludge thickener will separate the water and solid contents of the sludge. The supernatant or the water removed from the sludge shall be returned to the wet well of sewage pumping station.

90. The thickened sludge that settled at the bottom of the thickener will be collected mechanically, through a center-driven bottom truss with picket fences and fixed bridge-type sludge scraper and will be pumped to the sludge digesters. A total of two (1 duty + 1 standby) screw centrifugal sludge pumps of 50 m^3/hr capacity will be installed in the thickened/digested sludge pumping room to transport the sludge to the digesters. Typical view of sludge thickener unit is shown in below **Figure 3-16**.

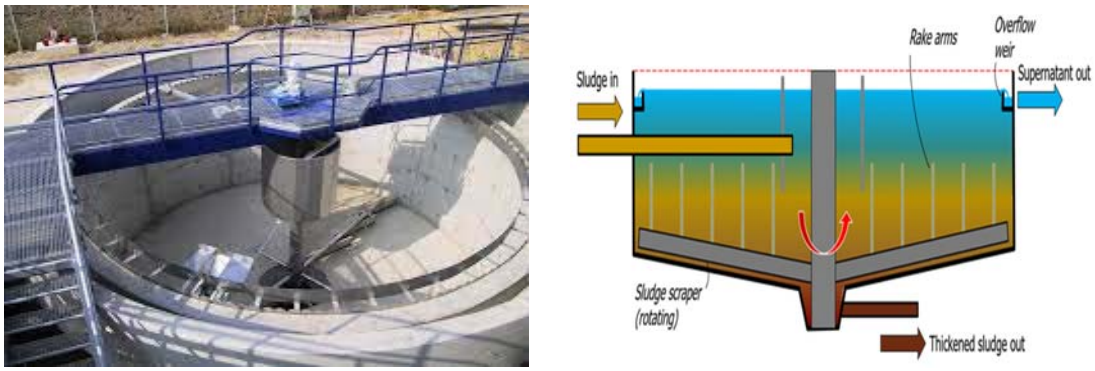


Figure 3-16: Typical View of Sludge Thickener

b) Sludge Digesters – Single Module (45 MGD)

91. The thickened sludge from sludge thickeners will be digested before final dewatering. The purpose of digestion is to stabilize the solids and bio-solids to reduce pathogens, eliminate odors and to inhibit or reduce the potential for purification. Anaerobic digestion is the most common method adopted for the stabilization of sludge in absence of any molecular oxygen.

92. The digesters will be equipped with a specially designed mixing system. The biogas generated from the digestion will be sent to flare. Typical view of sludge digester unit with flare is shown in below **Figure 3-17**.

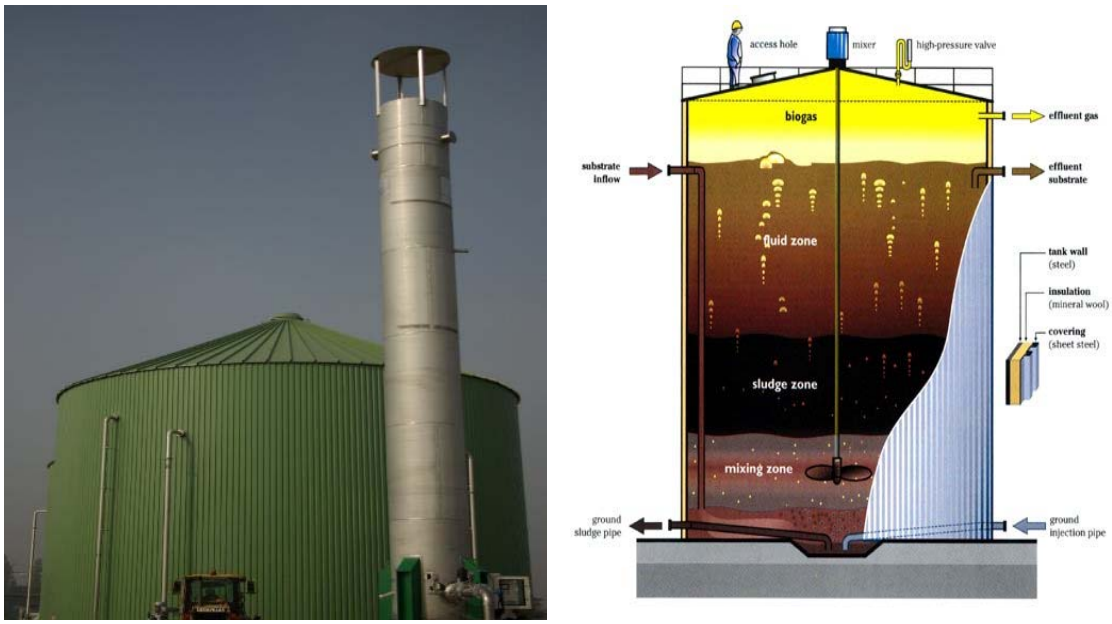


Figure 3-17: Typical View of Sludge Digester Unit

c) Sludge Drying Beds – Single Module (45 MGD)

93. From the sludge digesters the digested sludge will be pumped to sludge drying beds for dewatering. The filtrate water from sludge drying beds shall be pumped back to the coarse screen chamber. Based on the climate in Karachi, a drying time of 6 to 7 days shall be needed for adequate drying of the sludge at an application depth of 30 cm.

94. Belt filter press will also be provided to dry the sludge during the rainy and seasons, when outdoor drying may not be possible.

95. Design basis for sludge drying beds is presented in **Table 3-5** below, whereas typical view of sludge drying bed is shown in **Figure 3-18**.

Table 3-5: Design Basis for Sludge Drying Beds

Parameters	Value	Unit
Digested Sludge Data		
Combined sludge load	17,350	kg-TSS/d
Combined sludge flow	636	m^3/d
Design Criteria		
Drying period	6.6	Days
Application depth of sludge	0.3	meters
Solid content after drying	30	%
Design of Sludge Drying Beds		
Total area of SDBs, required	500	m^2
Number of SDBs	23	Units
Dimension of SDBs, adopted	0.3	m
Source: Process and Hydraulic Design Report – TP – IV		

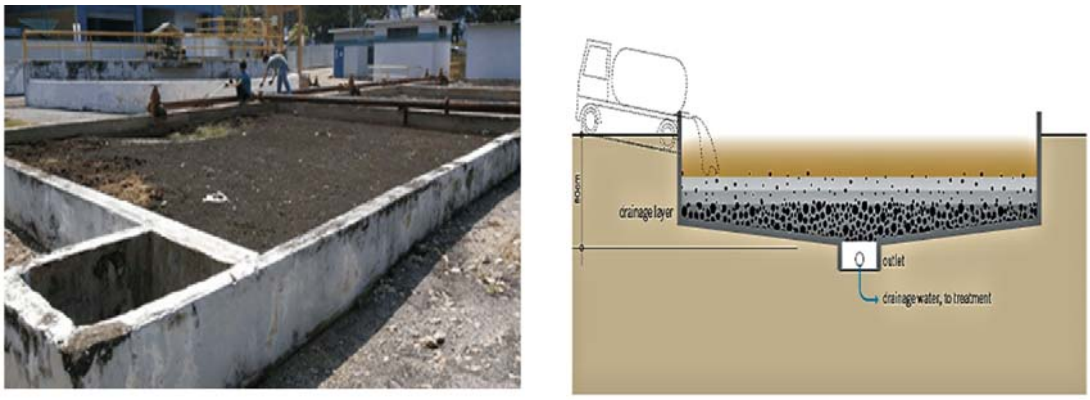


Figure 3-18: Typical View of Sludge Drying Bed

d) Sludge Transport

96. Dried sludge from Sludge Drying Beds (SDBs) shall be periodically removed and temporarily stored in Hook-lift Skips equipped with Lids. Filled skips shall further be transported through trucks for recycling purposes. Considering that the volume of each skip is 20 m^3, a total of 12 skips shall be transported daily.

3.4.5 Tertiary Treatment Options

97. The project shall provide ample ground to explore the possibility to opt for water reuse of the treated effluent through Public Private Partnership intervention with potential revenue streams to utilize the wastewater after tertiary treatment from TP-IV to nearby located twin industrial areas of Landhi & Korangi.

3.5 Project Utilities

3.5.1 Water

98. The water requirement during construction is estimated to be 60 m^3/day while during operation, the water requirement is about 9.25 m^3/day.

3.5.2 Power

99. The construction of the proposed project will require 3,000 kWh of power while during operation, the power requirement is 925 kWh.

3.5.3 Construction Materials

100. The list of construction materials, sources and quantities required for the civil works are described in **Table 3-6**.

101. Excavated materials estimated to be generated from construction activities is about 1,531,000 cubic meters (Technical Consultants). At maximum, the dry excavated material shall be reused for backfilling, whereas surplus dry excavated material as well as wet excavated material shall be managed and handled by SEPA certified waste management contractors to be engaged by the construction contractor with PIU approval.

Table 3-6: Sources of Raw Material for Project Construction

No.	Raw Material	Source	Approximate Quantities
1.	Rubble Stones for Soling	Available through many licensed crush plants located in Gadap Town, near Norther Bypass and other places of District Malir	20, 657 m^3
2.	Sand	Available through many licensed sand and gravel suppliers located in Gadap Town, other places of District Malir, in vicinity of M9 motorway and Hub area	5,783,682 m^3
3.	Cement	Ordinary Portland Cement and Sulphate Resistant Cement etc. are available at various cement plants located near Karachi e.g., Lucky Cement and Power Cement in Nooriabad, M9 Motorway	217,259 m^3
4.	Reinforcement steel	Reinforcement steel is locally available at steel re-rolling mills in and around Karachi e.g., Agha Steel, Aisha Steel etc.	22,000 ton

3.6 Project Activities

3.6.1 Pre-construction Phase

102. This will include securing the necessary permits and clearances from the national government agencies.

3.6.2 Construction Phase

103. The activities to be conducted during construction phase of the project are discussed below.

a) Development of Construction and Labor Camps

104. One of the first activities to be completed by the Contractor shall be the establishment of the construction and labor camp. The Contractor will also establish construction yards and sites including material storage areas, offices, workshops etc.

105. The proposed locations of the construction camp sites are shown in **Figure 3-1**. Two labor camps are being proposed for the construction of the interceptor while one labor camp will be assigned for the construction of the proposed TP-IV.

106. The camp sites during the construction of the interceptor will be located in local government-owned land and prior permission shall be taken from the department for the establishment of campsites at these locations. The proposed labor camp for the TP-IV will be located inside the proposed TP-IV site.

107. Each campsite will require about 1500 m^2 area. The construction activity will span over almost 18 months. During construction phase, an estimated 600 workers will be required and about 150 to 180 workers will temporarily reside in each of the three campsites.

108. The proposed site for the Contractor's camp shall include the facilities listed in **Table 3-7**. Typical layout plan for construction camp shown in the map attached as **Figure 3-19**.

Table 3-7: Contractor's Camp Facilities

Site	Facilities
Labor Campsite	◆ Accommodation ◆ Kitchen ◆ Dining area for Staff and Labor ◆ Sanitation facilities ◆ Septic tank ◆ Liquid and solid waste disposal facilities ◆ Generator(s), for operation when the power supply from the grid station was not available
Construction Campsite	◆ Uncovered material storage ◆ Covered material storage
Workshop Site	◆ Batching plant ◆ Material storage (including hazardous materials) ◆ Workshops ◆ Laboratory ◆ Site Offices ◆ Contractors accommodation ◆ Labor camp including welfare facilities such as kitchen & dining room ◆ Sanitation facilities ◆ Sewage disposal system ◆ Medical facilities ◆ Parking for vehicles and plant ◆ Generators

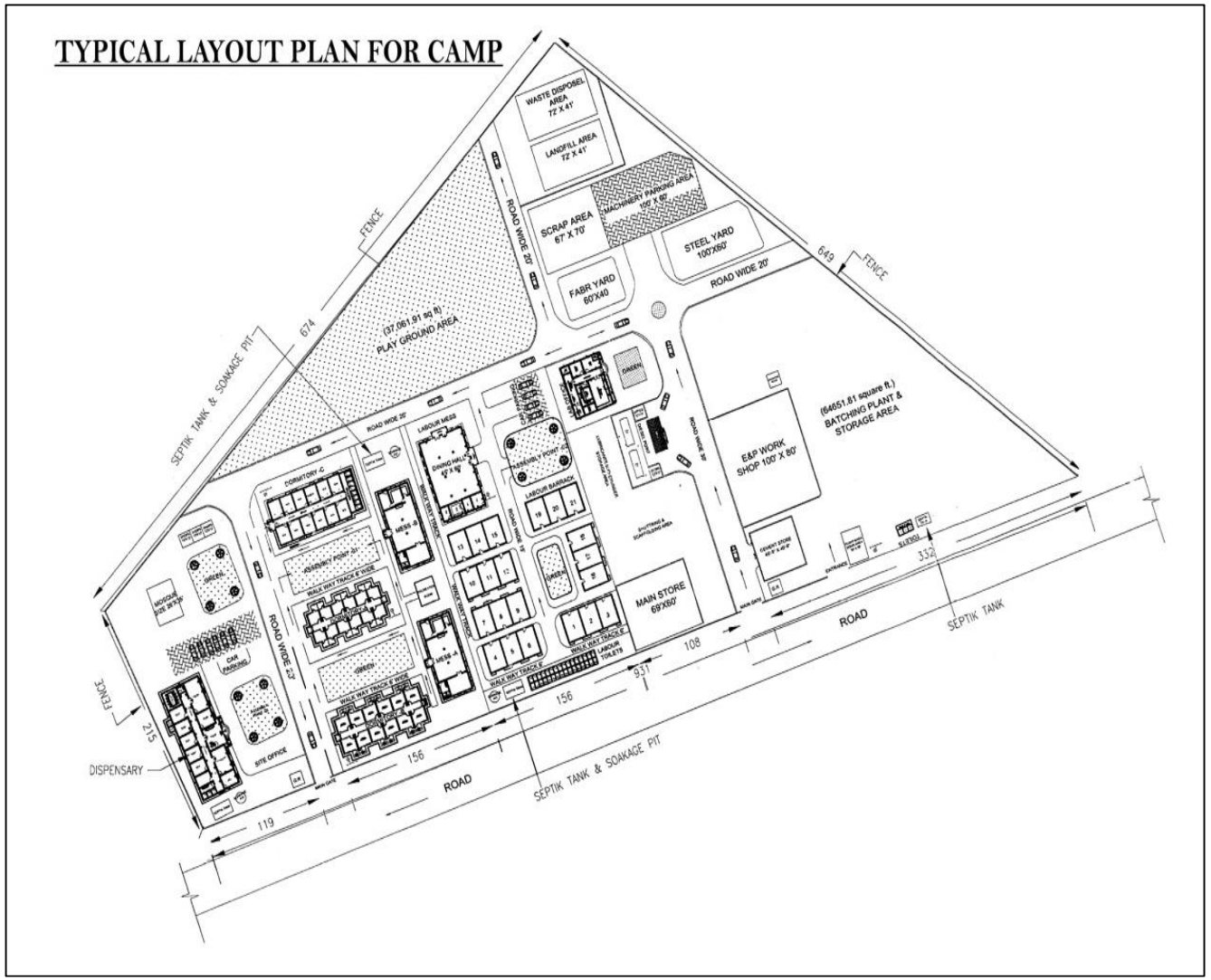


Figure 3-19: Typical layout plan for construction camp

b) Construction of Interceptor, Manholes and Sewer Connections

109. The following are the major civil works involved in the construction of the proposed Malir Basin Interceptor.

i. Minor Improvement of Access Roads

110. Two existing roads are proposed to be utilized as access roads for the construction machinery, material haulage and other construction vehicles to reach various sections of the interceptor alignment. These include the following:

- Road leading to the Interceptor alignment from Korangi Creek Road towards Chakra Nala Right Bank Road
- Road leading to the Interceptor alignment from EBM Causeway towards Malir Expressway

111. Both access roads are existing and being utilized by relevant government agencies and departments. Road No. 01 is utilized by Korangi Creek Cantonment Board, KWSC and SSWMB for cleaning of adjacent Chakra Drain while Road No. 02 is being used by Malir Expressway/ Local Government Department as an access road for construction works. **Figure 3-20** shows the pictorial views of these access roads.

112. These roads are wide enough to accommodate construction vehicles and machines. There are also no settlements located near these roads, However, minor works for strengthening these roads shall be performed where required.

Road No. 01: Road leading to the Interceptor alignment from Korangi Creek Road towards Chakra Nala Right Bank Road

Road No. 02: Road leading to the Interceptor alignment from EBM Causeway towards Malir Expressway Access Road

Figure 3-20: Interceptor Access Roads

ii. Trenching and Excavation

113. Open cut excavation shall be performed for major sections of the interceptor, while trenchless jacking will be employed for the proposed sewer line connection from TP-II to the proposed interceptor.

114. At maximum 8 m wide and 5.5 m deep, trench shall be excavated for the interceptor. The excavation shall be done with safe side slopes as per ground conditions and with sufficient margin for working on structural concrete. Excavation shall be carried out by excavators, and excavated material shall be temporarily piled at excavation sides.

115. Excavation activities will be conducted under various conditions, including both dry and wet conditions, particularly considering the proximity of certain sections of the interceptor alignment to the Malir River stream. To maximize efficiency and sustainability, the dry excavated material will be repurposed for backfilling in the embankment's shoulder areas. Any surplus dry excavated material, as well as material excavated under wet conditions, will be meticulously managed and handled through certified waste management contractors endorsed by SEPA (Sindh Environmental Protection Agency). The responsibility for securing these contractors and obtaining PIU (Project Implementation Unit) approval for this task will lie with the contractor, ensuring proper and compliant waste management throughout the project.

iii. Shoring

116. Provision of shoring required for supporting sides of trenches, bailing out of sub soil water and water from other sources such as from Malir River or rainwater will be part of the contractor's scope. Submersible pumps shall be utilized for dewatering and will also be included in the contractor's scope.

iv. Levelling Course (PCC) for Cross Drainage Structure

117. The excavated pit shall be manually dressed in sufficient working space around the raft to be constructed. Fix forms like ISMC 150 or wooden planks at the edge as formwork. P.C.C shall be supplied from the batching plant through transit mixers. It shall be unloaded through chute/s, and then it shall be manually spread & compacted in a uniform layer of levelling course thickness. After the initial set, the concrete surface shall be sprinkled with water to save it from cracking. Curing shall be done by keeping it moist with Hessian cloth or by a continuous spray of water. After allowing it to gain strength over 24 hours, it shall be released for raft activities.

v. Box Culvert Raft Concreting

118. Concrete shall be supplied from batching plant through transit mixers. Concrete shall be poured into the foundation using direct chute or concrete pump as per accessibility. Chutes shall be made using M.S. sheets/CGI sheets supported by structural steel members. Chutes shall be placed with an appropriate slope so that concrete free flows. In case of concreting using chute, the same shall be made wet by water before pouring concrete over it for concrete to free flow. After final set mortar bunds shall be made for ponding of water, the sand layer is laid in bunds to retain water for the proper curing. Within 24 hours, concrete will gain sufficient strength, and de-shuttering shall be done carefully.

vi. Box Culvert Wall Reinforcement

119. Against the dowels left through the raft, balance reinforcement shall be tied for the predetermined lift to be concreted. Vertical rods shall be provided with required overlaps as per

construction drawings. Efforts shall be made to minimize overlaps. Horizontals shall be tied in position. Concrete cover shall be provided by Concrete cover blocks tied with reinforcement as required.

vii. Box Culvert Wall Concreting

120. The concrete mixed from centralized batching plant/s shall be delivered through transit mixers. It shall be placed manually or through crane + bucket/Concrete pumps as per site condition. Concrete shall be laid in 350-400mm layer and vibrated with needle (electrical/petrol/diesel) vibrators. It shall be ensured that concreting is continuous and completed in a single pour to minimize the number of cold joints. The exposed area of the walls shall be green cut to receive next lift concrete. Shear keys (Construction Joint) shall be formed as per the construction drawing.

viii. Manholes Construction

121. Construction of manholes shall involve the following steps:

- Excavation for manhole shall be done as per the dimensions and levels specified in the plan or drawings.
- Excavation width shall include the necessary working space for accessibility for the mason to work freely below the ground.
- Bed concrete shall be laid over which the manhole shall be constructed.
- In the case of loose soil, special foundations shall be constructed to support the manhole.
- Block masonry shall be performed, and the bricks of specified quality shall be used in the construction of manholes.
- The finishing of the brick masonry in the external face shall be finished smooth.
- The joint of the masonry and pipe shall be specially treated to make it perfectly leak proof.
- The excess shaft in the circular manholes shall be corbelled inwardly at the top to reduce its size to the cover frame to be fitted.
- The inside of the brick masonry of manhole shall be plastered with cement mortar.
- The inside plastered surface shall be waterproofed with a waterproofing agent.
- The channels and benching in a manhole shall be constructed using cement concrete.
- The finish for the channel and benching shall be smoothly and neatly finished.

ix. Connection with Incoming Sewer Points

122. Approximately 2-meter-wide and 4-meter-deep excavation will be made for the construction of the intake structures to connect the 20 sewer points with the interceptor. At locations where the alignment of interceptor shall run in parallel to the Malir Expressway, the interceptor shall be connected via intake structure with the sewage culverts provided in the Malir Expressway Alignment.

123. **Figure 3-21** shows some locations of the under construction Malir Expressway where culverts have been constructed for the sewage disposal into the existing Malir River, while **Figure 3-22** shows a A-A Section Drawing of sewer connection with Interceptor Culvert.

Figure 3-21: Sewer Culverts in Malir Expressway Alignment

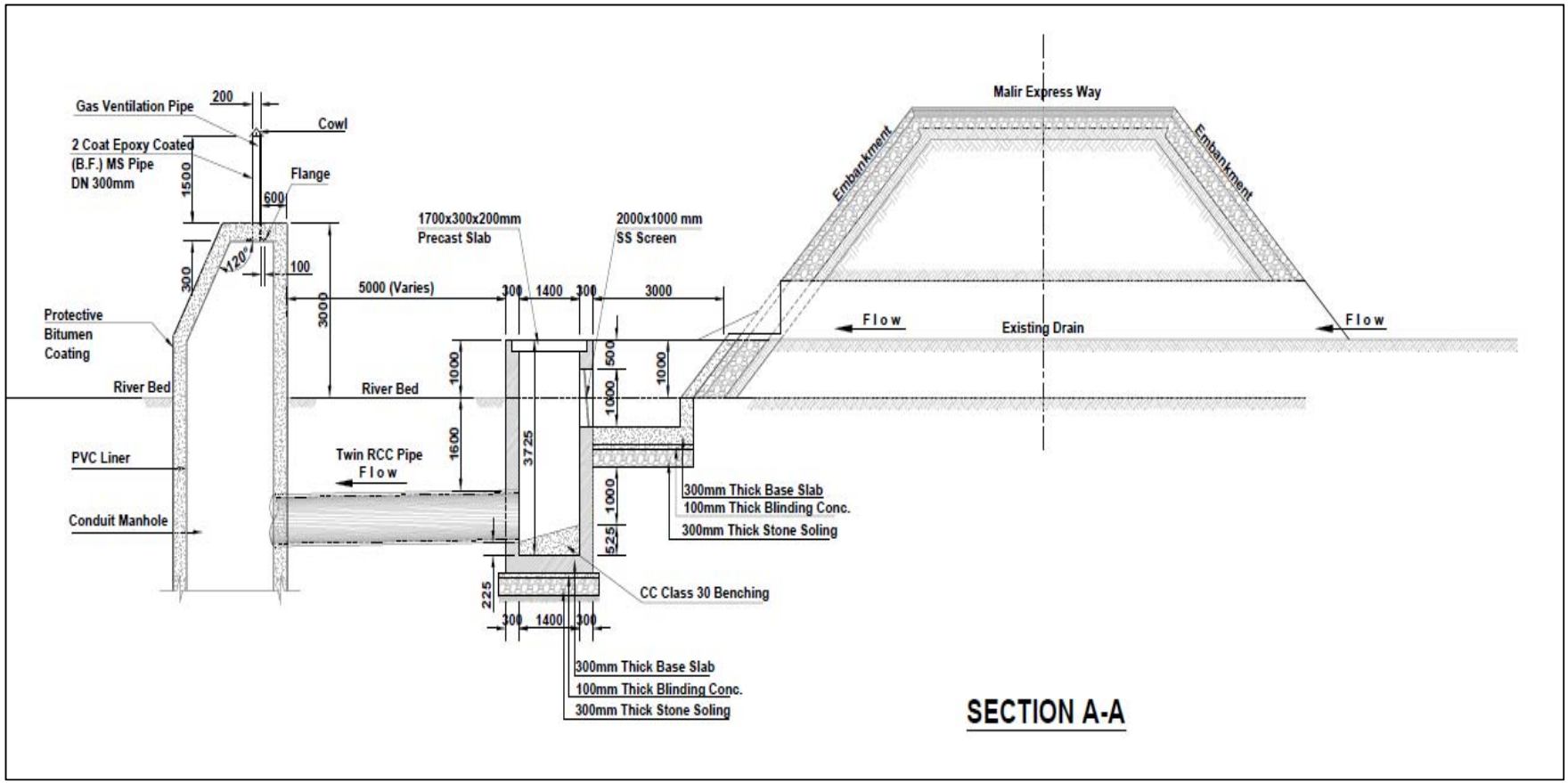


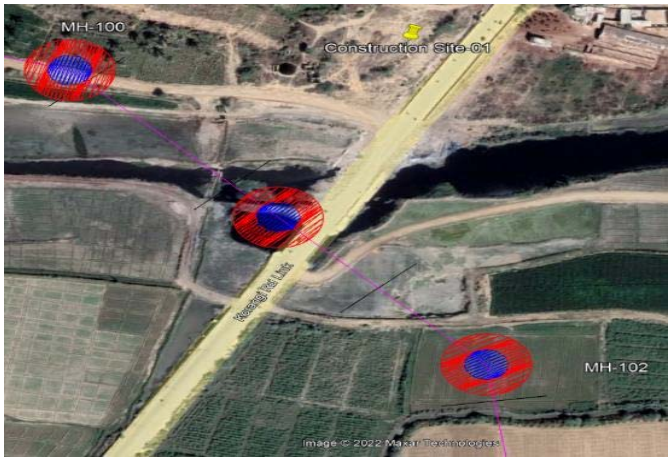
Figure 3-22: Intake Structure for Sewer Connection with Interceptor

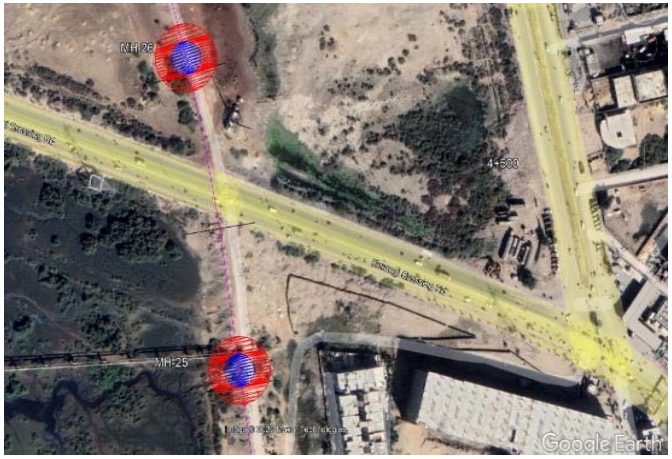
x. Pipe Jacking at Roads and Pipelines Crossings

124. Pipe Jacking, a trenchless method excavation, will be employed for the construction of the interceptor box culvert where the alignment will cross the following major roads and two existing oil pipelines. The details of these locations are as follows **Table 3-8**.

- 27.31 m at Korangi Crossing
- 46.88 m at EBM Causeway
- 17 m at Jumma Goth Causeway (Korangi Link Road)
- 18 m at PARCO Pipeline
- 18 m at PRL Pipeline
- 60 m Shaheed e Millat Road and Malir Expressway near Manzoor Colony Fire Station

Table 3-8: Jacking Locations along Interceptor Route

No.	Jacking Locations	Map	Picture
1	Korangi Link Road (Jumma Goth Causeway) Crossing between MH 102 and MH 101.		
2	EBM Causeway (Surgeon Faiz Khan Rd) Crossing between MH 42 and MH 41.		

No.	Jacking Locations	Map	Picture
3	Korangi Crossing Road - Crossing between MH 26 and MH 25.		
4	NRL Lines Crossing near MH 25.		

No.	Jacking Locations	Map	Picture
5	PRL Lines Crossing between MH 18 and MH 17.		
6	EBM Causeway / Baloch Colony Road near Manzoor Colony		

c) Construction of TP-IV

i. Access Roads

125. The existing road leading to TP – IV Site from Pakistan Refinery Road along PRL Eastern Boundary is proposed to be utilized for the movement of construction machinery, material haulage and other construction vehicles to reach the TP-IV Site. This road is already being utilized by the nearby installations such as PRL and other smaller industrial/warehouse units located along the way. **Figure 3-23** shows the photo of this road. Minor works for strengthening this road will be performed where required.

Figure 3-23: Existing Access Road to TP– IV

ii. Site Preparation and Excavation

126. Site preparation activities will be done in the proposed site such as excavation and grading, slope stabilization, installation of retaining walls, access roadways, underground utilities and drainage systems, structural excavation and groundwater dewatering as necessary to support work conducted below the groundwater table.

127. Underground utilities and drainage systems will be installed in conjunction with the excavation and grading work. Soil removed in trench and utility tunnel locations will be removed from the site along with the remaining soil from structural excavation work using the same workforce and equipment. Material deliveries for utility installations will include periodic trucks carrying concrete utility structures (manholes and catch basins), drainage piping and other equipment associated with the underground work.

128. Construction of onsite access roadways will require importing quarry spalls or any other appropriate roadway subbase. Final pavement of the onsite roads will not occur until late in the project to avoid damage to new pavement.

iii. Concrete Placing

129. When site grading and excavation have progressed to a point that large areas are at their final grade, work shall be initiated on building the plant. A layer of clean sub-base material, usually gravel, shall be placed to provide a good working surface for placing concrete. Foundations or base slabs, depending on the design, will then be constructed. Reinforcing steel (rebar) shall then be placed in the form or excavation. After placing any embedded items such as anchor bolts, drains, etc. the work shall be inspected, and concrete shall be placed. Much of the concrete for the wastewater treatment plant shall be required for the treatment process tanks. These require multiple concrete pours for the base slab followed by the walls. Contractors will generally try to establish a flow to the work such that several work crews are placing foundations and base slabs, followed by crews placing walls and, where applicable, elevated slabs or roof slabs. For some foundations, concrete can be poured directly from the mixing trucks into the forms. However, most concrete will be placed by pumping the concrete, either with truck-mounted pumps or with boom trucks. In some cases, concrete shall be poured into buckets and the buckets shall be hoisted by a crane and dumped into place.

iv. Piping

130. An important component of treatment plant construction is the construction of utility tunnels or galleries. These galleries shall be provided for the piping and electrical systems between process units and shall be constructed early in the project along with the process unit foundations. Once built, supports for piping and electrical lines shall be erected and the utilities shall be installed. Again, contractors will truck initial supplies of piping and electrical conduit and wire. It is anticipated that an average of 2 to 3 flatbed or trailer trucks will arrive on site daily to deliver materials to support these operations.

v. Mechanical Equipment

131. After the treatment units are constructed and the concrete has cured, installation of equipment and process systems would begin. Equipment deliveries will be ongoing throughout the project but will increase as the various system components become ready for installation. A crane, forklifts, or other hoists will be required onsite to offload and install equipment. Crew sizes are expected to increase as the work diversifies into plumbing, electrical and other system installations. Staging and parking areas will increase during equipment installation to accommodate the added materials, supplies and workers. In addition, items that require on site fabrication will need sufficient site area for fabrication processes. The key activities in the installation of mechanical equipment start with concrete placement. Generally, bolts or plates are embedded in the concrete to provide fasteners for mechanical equipment. After delivery to the site, equipment is placed on the foundation, levelled, and balanced, and finally grouted into place. Depending on the type of equipment, it is then connected to piping, ductwork, and electrical power /control systems as appropriate. For the most part, equipment will be delivered on standard sized flatbeds or trailer trucks. Oversized components may require special delivery procedures. As with any variance, the contractor must describe the delivery operations and the mitigation necessary to that operation. If deliveries are over-sized, it may be necessary to arrange for transport during off-peak hours or on a Sunday.

vi. Electrical Work

132. Electrical work for a treatment plant involves installation of the main substation equipment including transformers and switchgear. Electrical work includes tie-in to a main power service, as well as back-up services that can include alternate feeds and emergency generators. Conduit and cable trays shall be installed throughout the plant, primarily in the utility tunnels, to carry the conductors to various pieces of equipment that require electricity. Equipment primarily consists of the motors that run various parts of the plant and will range from 2-3 horsepower to over 200 horsepower. Cables shall be pulled from the power source and the motor control centers to each piece of equipment. Finally, cables shall be terminated both at the equipment and at the control panel and switching device from which the power is distributed.

vii. Instrumentation and Controls

133. Each piece of equipment in the treatment plant shall be monitored and controlled from a SCADA based centralized control console, located in the proposed administration building. To allow operators to see the status of each piece of equipment at any time, devices on the equipment shall be wired back to the central control panel. Controls can have multiple set points, different status denotations, and automated programs to optimize the plant operations. Systems can test the process effectiveness and adjust operating parameters to reduce power consumption, improve effluent quality, monitor odor, and many other functions.

viii. Support Facilities

134. There shall be two main support facilities for the treatment plant; the Administration building and the Maintenance Building. The administration building will provide offices, a laboratory, control room and employee amenities such as a lunchroom and showers. The building will be of block / concrete construction having necessary mechanical systems, electrical and plumbing works. The maintenance building will provide space for storage of spare parts and shop areas for repairing and maintaining the treatment plant equipment. This building shall also be a concrete construction with several bays with hoists and an overhead crane.

ix. Landscaping, Roads, and Sidewalks

135. Installation of landscape features and final plant roads and sidewalks will be one of the last major activities. Previous earthwork activities will bring the entire site to near its finish grade. Any required topsoil will be placed as part of this final operation. The site will include significant landscaping features and landscaping will be extensive at the site. The contractor shall establish an on-site nursery and grow selected trees and shrubs that will be planted around the site.

3.6.3 Operation Phase

136. Each piece of equipment in the treatment plant will be monitored and controlled from a SCADA-based centralized control console, located in the proposed administration building. To allow operators to see the status of each piece of equipment at any time, devices on the equipment shall be wired back to the central control panel. Controls can have multiple set points, different status denotations, and automated programs to optimize the plant operations. Systems can test the

process effectiveness and adjust operating parameters to reduce power consumption, improve effluent quality, monitor odor, and many other functions.

137. Intake chambers shall be periodically cleaned manually. A plan shall be devised and implemented by the KWSC during the operational phase of the project for the periodic cleaning of intake structures to ensure toe smooth sewage inflow and restrict backflows.

138. Regular and planned inspection of the interceptor will be conducted to ensure that there are no leaks along the alignment. The mechanical equipment of the STP and the pumping stations will also be inspected to ensure that all are functioning properly. If there are issues observed, repair will be implemented immediately.

3.7 Workforce Requirements

3.7.1 Construction Phase

139. Manpower requirement during construction is estimated to be about 600 persons for the construction of both interceptor and TP-IV.

3.7.2 Operational Phase

140. Estimated workforce requirement during operational phase of TP-IV is about 191 persons. Details are shown in **Table 3-9**.

Table 3-9: Sources of Raw Material for Project Construction

Category	Numbers	Category	Numbers
Management Staff		Laboratory Staff	
Plant Manager	1	Chemist	1
Mechanical Engineer	2	Assistant Chemist	2
Electrical Engineer	2	Laboratory Attendant	2
Shift Engineers	3	Operation Staff	
Shift Supervisors	3	Senior Operators	10
Mechanical Supervisor	4	Operators	20
Electrical Supervisor	4	Operators' Helpers	20
Stores Supervisor	4	Laborer and Coolies	40
Office Staff		Maintenance Staff	
Administration & Purchase Officer	2	Mechanic	4
Administration Assistants	2	Mechanic Helper	4
Finance Officer	1	Electrician	2
Accountants	1	Electrician Helper	4
Accounts Assistant	2	Equipment Cleaners	4
Charges Assessment Officer	1	Janitors	10
Charges C o l l e c t i o n Assistants	4	Miscellaneous Staff	
Office Attendants	5	Light Vehicle Driver	4
Janitors for Plant Building	2	Tractor-Trolley Drivers	10
		Gardener	6
		Security Guards	5
Source: Process and Hydraulic Design Report – TP – IV			

3.8 Project Implementation Schedule

141. The project construction phase is expected to be completed within 18 months. The Construction schedule is provided as **Figure 3-24**.

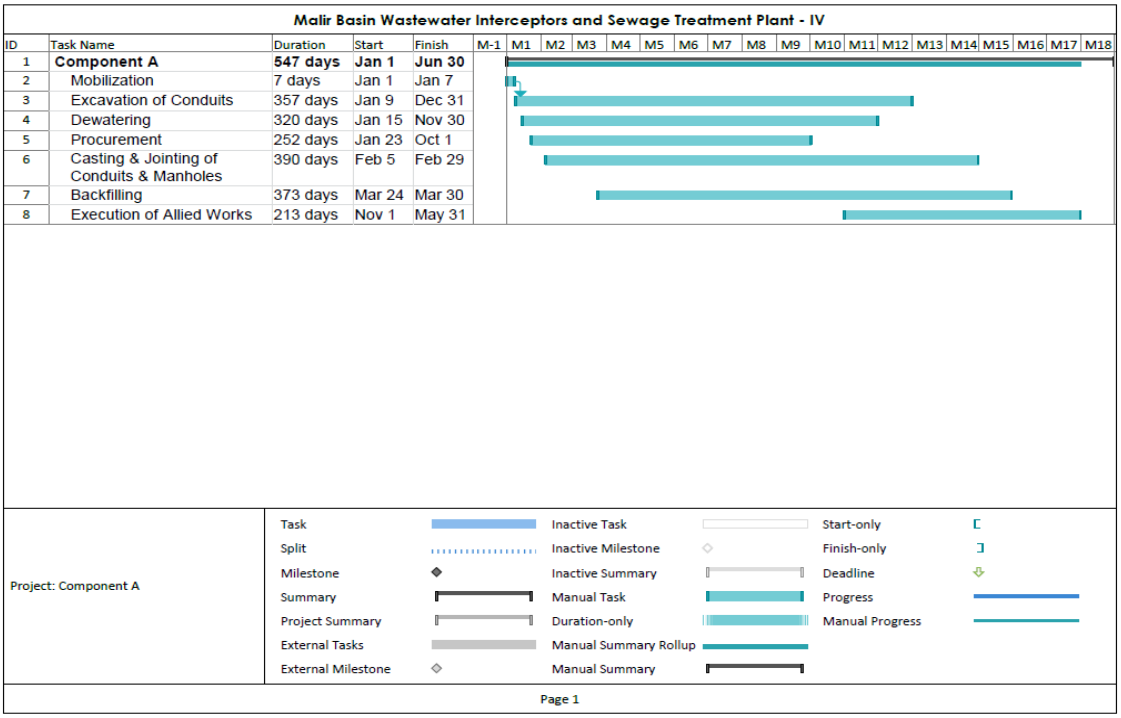


Figure 3-24: Construction Schedule for the Project

Source: Group 04 Technical Consultants

3.9 Project Cost

142. Total cost of the project is estimated to be **USD 199 Million**[6].

[6] Source: Project's PC-1 Documents

4 Environmental and Socio-Economic Baseline

4.1 Physical Environment of Project Area

4.1.1 Land Use

a) Interceptor and TP-II Bypass Line / Pump Room Connection

143. The main land use in 8.5 km out of the 22 km interceptor alignment is agricultural, the combined area of which is 14.2 hectares. Common vegetation in the river basin includes shrub trees and bushes. The lower portion of the basin has cultivated lands and vegetation, which gradually reduces towards the south. The land is affected by contaminated irrigation water.

144. Residential areas on both sides of the interceptor alignment include low-income settlements, which span up to the Korangi Link Road. Further downstream is the lower middle to middle class settlements in Shah Faisal Town on the right bank, and the low-income settlements and small to medium industrial units on the left bank. Residential settlements from the EBM Causeway to Korangi Crossing Road are at a considerable distance from the riverbanks. Low to middle-income Bhittai Colony settlement is situated at the left bank from Korangi Crossing Road onwards. The Malir Expressway is near the interceptor alignment, within the banks of Malir River.

145. The section of the project that extends from the TP-II Pump Room to the Interceptor is situated within the densely populated neighborhoods of Manzoor Colony and Mahmoudabad in Karachi. The area from the TP-II Pump Room to Manzoor Colony Fire Station falls within the residential and commercial land use categories. The segment from Manzoor Colony Fire Station to the interceptor traverses the Shaheed e Millat Road and the Malir Expressway. The landscape in this area is barren lands.

146. Views of major land uses are shown in **Figure 4-1** below.

Figure 4-1: Photos of Major Land uses along Interceptor and TP-II Connection Alignments

b) TP – IV Site

147. The TP-IV construction site spans an area of 42.9 hectares (106 acres) and is situated on flat terrain reclaimed from the Korangi Creek, which stretches over 20 kilometers. Korangi Creek is approximately 1,350 meters wide and 15 meters deep. The southwestern portions of the TP-IV site are influenced by tidal currents, leading to occasional inundation of seawater during high tide.

148. This site has a healthy green cover, predominantly characterized by halophytic plants, including various grasses, shrubs, and herbs. Given its proximity to the sea, the groundwater table in this area remains relatively high. The site itself comprises coastal salt marshes, with *Arthrocnemum indicum* as the dominant vegetation species.

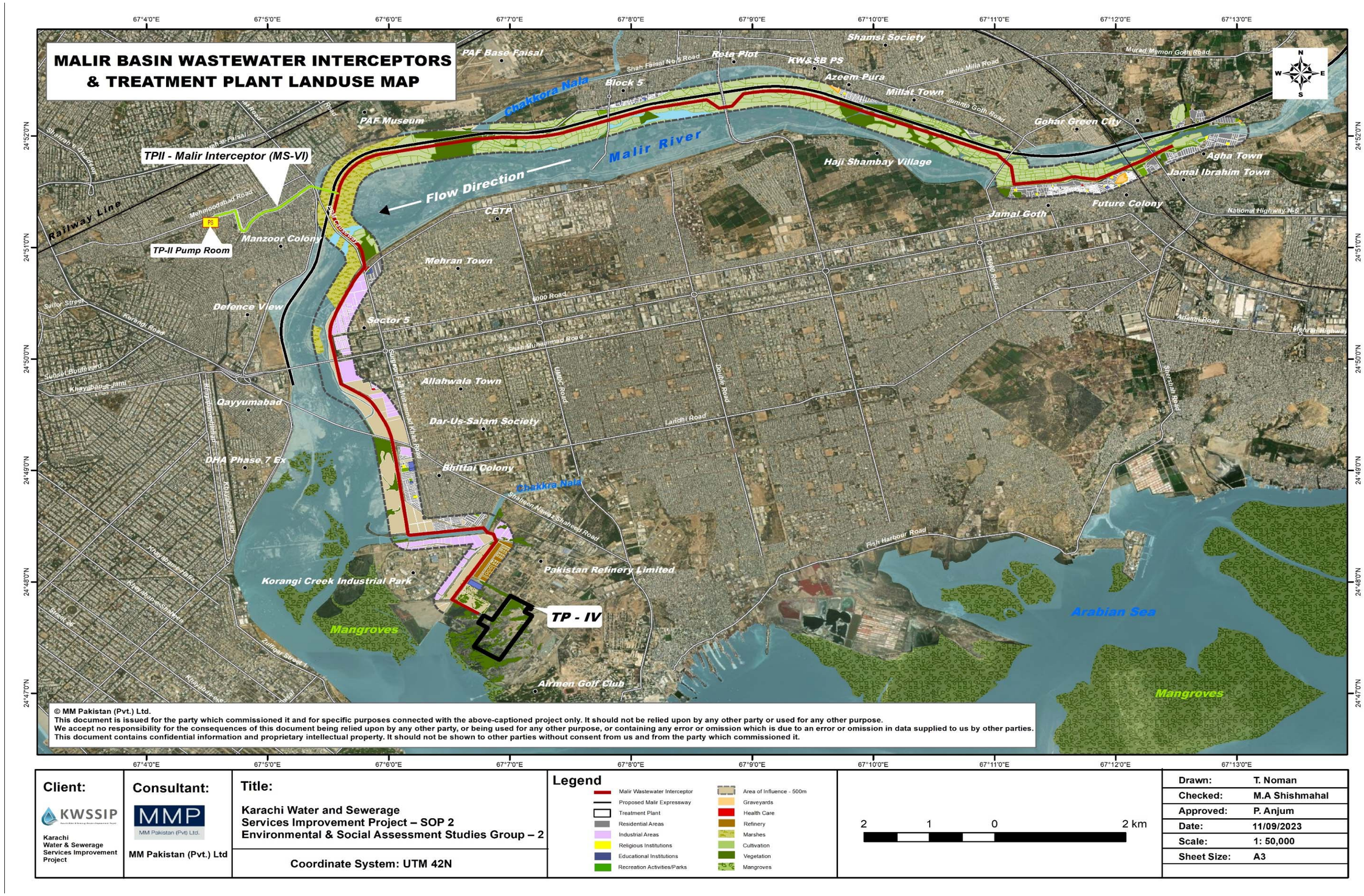
149. The TP-IV site does not have any human settlements. Instead, it serves as a location for livestock grazing, with herds of camels often observed grazing both on the site and in its immediate vicinity. During a consultation meeting, a representative from the Sindh Forest Department (SFD) clarified that grazing activities by local herders in such extensive areas do not require specific permissions from the SFD. Furthermore, it was emphasized that the construction of the project will not adversely impact grazing activities, as ample alternate land areas are available near the TP-IV site. This ensures that the project's construction will have minimal impact on the existing grazing practices in the region.

150. Some patches of mangroves are located along the left bank of Korangi Creek, south-southwest of the proposed TP-IV construction site. The Sindh Forest Department, Port Qasim Authority and Sindh Revenue Board are responsible for the protection and conservation of all the Indus Delta mangroves. Areas under the control of Sindh Forest Department and Port Qasim Authority are declared as "Protected Forests", whereas the area under the control of Board of Revenue is classified as "Government wasteland".

151. A 2.6-hectare (or 6.5 acre) patch of mangroves is located approximately 200 meters south-southwest of the TP-IV site. This mangrove area is under the jurisdiction of Sindh Forest Department and is composed almost entirely of *Avicennia marina.* Using ArcGIS, the density of the mangrove patch was estimated at 417 trees per acre, which categorizes the mangrove site into a forest area with moderate tree cover. The project will not have any impact on the mangrove area since the construction area is far from the site and the mangrove area is outside the AoI. The proposed effluent discharge point will not pose any impact on the mangrove area since it is in an open marsh within Kolangi Creek, approximately 400 meters from the south-southwestern boundary of the TP-IV construction site. The project shall have positive impacts on the mangrove areas as the project aims to solve the problem of untreated wastewater discharge into Kolangi Creek.

152. Figure 4-2 provides pictorial overview of TP-IV Site, Figure 4-3 shows the land-use map of interceptor and TP-IV sites, while Figure 4-4 shows the distance of the nearest mangroves patch from the boundary wall of TP-IV and the Discharge point for treated effluent.

Figure 4-2: Overview of TP-IV Site



Client: KWSSIP — Karachi Water & Sewerage Services Improvement Project

Consultant: MMP — MM Pakistan (Pvt) Ltd

Title:
Karachi Water and Sewerage Services Improvement Project – SOP 2
Environmental & Social Assessment Studies Group – 2

Coordinate System: UTM 42N

Legend

- Malir Wastewater Interceptor
- Proposed Malir Expressway
- Treatment Plant
- Residential Areas
- Industrial Areas
- Religious Institutions
- Educational Institutions
- Recreation Activities/Parks
- Area of Influence - 500m
- Graveyards
- Health Care
- Refinery
- Marshes
- Cultivation
- Vegetation
- Mangroves

2 1 0 2 km

Drawn:	T. Noman
Checked:	M.A Shishmahal
Approved:	P. Anjum
Date:	11/09/2023
Scale:	1: 50,000
Sheet Size:	A3

Figure 4-3: Land use Map for the Project Area

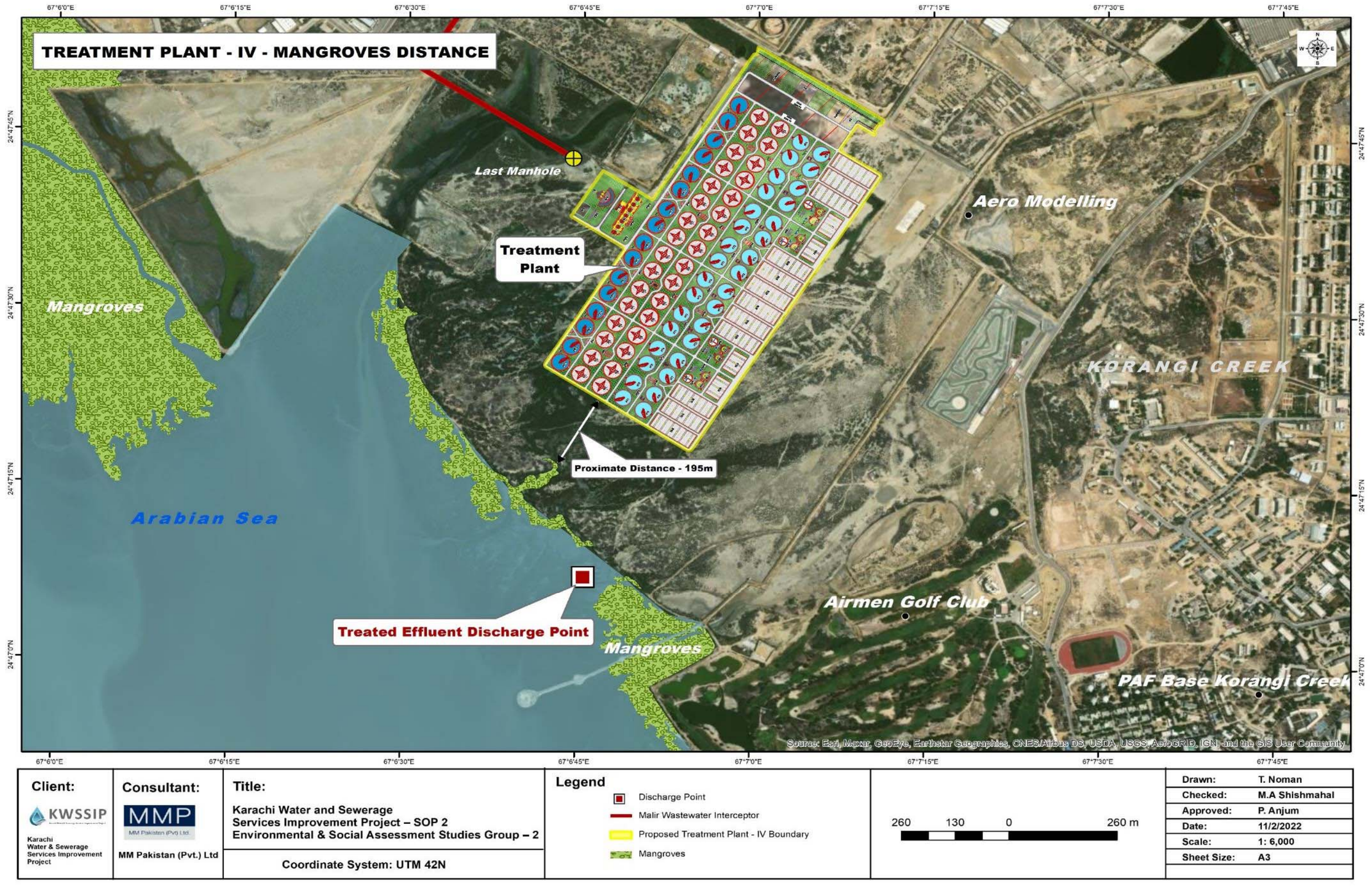


Figure 4-4: Distance of Mangroves from Boundary Wall of TP-IV

4.1.2 Geology/Topography

153. The interceptor is within the banks of Malir River. The central segment of the river basin exhibits a diverse composition of sedimentary deposits, including coarse conglomerates, sandstone, claystone, and limestone. In contrast, the lower plain of the river is characterized by alluvial deposits. The river assumes a wider, shallower, and braided course within the lower plain.

154. The surrounding catchment area presents challenging topography, featuring rugged terrain and rocky lands covered with sandy soil. To ensure structural integrity, engineering specifications have stipulated a bearing capacity of 4 tons per square foot (4 tons/ft²) and a subgrade modulus of 40,000 kilo-newton per square meter (40,000 km/m²) for depths exceeding 8 meters.

4.1.3 Hydrology

155. Malir River has a unique hydrological profile, characterized by the semi-arid climate and seasonal flow patterns. The river flows during the monsoon season, typically from July to September. Outside the monsoon season, the river has reduced or intermittent flow, occasionally drying up in certain stretches.

156. The hydrology of the river is linked to its catchment area, encompassing urban and suburban regions in Karachi. Rapid urbanization and infrastructure development have altered the flow dynamics, leading to occasional flash floods during heavy rainfall events.

157. **Flooding.** The interceptor alignment near Korangi Crossing Road and EBM Causeway is susceptible to flash floods caused by heavy rains. The most recent occurrence of flooding was recorded in July 2022. **Figure 4-5, Figure 4-6,** and **Figure 4-7** provide an overview of the latest flood situation recorded at these two locations.

158. To avoid Impacts of flooding on the sections of interceptor alignment which are in proximity to Korangi Crossing and EBM Causeway, construction works shall be scheduled in dry season of the year, and it shall be ensured that all the construction activities are completed well before monsoon. Standard methods for preventing flooding of construction sites shall also be employed include installation of flood barriers and walls Building of channels to divert water from flooding.

159. For operational phase, wet weather flow and flash flooding considerations have been kept in the design of interceptor and TP-IV. The depth of Interceptor at these locations shall be between 8 – 13m from the bed level, moreover interceptor manholes shall be 3m high from bed level therefore they will not be submerged during the flash flood condition. In addition, bitumen waterproofing shall also be done for Conduit and Manholes.

160. TP-IV site will be provided with adequate storm water protection measures such as flood barriers and walls to protect intrusion of storm water.

Figure 4-5: Flood Points at Korangi Crossing Road and EBM Causeway

Figure 4-6: Flood Situation at Korangi Crossing Road (27 July 2022)

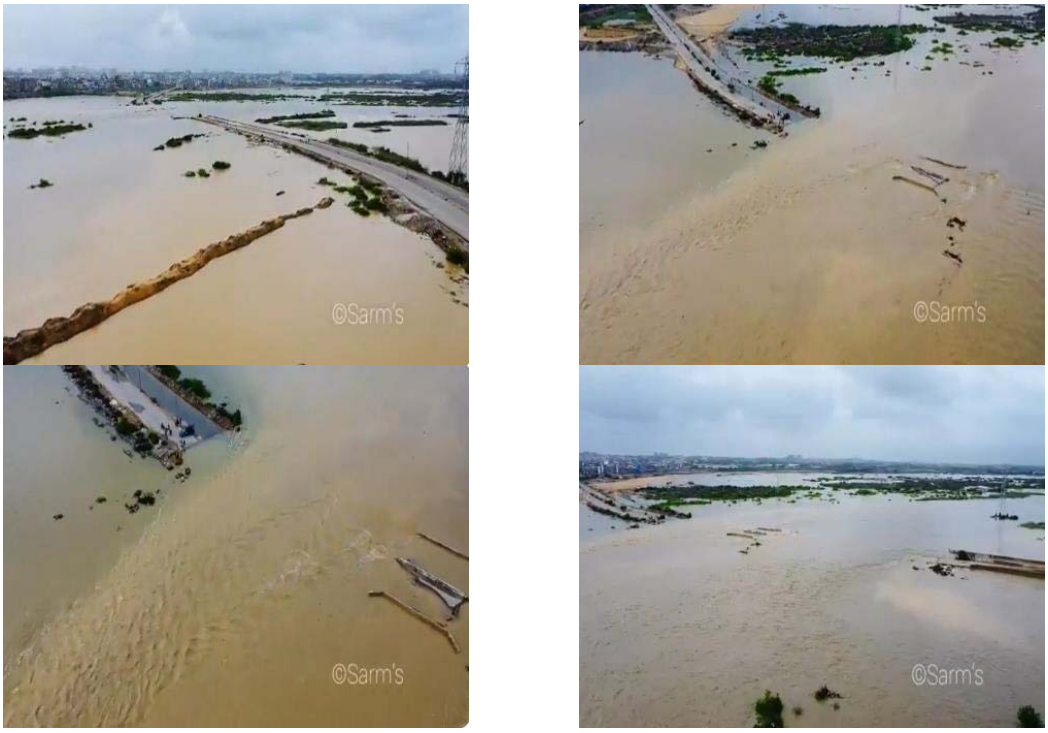


Figure 4-7: Flood Situation at EBM Causeway (27 July 2022)

4.1.4 Climate

161. According to the Koppen Climate Classification, the project area is situated within the Subtropical – Arid Climate Zone characterized by mild winters and hot summers. The climate in the project area is significantly influenced by its proximity to the coastline, leading to prevailing sea breezes and generally high relative humidity levels. The wind rose diagram (**Figure 4-8**) illustrates that for more than half of the year, including the monsoon season, prevailing winds blow from the southwest to the west. During the winter months, the wind direction shifts towards the east and northeast. Throughout the rainy season (July and August) the region experiences consistently overcast skies accompanied by generally light to heavy rainfall, which is influenced by the monsoon weather system.

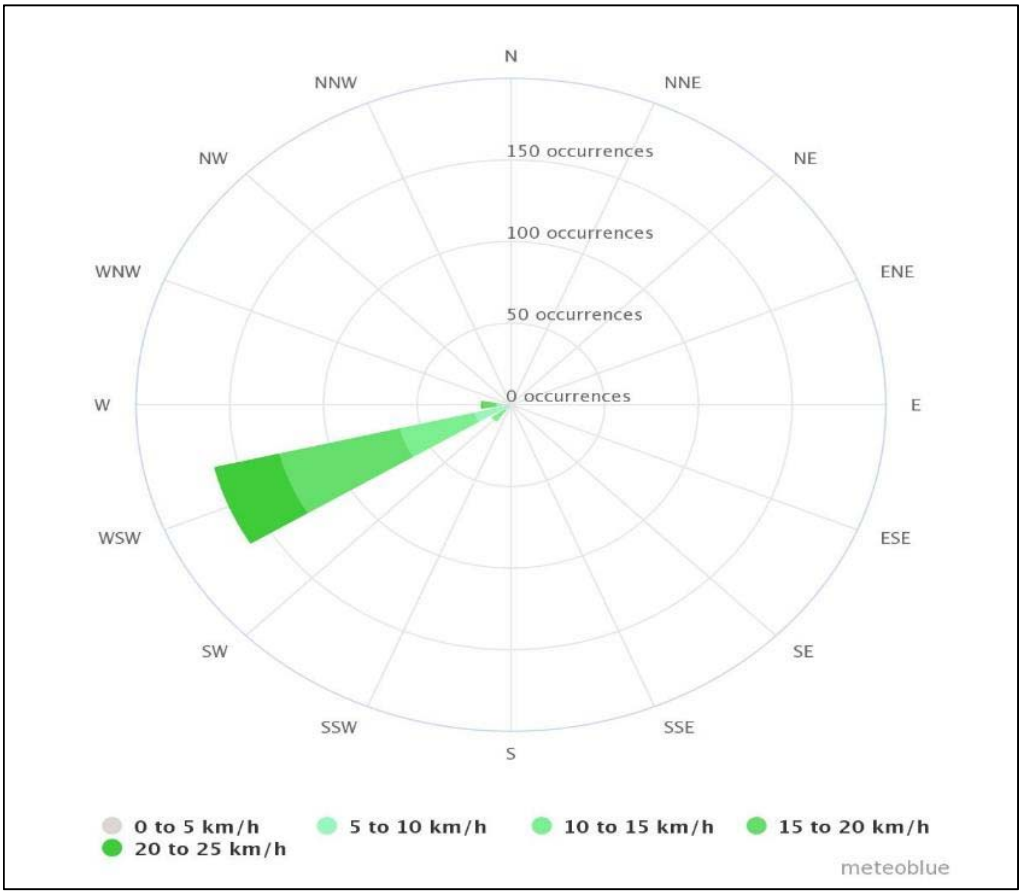


Figure 4-8: Wind Direction in the Project Area

4.1.5 Temperature

162. Temperature data from the nearest weather station from January 2012 to June 2022 reveals distinct seasonal variations. January and December are the cooler months, with daytime temperatures between 28°C to 31°C and nighttime temperatures from 7°C to 8°C. The warmest months are from April to June, with daytime temperatures between 40°C to 41°C and nighttime temperatures from 21°C to 26°C. The historical temperature data is in.

Table 4-1: Monthly Average Temperatures in the Project Area

Month	Maximum Average Temperatures (°C)	Minimum Average Temperatures (°C)
January	28.5	8.2
February	32.3	11.5
March	37.8	14.5
April	41.1	20.6
May	41.3	25.5
June	40.5	26.4
July	37.1	25.8
August	36.5	25.1
September	38.6	23.8
October	38.7	17.1
November	35.3	12.6
December	31.5	7.2
Source: PMD – Jinnah IAP (Jan 2012 to Jun 2022)		

163. Over the past few years, there has been a notable increase in the frequency of heatwaves in Karachi and its surrounding areas, particularly during the months of May through September. A heatwave is characterized by the occurrence of unusually hot, humid, or dry conditions persisting for three to five consecutive days during the summer season. One of the most devastating heatwaves in Karachi was from June 17 to 24, 2015, resulting in a loss of more than 1,200 lives.

4.1.6 Rainfall

164. The annual precipitation in the last five years (**Table 4-2**) reveals significant variability, with relatively low precipitation in 2018 (3.56mm) followed by substantial increase in subsequent years. Precipitation surged to 463.81 mm in 2019, 427.77 mm in 2020, 473.45 mm in 2021, and 769.65 mm in 2022. Additionally, there was a significant increase in the number of rainy days from four in 2018 to 33 to 56 days over the subsequent years.

Table 4-2: Annual Precipitation (2018-2022)

Year	Annual Precipitation (mm)	Number of Days with Rain
2018	3.56	04
2019	463.81	56
2020	427.77	42
2021	473.45	33
2022	769.65	49

4.2 Environmental Quality

165. Air, Noise, and Water quality monitoring were done at three locations from February 17 to 20, 2022. Monitoring points were selected based on their proximity to the core project intervention areas, as well as to the nearby residential settlements or sensitive receptors. Monitoring locations are shown in **Figure 4-9.**

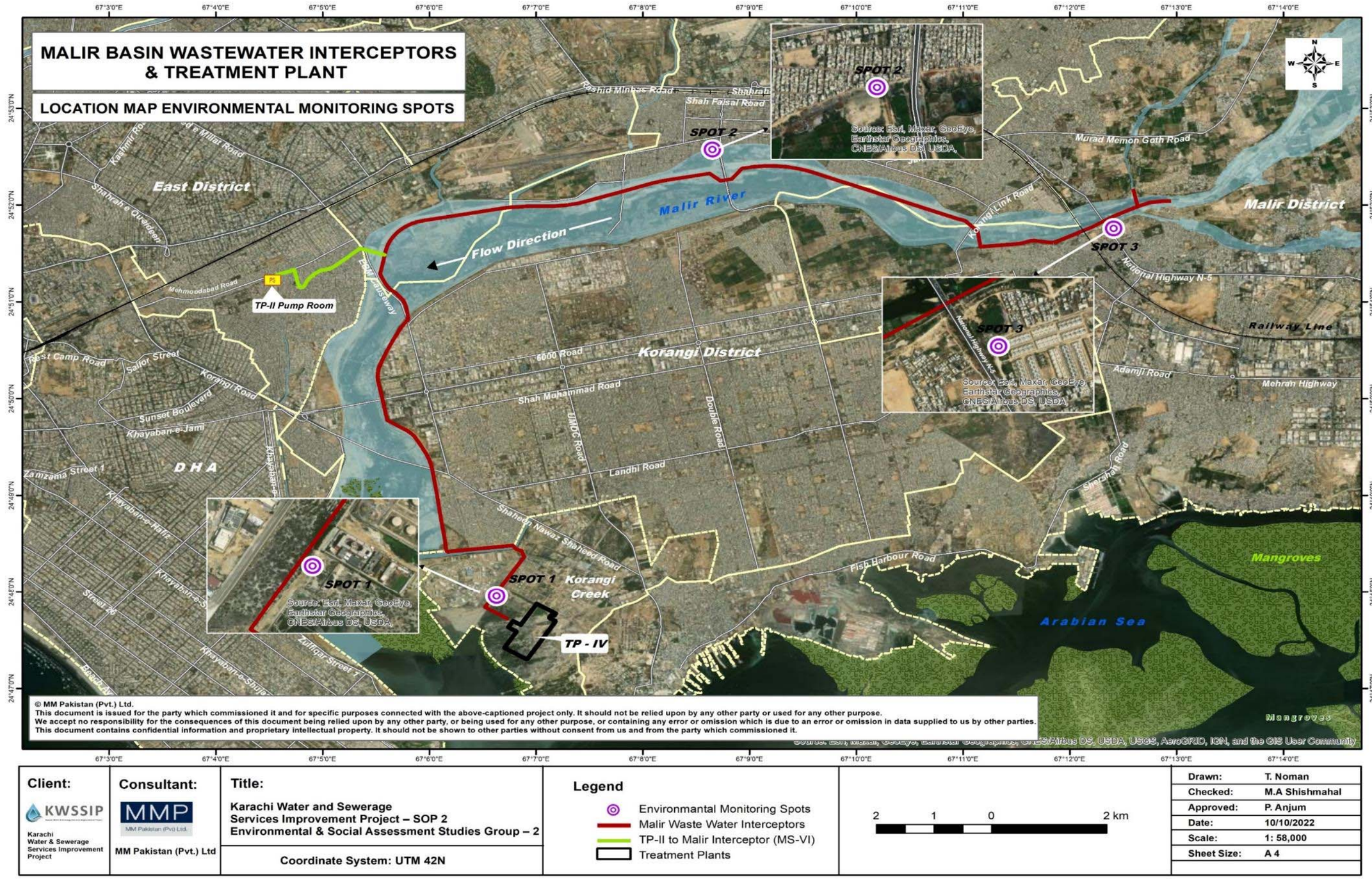


Figure 4-9: Environmental Monitoring Locations

4.2.1 Air Quality

166. Sampling was performed for a 24-hour period at each site following the Sindh EQS for ambient air. **Table 4-3** shows the observed average concentrations of ambient air quality parameters and compared with the SEQS / WBG standards.

Table 4-3: Ambient Air Quality Level

S. No.	Measuring Parameter	Unit	SEQs / WBG Limit 2	Monitoring Values		
				Point-1	Point-2	Point-3
1	Nitrogen Oxide (NO)	µg/ m^3	40	Nil	37.5	20.8
2	Sulfur Dioxide (SO2)	µg/ m^3	40	Nil	8.3	4.2
3	Carbon Monoxide (CO)	mg/m^3	4 (for 8 hrs)	Nil	0.75	2
4	Suspended Particulate Matter (SPM)	µg/ m^3	500	225	264	270
5	Particulate Matter (PM2.5)	µg/ m^3	15	17.21	25.50	40.42
6	Particulate Matter (PM10)	µg/ m^3	45	18.83	29.38	54.79
7	Ozone (O3)	µg/ m^3	130	18	20.75	17
8	Lead (Pb)	µg/ m^3	1.5	0.43	0.29	0.8

Point # 1: Adj. Salim Habib University – Korangi Creek (N 24.799280 E 67.110500)
Point # 2: Reta Plot Residential Settlement - Near Shah Faisal Bridge at Malir River (N 24.876197 E 67.144185)
Point # 3: River Valley Township – Near National Highway (N5) Bridge Malir River (N 24.862628 E 67.206837)

167. The $PM_{2.5.}$concentration measured in all three sampling points exceeded that SEQ/WBG limit. Furthermore, measured PM_{10} in Point 3 was also higher than the SEQ/WBG limit. This can be attributed to the vehicular movements on unpaved roads in these areas. Occasional visible dust emissions were observed along the various segments of the interceptor alignment.

4.2.2 Noise

168. Noise at the sites was monitored over a 24-hour period. The results have indicated noise levels exceeding the prescribed limits for nighttime readings in residential areas. For daytime measurements, one location recorded noise levels higher than the limits, while the other two locations were near the limit values. These findings are presented in **Table 4-4.**

169. Given that the baseline noise levels are already trending towards the higher end, the project is committed to the strict implementation of noise control measures. This proactive approach is intended to prevent any exacerbation of the existing baseline noise conditions and ensure compliance with relevant noise standards.

170. Photographs of the monitoring activities are shown in **Figure 4-10.**

Table 4-4: Noise Monitoring

Parameters	Units	SEQS	Monitoring Locations		
			Adj. Salim Habib University – Korangi Creek	Reta Plot Residential Settlement - Near Shah Faisal Bridge at Malir River	River Valley Township – Near National Highway (N5) Bridge Malir River
Noise	dB(A)	Day Time 55	53.35	51.95	62.17
		Night Time 45	47.3	45.5	49.9

Figure 4-10: Different Views of Environmental Monitoring

4.2.3 Groundwater Quality

171. Groundwater sampling and analysis were conducted following the established APHA methods. The results of this monitoring, which are presented in **Table 4-5**, were compared against the relevant Sindh Environmental Quality Standards (SEQS) and World Bank Group/World Health Organization (WBG/WHO) standards, with preference given to the more stringent standards for comparison purposes. The analysis reveals presence of bacterial contamination in all three samples, while all other parameters tested were found to be within the established limits. Total Dissolved Solids (TDS) level at point 2 exceeded the prescribed limits.

172. Sources of drinking water in these areas are primarily groundwater bores. Given the proximity of the monitoring locations to the Malir River, which carries untreated sewage and industrial wastewater, it is likely that the nearby aquifers are affected by bacterial contamination. As a result, residents in these areas resort to purchasing mineral water for drinking purposes. The implementation of the project is expected to have positive impacts on groundwater quality. The role of the interceptor in containing sewage flow and channeling it to the treatment plant will reduce the likelihood of sewage seepage into groundwater aquifers.

Table 4-5: Groundwater Quality Results

S. No	Measuring Parameters	Unit	Testing Method	SEQs Limits	Results		
					Point-1	Point-2	Point-3
1	Color	TCU	Pt-Co	< 15 TCU	6	2	<1
2	Taste	Taste	Sensory Evolution	Objection/ Non-Objection	Non-Objection	Non-Objection	Non-Objection
3	Odor	Odor	Sensory Evolution	Objection/ Non-Objection	Non-Objection	Non-Objection	Non-Objection
4	Turbidity	NTU	APHA-2130	< 5 NTU	1	ND	<1
5	Total Hardness as CaCO3	mg/l	APHA-2340	< 500	135	165	150
6	Total Dissolved Solids (TDS)	mg/l	APHA-2450C	< 1000	321	2265	351
7	pH @ 25^{o}C	pH	ASTM-1293	6.5 - 8.5	7.78	7.17	7.53
8	Aluminum (AL)	mg/l	ASTM D-857	<0.2	0.1	0.085	0.04
9	Antimony (Sb)	mg/l	APHA 3111 Sb	<0.005	Nil	Nil	ND
10	Arsenic (Ar)	mg/l	Merck Kit Method	0.01	Nil	Nil	0.022
11	Barium (Ba)	mg/l	APHA-D3651	0.7	Nil	Nil	0.019
12	Boron (B)	mg/l	APHA 4500-B	0.3	Nil	Nil	0.09
13	Cadmium (Cd)	mg/l	ASTM D-3557	0.003	Nil	Nil	0.01
14	Chloride (Cl^-)	mg/l	APHA 4500-Cl^-	< 250	76.43	175.6	69.4
15	Chromium (Cr)	mg/l	APHA 3500-CrB	< 0.05	Nil	Nil	0.021
16	Copper (Cu)	mg/l	Test Kit Method	2	Nil	Nil	0.61
17	Cyanide (Cn)	mg/l	APHA 4500 CN	<0.05	Nil	Nil	0.013
18	Fluoride (F)	mg/l	APHA 4500 F^-	< 1.5	0.81	0.951	0.61
19	Lead (Pb)	mg/l	APHA 3500 Pb B	< 0.01	Nil	Nil	ND
20	Manganese (Mn)	mg/l	APHA 3500 MnB	< 0.5	Nil	Nil	0.29
21	Mercury (Hg)	mg/l	Test Kit Method	< 0.001	Nil	Nil	ND
22	Nickel (Ni)	mg/l	APHA 3500 Ni	< 0.02	Nil	Nil	0.009
23	Nitrate (N03)	mg/l	Test Kit Method	< 0.50	Nil	Nil	ND
24	Nitrite (NO2)	mg/l	Test Kit Method	< 3	Nil	Nil	ND

S. No	Measuring Parameters	Unit	Testing Method	SEQs Limits	Results		
					Point-1	Point-2	Point-3
25	Selenium (Se)	mg/l	APHA 3500 Se	0.01	Nil	Nil	ND
26	Residual Chlorine	mg/l	Test Kit Method	0.2 - 1.5	0.45	0.32	0.29
27	Zinc (ZN)	mg/l	APHA 3500 Zn	3	1	1	2
28	Fecal Coliform	Count/ ml	APHA 922 B	0 Per 100 ml	Nil	Nil	ND
29	E Coli	Count/ ml	Total Viable Count	0 Per 100 ml	Nil	Nil	2
30	Total Bacterial Count	Count/ ml	APHA 922 B	0 Per 100 ml	18	13	1
31	Pesticides	mg/l	Kit Method	0.001	Nil	Nil	3
Point # 1: Adj. Salim Habib University – Korangi Creek (N 24.799280 E 67.110500) Point # 2: Reta Plot Residential Settlement - Near Shah Faisal Bridge at Malir River (N 24.876197 E 67.144185) Point # 3: River Valley Township – Near National Highway (N5) Bridge Malir River (N 24.862628 E 67.206837)							

4.2.4 Water Quality of Korangi Creek

173. A water sample from Korangi Creek was analyzed. Access to the TP-IV discharge point was not possible due to security restrictions by PAF and high tide. Therefore, a sample was collected from the right bank of Korangi Creek near Creek Garden, Zulfiqar Street DHA Phase 08 – Lat 24.7854 Lon 67.0913. The sample was compared to the SEQS 'Sea Water Discharge' Parameters. Results are shown in **Table 4-6** below. Results indicate higher levels of BOD_5, COD, TSS and other pollutants, which indicate the degraded quality of water at Korangi Creek.

Table 4-6: Results of Water Quality Monitoring of Korangi Creek

S. No	Measuring Parameters	Unit	Testing Method	SEQs Limits	Results	Remarks
1	Temperature	ºC	APHA-2550-B	< 3ºC	26	OK
2	pH @ 25ºC	pH	AST-D-1293	6 to 9	6.6	OK
3	Biochemical Oxygen Demand (BOD)	mg/l	APHA-5210	80	331	High
4	Chemical Oxygen Demand (COD)	mg/l	AST-D-1252	150	992.52	High
5	Total Suspended Solids (TSS)	mg/l	APHA-24500	200	1200	High
6	Total Dissolved Solids (TDS)	mg/l	APHA-2450	3500	10500	High
7	Oil and Grease	mg/l	ASTM-D-4281	10	102	High
8	Phenolic Compounds as Phenols	mg/l	ASTM-D-1781	0.1	0.1	OK
9	Chloride (as Cl^-)	mg/l	ASTM-D-1512	1000	13127.135	High
10	Fluoride (as F^-)	mg/l	APHA-4500-F	10	158	High
11	Cyanide (as CN^-)	mg/l	APHA-4500-E	1	0.25	OK
12	Anionic Detergents as (MBAS)	mg/l	APHA-5540-C	20	16	OK
13	Sulphates (SO_4^{2-})	mg/l	ASTM	600	2.64	OK
14	Sulphide (S^{2-})	mg/l	APHA-4500-S^2	1	NIL	OK

S. No	Measuring Parameters	Unit	Testing Method	SEQs Limits	Results	Remarks
15	Ammonia (NH_3)	mg/l	APHA-4500-NH_3	40	0.005	OK
16	Pesticides	mg/l	Kit Method	0.15	ND	OK
17	Cadmium (Cd)	mg/l	APHA-3500-Cd	0.1	0.001	OK
18	Chromium (Cr)	mg/l	APHA-3500-Cr	1	0.08	OK
19	Copper (Cu)	mg/l	APHA-3500-Cu	1	0.045	OK
20	Lead (Pb)	mg/l	APHA-3500-Pb	0.5	0.15	OK
21	Mercury (Hg)	mg/l	Strip Method	0.01	0.004	OK
22	Selenium (Se)	mg/l	APHA-3500-Se	0.5	0.19	OK
23	Nickel (Ni)	mg/l	APHA-3500-Ni	1	0.002	OK
24	Silver (Ag)	mg/l	APHA	1	ND	OK
25	Total Toxic Metals	mg/l	Calculated	2	0.99	OK
26	Zinc (Zn)	mg/l	APHA-3111-B	5	0.006	OK
27	Arsenic (As)	mg/l	Kit Method	1	0.017	OK
28	Barium (Ba)	mg/l	APHA-3500-Ba	1.5	0.008	OK
29	Iron (Fe)	mg/l	APHA-3500-Fe	8	0.001	OK
30	Manganese (Mn)	mg/l	APHA-3500-Mn	1.5	0.01	OK
31	Boron (B)	mg/l	APHA-4500-B	6	3.13	OK
32	Chlorine (Cl)	mg/l	APHA-4500-Cl-G	1	3500	High
Point # 1: Right Bank of Korangi Creek near Creek Garden, Zulfiqar Street DHA Phase 08 (N 24.7854 E 67.0913)						

4.3 Ecological Environment

174. The existing flora and fauna within the study area was determined through detailed field assessments carried out on the following dates:

- December 22 to 23, 2021
- January 18 to 25, 2022
- June 13 to 15, 2022
- July 19, 2022

4.3.1 Flora

175. The natural vegetation in the Malir River is found to be fragmented due to encroached crop fields and encroachment of residential structures on the embankment. Overall, the river itself and its adjoining areas on the banks support a variety of vegetation consisting of bushes, shrubs, trees, agricultural crops, and vegetables, among others.

176. A detailed inventory of trees that will be cut was done. Flora species were identified through visual observations; plants that were not identified were photographed and identified using PLANTNET software[7].The natural vegetation within AoI (both DIA and IDA) was recorded through direct observations. Vegetation growing in the AoI if the Interceptor are listed in **Table 4-7**.

[7] PlantNet is an application that allows to identify plants simply by photographing them with smartphone. It allows to identify and better understand all kinds of plants living in nature: flowering plants, trees, grasses etc. PlantNet claims 99% accuracy identifying common species and overall 95% rate with a database of more than 10,000 plant species. PlantNet application is uses in the following sequence:

Table 4-7: Vegetation Growing within the AoI

S. No.	Species	Common Name	IUCN Status
Trees			
1.	*Azadarichta indica*	Neem tree	LC
2.	*Cocos nucifera*	Coconut	NE
3.	*Conocarpus lancifolius*	Damas	LC
4.	*Cordia myxa*	Lesora	LC
5.	*Corymbia citriodora*	Lemon scented tree/safeeda	LC
6.	*Melia azedarach*	Bakain	LC
7.	*Parkensonia aculeate*	Palo Verde	LC
8.	*Phoenix dactylifera*	Khajoor	LC
9.	*Pithecellobium dulce*	Jungle jalebi	LC
10.	*Prosopis glandulosa*	Honey Mesquite	LC
11.	*Acacia nilotica*	Kikar	LC
Shrubs			
1.	*Abutilon indicum*	Kanghai	NE
2.	*Arthrocnemum indicum*	(Saltwort),	NE
3.	*Calotropis procera*	Akk	NE
4.	*Datura alba*	Tooh	NE
5.	*Prosopis juliflora*	Keekar	NE
6.	*Ricinus communis*	Castor bean	NE
7.	*Salvadoa persica*	Khabar	LC
8.	*Solanum albicaule*	Bittersweet	NE
9.	*Tamarix aphylla*	Lai	NE
10.	*Withania coagulans*	Indian rennet	NE
11.	Ziziphus nummularia	Jungli Beer	NE
Herbs			
1.	*Aerva javanica*	Booh	NE
2.	*Amaranthus virdis*	Slender amaranth	NE
3.	*Caroxylon imbricatum*	Saltwort	NE
4.	*Corchorus olitorius*	Jute mallow	NE
5.	*Haloxylon stocksii*	Khar, Sajji	NE
6.	*Heliotropium indicum*	Indian turnsole	NE
7.	*Suaeda fruticosa*	Shrubby seablite	NE
Grasses			
1.	*Chloris Barbata*	Swollen fingergrass	NE
2.	*Cynodon dactylon*	Khabal	NE
3.	*Cyperus rotundus*	Nut grass	LC

S. No.	Species	Common Name	IUCN Status
4.	*Dactyloctenium aegyptium*	Crow foot grass	NE
5.	*Desmostachya bipinnata*	Half grass /Dabh	LC
6.	*Phragmites australis*	Reed/ kaano	LC
7.	*Sorghum halepense*	Johnson grass	NE
8.	*Sporobolus sp*	Smut grass	LC
9.	*Typha latifolia*	Broadleaf cattail	LC
NE: Not Evaluated LC: Least Concern			

177. The TP-IV construction site that spans over an area of 42.9 hectares (106 acres) is a flat land located at the left bank of Korangi Creek, nearly 2.5 km downstream where the Malir River joins Korangi/Gizri Creeks. The site is influenced by the seawater at high tide and generally barren with loamy sand soils. The following species were recorded:

a. **Trees:** *Conocarpus lancifolius*, *Acacia nilotica (*Kikar*), Prosopis juliflora* (Jangli Kiker*)*

b. **Shrubs:** *Aerva javanica* (Aerva javanica), *Arthrocnemum indicum* (Saltwort), *Prosopis glandulosa* (Mesquite), *Tamarix dioica* (Lai), *Salvadora persica* (Khabbar-shrubby)

c. **Grasses/Sedges:** *Aeluropus lagopoides* (grass of salt deserts), *Scirpus sp. Desmostachya bipinnata* (Dab), *Phragmites australis, Typha sp.* (Catail).

178. The creek system is also characterized by mangroves, which is discussed in detail in **Section 4.1.1** of this report. Mangroves will not be disturbed or cut.

4.3.2 Fauna

179. Data on fauna was gathered through random sampling, visual encounters, incidental observations, and recording of pug marks in the Area of Influence (AoI). Avifauna survey was conducted through recognition of bird calls, line transect, and point count method. Birds identified in the field were confirmed using the handbook for bird identification (Grimmett *et al.*, 2008). The conservation status of faunal species was checked using the IUCN Red List of Endangered Species. The map showing locations of the faunal surveys is in **Figure 4-11**.

Figure 4-11: Locations of faunal surveys in the AoI

4.3.3 Terrestrial Mammals

180. A total of 11 species of mammals were recorded during the ESIA field visits. All recorded mammals are common in the area. These species may be encountered during clearance of vegetation and excavation. No significant impacts on the recorded species as these can naturally disperse to another habitat during construction activities. A complete list of the mammalian species observed in the project area is given in **Table 4-8**.

Table 4-8: List of mammalian species observed/reported in the project area

No.	Common Name	Scientific Name	Occurrence			Listing
			Common	Less Common	Rare	IUCN Red list
1.	Asiatic Jackal	*Canis aureus*		x		LC
2.	Balochistan Gerbil	*Gerbillus nanus*		x		LC
3.	House Mouse	*Mus musculus*	x			LC
4.	Five stripped-palm Squirrel	*Funambulus pennantii*	x			LC
5.	Long-eared desert Hedgehog	*Hemiechinus collaris*	x			LC
6.	Small Indian Mongoose	*Herpestes javanicus*	x			LC
7.	Indian Crested Porcupine	*Hystrix indica*	x			LC
8.	Indian Gerbil	*Tatera indica*	x			LC
9.	Little Indian field Mouse	*Mus booduga*	x			LC
10.	Indian Grey Mongoose	*Herpestes edwardsi*	x			LC
11.	House Rat	*Rattus rattus*	x			LC

4.3.4 Reptiles

181. A total of 10 reptile species were recorded in the project area, nine of which are common while one, the Indian/Bengal Monitor, is less common. The Indian Fringe-toed sand lizard and Indian garden lizard are commonly found in arid habitats. Snakes are also common in dry and vegetative areas. The species of reptiles survive in disturbed environment as well. The project activities may disturb the species. However, these species can adapt to changes in their habitat. A complete list of reptiles observed / recorded during the ESIA is given in **Table 4-9**.

Table 4-9: List of Reptiles Observed / Reported in the Project Area

No.	Common Name	Scientific Name	Listing		
			WP Act	IUCN Red list	CITES Appendix
1	Indian Spiny-tailed Lizard	*Uromastyx hardwickii*	x		II
2	Indian Cobra	*Naja naja naja*			II

No.	Common Name	Scientific Name	Listing		
			WP Act	IUCN Red list	CITES Appendix
4	Indian Fringe-toed Sand lizard	*Acanthodactylus cantoris cantoris*			
5	Indian/Bengal Monitor	*Varanus bengalensis*	**x**		**I**
6	Saw scaled Viper	*Echis carinatus pyramidum*			
7	Garden Lizard	*Calotes versicolor*			
8	Krait	*Bungarus caeruleus*			
9	Sindh Sand Gecko	*Crossobamon orientalis*			
10	Spotted Indian House Gecko	*Hemidactylus brookii brookii*			

4.3.5 Avifauna / Birds

182. The project area is composed of various habitats that support a variety of resident and migratory avifauna. The seasons/perennial wetlands are located in the depressions of Malir River Basin and in pond areas of dams upstream in Thaddo and Malir. The rocky and sandy areas around the dams, as well as the catchment areas serve as habitat for different avifauna; these areas are located away from the AoI. Agricultural areas within the riverbank and along fringes of embankments provide food and shelter for several species.

183. The project area is a blend of different habitats (highly degraded) but still supports a variety of avifauna; both resident and migratory. The seasonal / perennial wetlands are located especially in depressions of Malir River Basin and pond areas of dams upstream at Thaddo and Malir. The rocky and sandy areas around these dams and their catchment areas are habitat of different fauna and those are not being considered here due to their location away from area of influence. The agricultural fields inside riverbank and along fringes of embankments provide food and shelter to several species, which have adapted with human settlements. Of the avian species, none may be regarded as the key species of the project.

184. There are 46 bird species recorded in the broader project area, 14 of which are migratory while 32 are resident species. 11 of the species, which include raptors, egrets, and herons, are under the mandate of Sindh Wildlife Protection, Preservation, Conservation, and Management Act (2020). None of the identified avifauna species are on the IUCN Red List. However, four migratory species are listed on CMS appendices, while five are listed on CITES.

185. The birds observed in the project area is provided in **Table 4-10**. The common birds in the project area are Black Drongo, Blue Rock Pigeon, Common Myna, Bank Myna, Crested lark, House Sparrow, and Black Kite. Less common and rare birds include Grey Partridge, Pied Wagtail, and Yellow Wagtail.

186. All bird species were recorded in the broader area of Malir River, not specifically on or along the project AoI. Due to the distance of the habitat from the project area, no bird species are expected to be disturbed by the construction activities.

Table 4-10: Birds in the Project Area

No.	Common Name	Scientific Name	Status		Listing			
			Migratory	Resident	WPO/Act	IUCN Red List	CMS Appendix	CITES
1.	Bank Myna	*Acridotheres ginginianus*		x				
2.	Black Drongo / King Crow	*Dicrurus macrocercus*		x				
3.	Black headed Gull	*Larus ridibundus*	x					
4.	Black Kite	*Milvus migrans*		x	P			II
5.	Black-winged Stilt	*Himantopus himantopus*	x				II	
6.	Blue Rock Pigeon	*Columba livia*		x				III
7.	Bluethroat	*Luscinia svecica*	x					
8.	Brahminy Kite	*Haliastur indus*		x	P			II
9.	Cattle Egret	*Bubulcus ibis*		x	P			III
10.	Collared Dove	*Streptopelia decaocto*		x				
11.	Common Babbler	*Turdoides caudatus*		x				
12.	Common Sandpiper	*Actitis hypoleucos*	x					
13.	Common Starling	*Sturnus vulgaris*			P			
14.	Crested Lark	*Galerida cristata*		x				
15.	Great White Egret	*Egretta alba*	x		P			
16.	Grey Partridge	*Francolinus pondicerianus*		x				
17.	Gull Billed Tern	*Gelochelidon nilotica*	x		P			
18.	Hoopoe	*Upupa epops*		x				
19.	House Crow	*Corvus splendens*		x				
20.	House Sparrow	*Passer domesticus*		x				
21.	Indian Crow Pheasant	*Centropus sinensis*		x				
22.	Indian Myna/Common Myna	*Acridotheres tristis*		x				
23.	Indian Pond Heron	*Ardeola grayii*		x	P			
24.	Indian Robin	*Saxicoloides fulicata*		x				
25.	Indian Sand Martin	*Riparia paludicola*		x				
26.	Intermediate Egret	*Egretta intermedia*	x					
27.	Jungle Babbler	*Turdoides striatus*		x				
28.	Koel	*Eudynamys scolopacea*		x				
29.	Little Egret	*Egretta garzetta*		x	P			
30.	Little Grebe	*Tachybaptus ruficollis*		x				
31.	Little Green Bee-eater	*Merops orientalis*		x				
32.	Little Stint	*Calidris minuta*	x				II	
33.	Little Tern	*Sterna albifrons*	x				II	

No.	Common Name	Scientific Name	Status		Listing			
			Migratory	Resident	WPO/Act	IUCN Red List	CMS Appendix	CITES
34.	Marsh Harrier	*Circus aeruginosus*	x		P			II
35.	Pied Bushchat	*Saxicola caprata*		x				
36.	Purple Sunbird	*Nectarinia asiatica*		x				
37.	Redshank		x		P		II	
38.	Red-vented Bulbul	*Pycnonotus cafer*		x				
39.	Red-wattled Lapwing	*Hoplopterus indicus*		x				
40.	Reef Heron	*Egretta gularis*		x	P			
41.	River Tern	*Sterna aurantia*		x				
42.	Whiskered Tern	*Chlidonias hybridus*	x					
43.	White / Pied Wagtail	*Motacilla alba*	x					
44.	White-breasted Kingfisher	*Halcyon smyrnensis*		x				
45.	White-cheeked Bulbul	*Pycnonotus leucogenys*		x				
46.	Yellow Wagtail	*Motacilla flava*	x					

4.3.6 Protected Area & Critical Habitats

187. The mangrove area located along the left bank of Korangi Creek is considered as a protected area under the Sindh Forest Department, Port Qasim Authority, and Sindh Revenue Board. Areas under the control of Sindh Forest Department and Port Qasim Authority are declared as "Protected Forests", whereas the area under the control of Board of Revenue is classified as "Government Wasteland". Details of the mangrove areas are discussed in **Section 4.1.1 (b)**.

188. The SFD shall be part of the regular monitoring activities to ensure that the project will not pose any adverse impacts on the mangrove area. The project shall have positive impacts on the water quality in Korangi Creek.

4.3.7 Trees and Vegetation to be Cleared

189. About 57 trees growing in the Direct Impact Area (DIA) will be cut prior to the construction activities. The tree species are commonly found in the area, and none are critically endangered. These include eight neem trees, 13 coconut palms, and 20 kikar (*Acacia nilotica*), among others. Details of these trees are provided in **Section 6.2.6**. The contractor shall be required to plant 10 trees for every tree cut or uprooted. Prior to construction activities, suitable spaces for compensatory tree plantation will be identified by the PIU KWSSIP in consultation with Local Government Department, Forest Department, Parks and Horticulture Department – KMC, and District Municipal Corporations (DMCs). A Compensatory Tree Plantation Plan providing details on different aspects of compensatory plantation and to be followed by the contractor is attached as **Annexure 4-1**.

190. Aside from trees, shrubs including *Salvadoa persica and Calotropis procera* growing along the interceptor alignment adjacent Chakora Nala and *Aerva javanica and Arthrocnemum indicum* growing at TP-IV shall be cleared. All these shrub species are common in the area. However, the contractor shall be required to compensate the clearing of these shrubs through plantation of ornamental shrubs at areas to be specified by the PIU at the time of project execution.

191. Details on the clearance of vegetation related to agricultural activities are provided in the Resettlement Plan attached on this report as **Annexure 2-1**.

4.4 Social Environment

192. A household survey was done to determine the socio-economic condition in the area. The questionnaire is provided in **Annexure 4-2**. With the absence of data on actual households in each locality, random reconnaissance surveys were conducted in each settlement. Five to ten residents were engaged to estimate average household sizes. Sample sizes for each settlement were calculated based on information provided by residents. Primary data was collected from the communities through formal and informal consultations with Project-Affected Parties and other Interested Parties. A significant portion of the population live with their extended families primarily due to factors such as poverty and family bonds.

193. Aside from the household survey, review of secondary data and rounds of public consultations were also done.

4.4.1 Economic Condition

a) Local Economy

194. Poverty is pervasive in majority of the settlements within the AoI. Majority of the residents are laborers, daily wage workers, rickshaw drivers, and small shop owners. For many of the residents, including the vulnerable groups, access to basic services such as healthcare, clean drinking water, and proper road infrastructure is limited.

b) Agriculture

195. Agricultural activities are well-documented in specific areas adjacent to the Malir River, namely Haji Shambay Village, Jalal Murad, Sharafi Goth, and Roshanabad. Irrigation for crop cultivation relies on the waters of the Malir River. Wheat is cultivated during the Kharif season, while vegetables and fodder crops are grown during the Rabi season.

c) Employment

196. The analysis of occupational status in **Table 4-11** reveals a multifaceted economic landscape within the project area. Most respondents are laborers (38%), which is likely due to the nearby industrial areas. This is followed by small businesses/shopkeepers (20%), private employees (18%), and farmers (10%). There are a number of laborers and private employees that work in the nearby industrial areas, while farmers are dependent on the irrigation provided by the Malir River.

Table 4-11: Occupational Status

S. No	Occupational Status	Numbers	%
1.	Small Business/ Shopkeeper	23	20
2.	Labor	44	38
3.	Driver	5	4
4.	Private Job (Nearby Industrial Areas)	21	18
5.	Govt. Job	8	7
6.	Farming / Agriculture	11	10
7.	Other	3	3
Total		**115**	**100**

4.4.2 Social Infrastructure and Services

197. The respondents' access to basic services is summarized in **Table 4-12.** The survey highlights the strengths and areas for improvement in the provision of basic services.

Table 4-12: Social Infrastructure

S. No	Facility	Numbers	%
1.	Electricity	115	100
2.	Water Supply	96	83.5
3.	Sewerage	82	71
4.	Dispensary/ hospital	110	95.7
5.	School	115	100
6.	Metaled Roads	90	78.3
7.	Graveyard	115	100

198. It is evident that access to sewerage must be improved, as only 71% of surveyed households have access to this service. The existing sewerage system in the project area is in a dire state, with even light rains causing flooding in narrow streets of the localities. Overflowing sewerage lines and absence or poor condition of drainage systems frequently result in stagnant water in the streets, creating unsanitary conditions for residents. To address these issues, settlements in the area established their own pipe and open sewerage systems that directly discharge effluent into the Malir River. Many households have flush-type latrines connected to these community sewerage systems.

4.4.3 Transportation and Traffic

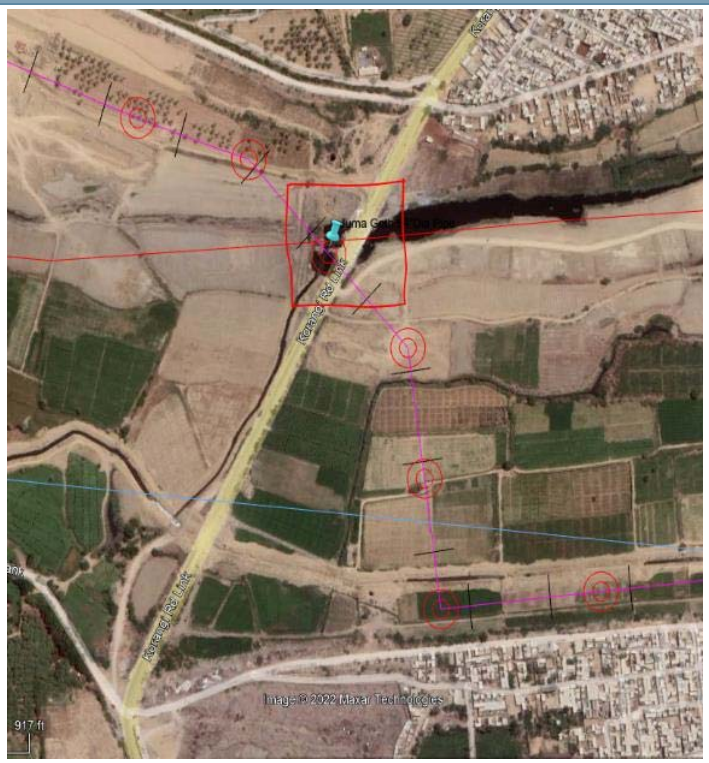
199. Sections of three major roads and two connecting roads in the vicinity of the project will be briefly used during construction for the following purposes:

- To move from one side of the interceptor alignment to the other,
- To access the TP-IV construction site, and
- To access the TP-II connection project area

200. Roads to be used are shown in **Table 4-13**.

Table 4-13: Roads to be Used during Construction Phase

S. No.	Location	Location Map
1.	Korangi Crossing or Hussain Dadabhoy Road	
2.	EBM Causeway or Surgeon Faiz Mohammad Khan Road	

S. No.	Location	Location Map
3.	Korangi Link Road or Jumma Goth Causeway	
4.	Allama Iqbal Road and Mahmoudabad Road	

201. An assessment of traffic was done based on the following sources:

- Real-time crowdsourcing data[8] showing typical traffic flow profile at the main and connecting roads, and
- Traffic count surveys (October 2021) performed at 11 locations for the Malir Expressway Project, including EBM Causeway (Surgeon Faiz Mohammad Khan Road) and Korangi Link

[8] Google Maps Platform – Traffic Layer

Road (Jumma Goth Causeway). Korangi Road near Brooks Chowrangi was also considered as it is in proximity to Korangi Crossing (Hussain Dadabhoy Road).

a) Assessment Based on Real-time Traffic Data

202. **Table 4-14** summarizes the traffic flow analysis at four road sections based on real-time traffic data.

Table 4-14: Traffic Assessment based on Real-time Data

S. No.	Location	Traffic Flow Analysis
1.	Korangi Crossing (Hussain Dadabhoy Road)	Traffic flow for most part of the day remains normal. Slightly reduced flows occur between 8:00 am to 11:00 am and between 4:00 pm to 8:00 pm.
2.	EBM Causeway (Surgeon Faiz Mohammad Khan Road)	Traffic flow for most part of the day remains normal. Slightly reduced flows occur between 8:00 am to 11:00 am and between 4:00 pm to 8:00 pm.
3.	Korangi Link Road (Jumma Goth Causeway)	Traffic flow throughout the day remains normal.
4.	Allama Iqbal Road and Mahmoudabad Road	Traffic flow for most part of the day remains slightly reduced. Between 6:00 pm to 9:00 pm, traffic at both roads is slow with occasional congestion.

b) Assessment Based on Traffic Count Study

203. Traffic counts at the three roads were done for three days. Vehicles were categorized into: Motorcycles & Rickshaws, Passenger Cars, Public Transport (i.e., minibuses and buses), and Trucks. **Table 4-15** shows the traffic counts for each direction at these three roads. Based on the traffic count details, it was found that most of the traffic flow at these roads consists of passenger cars and motorcycles.

Table 4-15: Directional Traffic Counts at Three Locations (Vehicles per Day)

S. No.	Locations	Directions	Motorcycle	Rickshaw	Cars	Hiace	Minibus	Large Bus	Truck 2-Axle	Truck 3-Axle	Truck 4-Axle	Truck 5-Axle	Truck 6-Axle	Total
1	Korangi Road Near Brooks Chowrangi	Shan Chowrangi to Brooks Chowrangi	11,635	3,610	9,232	1,612	938	287	213	359	586	82	104	28,658
		Brooks Chowrangi to Shan Chowrangi	38,804	7,178	19,778	2,776	1,674	600	318	590	965	136	191	73,010
		Total (Both Directions)	**50,439**	**10,788**	**29,010**	**4,388**	**2,612**	**887**	**531**	**949**	**1,551**	**218**	**295**	**101,668**
2	EBM Causeway	Ebm Causeway to Brooks Chowrangi	78,450	6,532	17,049	3,091	95	78	587	881	1,468	70	139	108,440
		Brooks Chowrangi to Ebm Causeway	84,853	5,758	18,158	2,264	104	63	541	812	1,353	38	235	114,179
		Total (Both Directions)	**163,303**	**12,290**	**35,207**	**5,355**	**199**	**141**	**1,128**	**1,693**	**2,821**	**108**	**374**	**222,619**
3	Shah Faisal to Main Korangi Road	Shah Faisal to Murtaza Chowrangi	109,045	10,714	21,456	3,506	394	380	428	642	1,069	180	283	148,097
		Murtaza Chowrangi to Shah Faisal	124,151	9,061	19,229	3,037	345	96	538	806	1,344	70	164	158,841
		Total (Both Directions)	**233,196**	**19,775**	**40,685**	**6,543**	**739**	**476**	**966**	**1,448**	**2,413**	**250**	**447**	**306,938**

4.4.4 Mechanism of Conflict Resolution

204. Conflict resolution may be coursed through the police and government judiciary system, or through mutual understanding (“jirga” or council of elders). People in the project area are generally peaceful, although there have been disputes among individuals or groups.

4.4.5 Sites of Religious Significance

205. No site of religious significance was found in the alignment of Malir Basin Wastewater Interceptor and Treatment Plant project

4.4.6 Awareness and Acceptability Regarding the Proposed Project

206. As shown in **Table 4-16,** 80% of the respondents have prior knowledge of the Project. Their awareness can be seen as a positive indicator of community engagement and interest in the project's objectives and potential benefits. All respondents, irrespective of their prior knowledge, were proactively briefed about the comprehensive features and advantages of the proposed Project. This approach to community engagement ensures that all residents have access to vital project information, fostering transparency, participation, and informed decision-making in favor of the Project.

Table 4-16: Awareness about the Project

S. No	Awareness of the Project	Numbers	%
1.	Yes	92	80
2.	No	23	20
Total		**115**	**100**

207. **Table 4-17** presents the acceptability of the project among the respondents. Most of the respondents support the project (97.4%), emphasizing the need for its implementation. The respondents recognize the benefits the project can bring to the community. However, a small minority expressed their reservations due to potential disruption of their livelihood, which relies on the cultivation of vegetables irrigated with sewerage water. The Resettlement Plan (RP) of the project has provisions for such concerns to ensure that the affected individuals are adequately compensated for any losses incurred due to the project implementation.

Table 4-17: Acceptability of the Proposed Project

S. No	Acceptability of the Proposed Project	Numbers	%
1.	Yes	112	97.4
2.	No	03	2.6
Total		115	100

4.4.7 Sensitive Receptors

208. Several sensitive receptors were identified in the vicinity of the project areas. These include the following:

a. **Salim Habib University – Korangi Creek:** Situated approximately 40 meters away from the Interceptor Alignment and roughly 400 meters from TP-IV North-Eastern boundary wall.

b. **Karachi Public School (Play Area) – Bhittai Colony:** Located about 60 meters from the Interceptor Alignment.

c. **Mohammadi Masjid / M.Y Clinic – Sidra Street (along Manzoor Colony Drain):** Positioned approximately 8 meters from the pipeline connecting TP-II Pump Room to the Interceptor.

209. To safeguard these sensitive receptors from potential disturbances arising from construction activities, comprehensive noise and dust control measures will be implemented. These measures will include, but are not limited to, the use of noise barriers, scheduling construction activities during less disruptive hours, regular watering to suppress dust, and the deployment of dust screens where necessary. Additionally, continuous monitoring and adherence to established environmental guidelines will be upheld to ensure the protection and well-being of the nearby communities and institutions. Photographs of these receptors taken from locations near the interceptor alignment, as well as their corresponding location maps, are provided as **Figure 4-12** for reference.

TP-II – Interceptor Pipeline on the Left (inside Manzoor Colony Drain) and Mohammadi Masjid / M.Y Clinic – Sidra Street on the Right

Interceptor Alignment on the Left beyond the Tree Line and Salim Habib University on the Right

Interceptor Alignment on the Right beyond the retaining wall and Karachi Public School (Play Area) Boundary Wall on the Left

Figure 4-12: Sensitive Receptors along the Interceptor Alignment and TP-II Connection Pipeline

4.4.8 Women (Concerns on the Project and Way Forward)

210. The concerns raised by local women regarding project activities are indicative of their active engagement and their aspirations for improved living conditions. These issues emphasize the importance of addressing the community's needs and priorities in the planning and implementation of the project.

- **Timely Construction:** The request for expeditious construction aligns with the desire to minimize disruption to daily life. Faster construction can alleviate inconveniences caused by extended project timelines.
- **Health and Education Facilities:** Women's demands for better health facilities in local hospitals and improved educational facilities in schools reflect their commitment to the well-being and education of their families. Addressing these needs can enhance the overall quality of life in the community.
- **Safe and Sufficient Drinking Water:** The call for safer and more abundant drinking water highlights a critical necessity for the community. Ensuring access to clean and ample drinking water is essential for public health and well-being.
- **Employment Opportunities:** Recognizing the unemployment rate among educated women, offering opportunities during project execution can contribute to economic empowerment and community development.
- **Skill Development:** Enhancing the skills of women engaged in embroidery work through livelihood development centers can promote income generation and economic independence.
- **Water Delivery Concerns:** The negative impact of water delivery via tankers on road infrastructure and road safety is acknowledged. This highlights the need for more sustainable and efficient water delivery solutions.
- **Reforming KWSC:** The call for comprehensive reforms in the Karachi Water and Sewerage Corporation (KWSC) suggests a desire for a more effective and accountable water and sewerage service provider. Autonomy and improved service delivery can address longstanding issues in this sector.

4.4.9 Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) and Gender Based Violence (GBV)

211. The feedback given by female respondents during the survey on GBV and SEA/SH provides insights into the socio-cultural context and challenges faced by women in the communities:

- **Tribal Practices:** In villages such as Agha Town, Mansehra Colony No. 1 and 2, and Hamal Goth, where the Pathan and Hazara communities are predominant, tribal practices play a significant role in preventing issues on SEA/SH. These practices contribute to community cohesion and security.
- **Barriers to Education:** Challenges related to education, particularly for girls, exist in areas like Mansehra Colony No. 1 and 2 due to the distance of schools and limited access to public transportation. This can result in girls being confined to their homes, affecting their access to basic services. Cultural practices like Purdah (veiling) and restricted movement further compound this situation.
- **Low Incidence of Sexual Harassment:** Residents report that sexual harassment is not common in the area. However, domestic violence, while not reported during the surveys, is recognized as a potential issue.

- **Harassment in Industries:** In the Reta Plot area, female industrial workers face harassment but often do not report it due to fear of losing their jobs, highlighting the vulnerability of working women in certain employment settings.
- **Low Literacy Rates:** In Mansehra Colony, low female literacy rates are documented, partly due to the prevailing cultural norms that discourage girls from leaving their homes for educational purposes.
- **Limited Property Ownership:** Women in the consulted villages participate in household decisions, but they have limited involvement in major property transactions and often lack property ownership rights, reflecting gender disparities in property matters.
- **Security Concerns:** In Haji Shambay Goth and Jalal Murad Colony, women do not face specific restrictions, but some security concerns, such as theft incidents, have led them to avoid going outside alone.

5 Analysis of Alternatives

212. This chapter presents an analytical overview of the different alternatives considered for the proposed Malir Basin Interceptor and STP. The purpose of assessing various alternatives is to methodically compare viable alternatives to the proposed project site, design technology and operation. The alternative project activities which have been considered and the reasons for their rejection are discussed below.

5.1 No Project Option

213. Without the project, the volume of untreated sewage discharged to Malir River will increase over the years. This will lead to further degradation of the water quality of the Malir River which may also have negative impacts to the health of the public who are using this river as their water source.

5.2 Route Alternatives

214. Two alignments, as shown in **Figure 5-1** and **Figure 5-2,** were considered for the interceptor. Both the alignments run along Malir River. Based on the assessment conducted, Alignment No. 1 was identified to be more feasible due to the following reasons:

- Easy to be aligned with the under construction Malir Expressway.
- Socially and environmentally feasible, providing opportunity of utilizing already built Malir Expressway access roads and campsites locations for the project, avoiding additional E&S impacts due to the construction of new access roads and land clearance for campsites.
- Allow easy connectivity with the sewer connections, especially those located on the right bank of Malir River as provision of culverts has already been kept in the Malir Expressway design.

5.2.1 Alignment Selection Details

215. The selection of Alignment No. 01 for the interceptor along the Malir River, as opposed to Alignment No. 2, is based on several important environmental and social considerations, discussed as follows:

a) Alignment with the Under Construction Malir Expressway:

- **Feasibility:** One of the primary reasons for choosing Alignment No. 01 is its compatibility with the under-construction Malir Expressway. This alignment takes advantage of the existing infrastructure, making it more feasible and cost-effective. Aligning the interceptor with the expressway streamlines construction efforts and reduces the need for extensive modifications or adjustments.
- **Reduced Environmental Impact:** By aligning with the Malir Expressway, the project minimizes the disturbance to the natural environment. Construction along the same path as the expressway avoids the need for additional land clearing, reducing habitat disruption and preserving local ecosystems. This alignment choice demonstrates a commitment to environmentally responsible development.

b) Social and Environmental Feasibility:

- **Utilizing Existing Infrastructure:** The utilization of already built Malir Expressway access roads and campsites for the interceptor project offers significant advantages. It not only reduces construction costs but also minimizes social and environmental impacts. These sites are likely to have been selected with environmental and social considerations in mind during the expressway's planning and construction, further enhancing the alignment's suitability.
- **Avoiding New Access Roads:** Selecting Alignment No. 01 eliminates the need to create new access roads, which can have adverse effects on local communities and ecosystems. The construction of new access roads often results in land clearance, which can disrupt natural habitats, increase sedimentation in nearby water bodies, and potentially displace or inconvenience nearby residents.

a- Sewer Connectivity:

- **Culvert Provision:** The decision to align the interceptor with the Malir Expressway also considers the existing infrastructure for sewer connections. The design of the Malir Expressway already includes provisions for culverts, which can facilitate easy connectivity for the interceptor project. This alignment choice ensures efficient integration with sewer systems, particularly on the right bank of the Malir River, where existing infrastructure can be leveraged without further disruption.

216. In summary, Alignment No. 01 for the interceptor along the Malir River has been selected primarily because it offers practical advantages in terms of cost-effectiveness, reduced environmental impact, and minimized disruption to local communities. By aligning with the under-construction Malir Expressway and utilizing existing access roads and campsites, the project demonstrates a commitment to both environmental conservation and the welfare of the surrounding social environment. Additionally, the provision of culverts in the Malir Expressway design further supports the ease of integration with existing sewer connections. Overall, these considerations contribute to Alignment No. 01 being the preferred choice from both environmental and social perspectives.

Figure 5-1: Alignment 1 for Interceptor (Selected Route)

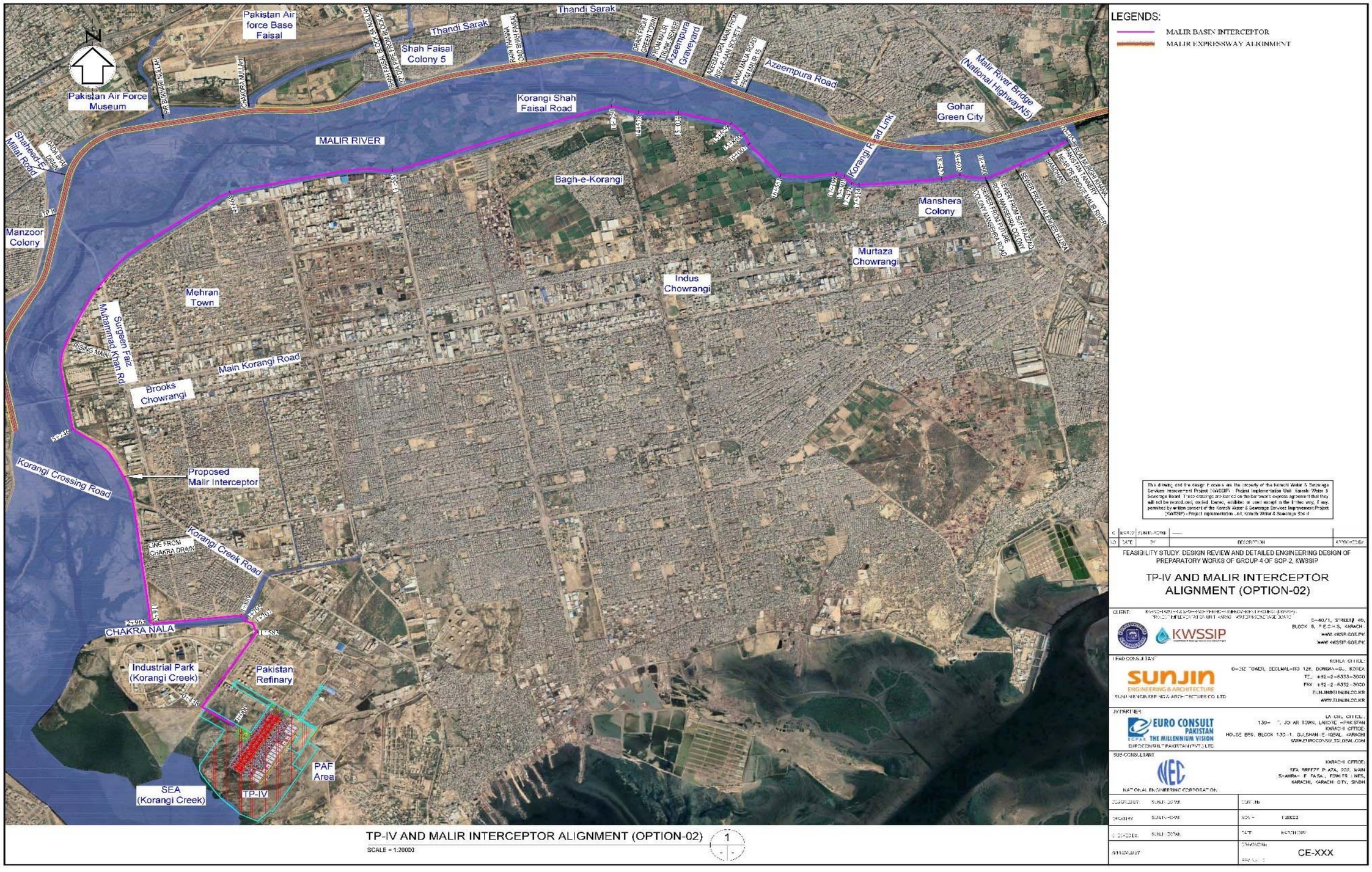


Figure 5-2: Alignment 2 for Interceptor

5.3 Treatment Process Alternatives

217. **Table 5-1** presents the factors considered in the selection of the treatment process for TP-IV.

Table 5-1: Governing Factors for the Selection of Treatment System

Major Criteria	Sub Criteria	Description
Ecological (Primary)	Nature & Strength of Sewage and Removal Efficiency	The applicable physical, chemical, and biological treatment processes are primarily governed by the nature of pollutants to be removed and their strengths in the sewage. It has been considered essential that the selected treatment system should ensure the required pollutant removal efficiencies.
Economic	Cost – Capital and O&M	The selected system should be the least cost alternative, keeping in view both capital as well as operational costs, within the range of technically feasible options.
	Equipment	The selected system should require minimum mechanical equipment and that the equipment should be available in local market.
Technical	Reliability	The selected treatment system should allow enough resistance to shock loads (sudden surges in sewage flow, characteristic or any toxic substance concentrations) and the treated effluent quality should not be affected.
	Compatibility	The treatment system operations should be well adapted to the existing conditions and has the provision of future expansion.
	Operational Skills	The proposed system should be simple, and the skills required for the routine O&M should be available locally, with minimum frequent training needs.
Environmental	Physical Constraints – Land Requirement	The selected treatment system should be easily compatible and efficiently operate-able keeping in view the available land and topography of the site.
	Energy Consumption	The selected treatment system should be energy efficient.
	Nuisance	The degree of odor and noise nuisance caused by the selected treatment system should be below the nuisance threshold.
	Safety	The selected treatment system should ensure occupational, human, and environmental safety and offer maximum benefits to the environment.

218. Different biological treatment processes for the removal of organic matter in the sewage were considered and assessed using the criteria mentioned. The results of the comparison are presented in **Table 5-2.**

Table 5-2: Comparison of Various Treatment Technologies under TP-IV Conditions

Facultative Ponds	Trickling Filters	Complete Mix Aeration Lagoons	Activated Sludge	Rotating Biological Contactors	Anaerobic Ponds	Up-flow Anaerobic Sludge Blanket
Maximum BOD_5 Removal (%)						
60	75 – 85	70 – 80	> 90	90	50 – 55	50 – 60
✖	✓	✖	✓	✓	✖	✖
Land Requirement (Hectares)						
318	8.7	85	8.8	8.5	25	7
✖	✓	✖	✓	✓	✓	✓
Reliability & Resistance to Shock Loads						
high	moderate to high	moderate to high	high	moderate to low	low	Low
✓	✓	✓	✓	✖	✖	✖
Equipment & Energy Requirement						
none	moderate	high	high	moderate	Low to none	Low
✓	✖	✖	✖	✖	✓	✓
Implementation – Construction / O&M Ease						
moderate / high	moderate	moderate / low	moderate / low	moderate	moderate / high	moderate
✓	✓	✖	✖	✓	✓	✓
Aesthetic (Nuisance)						
moderate odor & insect issues	moderate insect issues	sever noise & aerosols issues	varying noise & aerosol issues	moderate insect issues	sever odor, color & insect issues	sever odor and color issues
✖	✓	✖	✓	✓	✖	✖
Environmental & Occupational Safety						
moderate to low	moderate	moderate to high	moderate to high	high	low	Low
✖	✓	✓	✓	✓	✖	✖
Compatibility to Current and Future Conditions						
low	high	moderate to low	high	moderate	low	moderate
✖	✓	✖	✓	✖	✖	✖
Sludge Production and Management Requirement						
low	moderate	high	high	moderate to high	low	Low
✓	✓	✖	✖	✖	✓	✓
Overall Remarks						
✖	✓	✖	✓	✖	✖	✖

219. As shown, trickling filters and activated sludge systems were favorable to be employed in the STP. Considering this, the following treatment systems were considered for TP-IV.

a) Alternative A: Trickling Filter System

220. This option comprises of screen chamber (coarse), sewage pumping station, screen chamber (fine), grit chamber, primary settling tanks, trickling filters, and secondary settling tanks. Schematic of Alternative A is shown in **Figure 5-3**.

221. In this option, organic matter and suspended solids in the sewage are removed in the sedimentation tanks and tricking filters. Trickling filters is an aerobic treatment system which consist of a filter medium that can be made of a bed of rock, slag, or plastic cover where the sewage is trickled or spray. The microorganisms attached in the filter media are used to remove organic matter from the sewage.

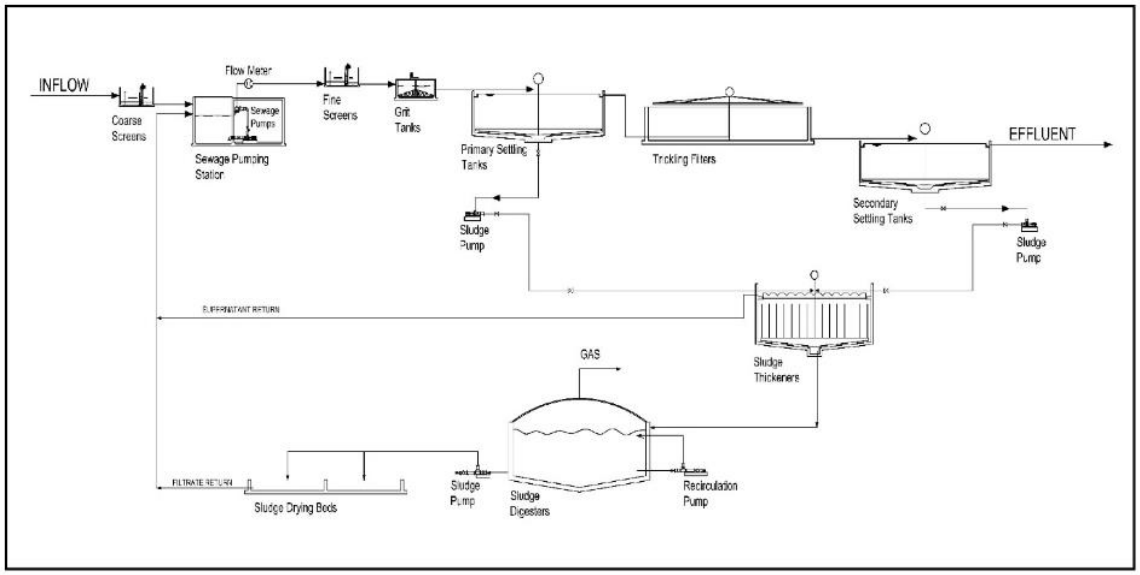


Figure 5-3: Schematic of Alternative A

b) Alternative B: Activated Sludge System

222. This option comprises of screen chamber (coarse), sewage pumping station, screen chamber (fine), grit chamber, aeration tanks and secondary settling tanks. Schematic of alternative B is shown in **Figure 5-4**.

223. This option uses activated sludge system to remove the biodegradable organic matter and suspended solids in the sewage. The conventional activated sludge is an aerobic, continuous-flow system where wastewater is fed into an aeration basin and mixed with 'activated microorganisms' resulting in mixed liquor. The principal role of micro-organisms in the activated sludge process is to convert dissolved and particulate organic matter, measured as BOD_5, into cell mass. After specific retention time, the treated wastewater passes into secondary clarifier where sludge is allowed to settle. A portion of settled sludge is recycled back to the anaerobic tank to maintain the required activated sludge concentration while the remaining is wasted to maintain required solids retention time for effective organic removal.

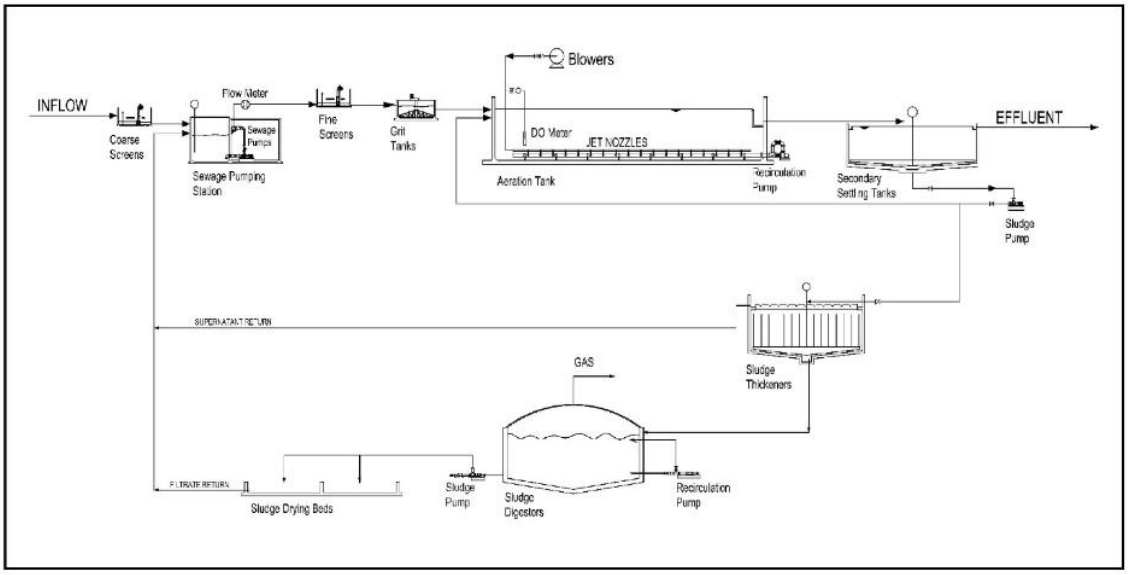


Figure 5-4: Schematic of Alternative B

c) Alternative C: Moving Bed Biofilm System

224. This option comprises of screen chamber (coarse), sewage pumping station, screen chamber (fine), grit chamber, moving bed biofilm reactors (MBBR) and secondary settling tanks. Schematic of Alternative C is shown in **Figure 5-5**.

225. The MBBR is an aerobic system that uses biofilm carrier media for the substrate removal in the wastewater. These carriers are designed to have a high surface unit per volume to provide enough area where the microorganisms can attach and grow to carry out the treatment. The carrier media are kept suspended by a diffused air aeration system for the aerobic process or by mechanical mixing system for the anoxic or anaerobic process. Unlike the activated sludge process, MBRR does not recycle activated sludge. However, MBBR processes are still capable to provide similar BOD and nitrogen removal treatment performance as activated sludge process.

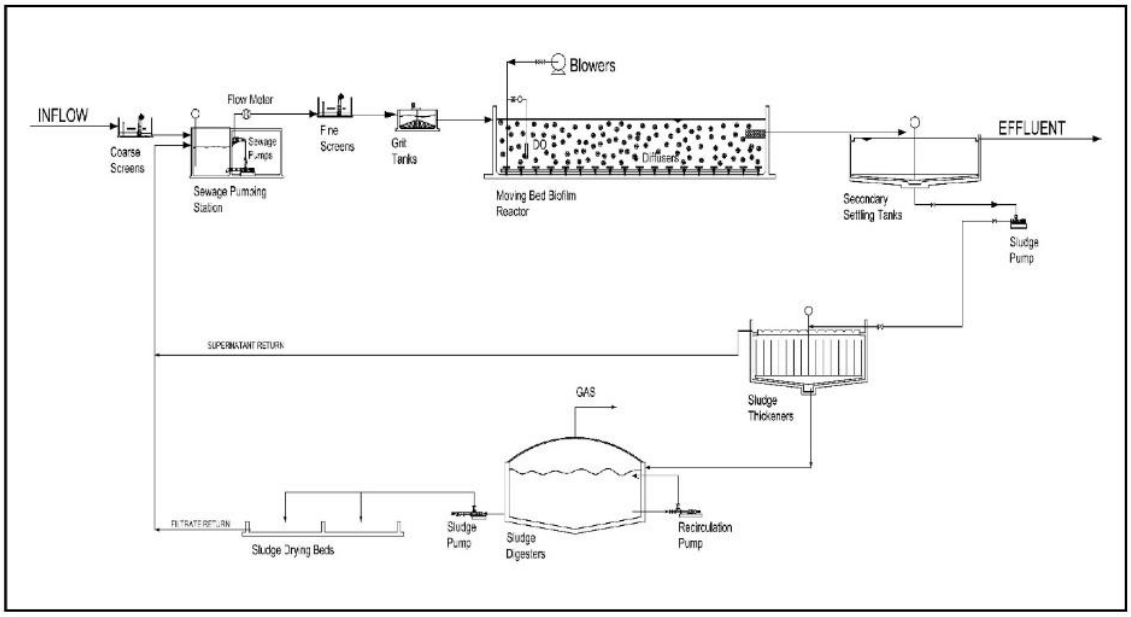


Figure 5-5: Schematic of Alternative C

226. To further compare the alternatives, capital cost and annual operation and maintenance cost were estimated. **Table 5-3** present the preliminary capital cost estimates and annual O&M costs for each option for total flow of 180 MGD.

Table 5-3: Preliminary Capital &Annual O&M Cost Estimates for 180 MGD

Treatment Component	Treatment Alternatives (Rs. Million)		
	A	B	C
Capital Cost			
Total Capital Cost for 180 MGD	21,210	25,539	23,332
Annual O&M Cost			
Total O&M Cost for 180 MGD	406	1,159	1,159

227. Based on the assessment conducted, the combination of Tricking Filter with Primary Settling (Alternative A) was found to be most suitable for TP-IV in terms of technical performance, environmental sustainability, and economic viability. This combination has a simple design, low running cost, small footprint, good organics removal and energy efficiency.

6 Environmental and Social Risks and Impacts

6.1 Introduction

228. This chapter identifies and assesses the potential impacts of Malir Basin Interceptor and TP-IV Project on physical, biological, and socio-economic environment that could arise during pre-construction (design), construction and operational phases of the project.

229. The Malir Basin Interceptor and TP-IV Project is expected to have negative impacts and threats, due to the nature of the construction activities, but is also expected to be beneficial to the people within Karachi City by providing treatment to sewage generated within Malir Basin.

230. The results of the E&S risk assessment conducted for the proposed Malir Basin Interceptor and TP-IV project is shown in **Table 6-1**.

Table 6-1: Summary of E&S Risk Assessment of the Proposed Malir Basi Interceptor and TP-IV

Environmental and Social Risks and Impact	Project Phase	Risk Assessment			Description
		Likelihood	Consequence	Risk Rating	
ESS2: Labor and Working Condition					
Occupational Health and Safety	Construction	Certain (5)	Major (3)	Significant (15)	Construction workers are exposed to occupational health and safety risks and hazards when performing construction activities such as excavation, micro tunnelling, operation of heavy equipment and machines, labor works, civil works, and others.
	Operation	Likely (3)	Major (3)	Medium (9)	Workers are exposed to occupational health and safety hazards related to the O&M of the STP and interceptor, especially during collection of screened wastes, repair of leaks and overflows and sludge management.
Labor risks	Construction, Operation	Certain (5)	Major (3)	Significant (15)	Workers are exposed to labor risks such as child and forced labor, GBV, discrimination, SEA/SH, and labor exploitations.
ESS3: Resource Efficiency and Pollution Prevention Management					
Resource efficiency	Construction	Certain (5)	Major (3)	Significant (15)	Non-renewable materials such as water (~60 m^3/day), rubble stones (20,657 m^3), sand (~5,783,682 m^3), cement (~217,259 m^3), reinforced steel (~22,000 ton) and fuel will be used during construction.
	Operation	Likely (3)	Minor (1)	Low (3)	The operation will require 9.25 m^3 per day of water and 925 kWh per day of power.
Soil Contamination	Construction	Likely (3)	Moderate (2)	Medium (6)	◆ Soil will be exposed to erosion due to removal of vegetation, excavations for laying the interceptor, construction camps and workshops. ◆ Erosion may increase during intense rainfall events.

Environmental and Social Risks and Impact	Project Phase	Risk Assessment			Description
		Likelihood	Consequence	Risk Rating	
					◆ Contamination of soil may also be caused by oil spills or uncontrolled runoff from equipment washing yards. ◆ Improper disposal of solid waste and wastewater from the workers' camps.
	Operation	Certain (5)	Major (3)	Significant (15)	Improper disposal of the solid wastes collected from the intake structures of the interceptor and bar screens from the STP may cause contamination of soil. Sludge generated in the STP may contain heavy metals and if used in horticulture activities, it may cause soil contamination.
Pollution of Water Resources	Construction	Certain (5)	Moderate (2)	Medium (10)	Runoff from the construction works area, especially during wet season, may contain increased loads of sediments, suspended solids and other contaminants which will increase the pollution load of the available water resources in the project area. The following are the potential sources of pollution of water sources: ◆ Discharge of untreated wastewater from contractors' camps and construction site ◆ Oil and chemical spills ◆ Dumping of wastes from contractors' camps and construction site
	Operation	Unlikely (2)	Moderate (2)	Low (4)	Discharge of effluent from TP-IV that is not compliant with the standards.
Air Pollution	Construction	Certain (5)	Major (3)	Significant (15)	The use of vehicles, heavy equipment and generator sets will emit gaseous air pollutants such as carbon

Environmental and Social Risks and Impact	Project Phase	Risk Assessment			Description
		Likelihood	Consequence	Risk Rating	
					monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2). Earthmoving activities and excavation will generate dust. This may cause nuisance and respiratory stresses to vulnerable groups such as children and elderly.
	Operation	Unlikely (2)	Moderate (2)	Low (4)	Operation of standby generator will have air emissions.
Noise	Construction	Certain (5)	Moderate (2)	Medium (10)	The noise may be produced due to the operation of construction machinery and other equipment. Sources of noise during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plants, pneumatic drills, stone crushers, asphalt plants and other equipment. This may cause disturbance to the activities in the mosques, schools, and households within AoI.
	Operation	Rare (1)	Minor (1)	Low (1)	The operation of the standby generator will generate noise.
Construction Wastes	Construction	Certain (5)	Major (3)	Significant (15)	Domestic solid waste will be generated by the workers in the contractors' camps. Improper storing of kitchen and food wastes may attract rodents and other pests. Construction waste will be generated. This waste can also be hazardous. Improper storage and disposal of these wastes may cause pollution to soil and water, if dumped in water bodies.

Environmental and Social Risks and Impact	Project Phase	Risk Assessment			Description
		Likelihood	Consequence	Risk Rating	
Screenings, solid wastes from workers and sludge	Operation	Certain (5)	Major (3)	Significant (15)	Wastes removed from the bar screens and intake structures of the interceptor, wastes generated by the workers, and sludge from the STP may cause pollution to soil and water if not properly disposed.
ESS4: Community Health and Safety					
Traffic management and accidents	Construction	Certain (5)	Major (3)	Significant (15)	The following construction activities may cause/increase traffic within the AoI: ◆ Passing of construction vehicles and machinery in the proposed access roads ◆ Pipe jacking in Korangi Link Road, EBM Causeway, Korangi Cros Road, NRL lines crossing, PRL lines crossing, and Baloch Colony Road. ◆ Open cut excavation along the interceptor alignment ◆ The delivery of construction materials onsite, use of heavy equipment and the storage of excavated materials onsite Aside from traffic generation, these activities may also cause road accidents and road damage.
	Operation	Unlikely (2)	Moderate (2)	Low (4)	Repairs and maintenance of the interceptor may cause localized traffic in the area. Transport of dewatered sludge from STP to end-users.

Environmental and Social Risks and Impact	Project Phase	Risk Assessment			Description
		Likelihood	Consequence	Risk Rating	
Community Health and Safety Risks	Construction	Certain (5)	Major (3)	Significant (15)	Community health and safety risks include (i) Exposure to dusts and air emissions from the construction site may cause respiratory distress most especially to the vulnerable groups such as children and the elderly (ii) Pedestrians or vehicles passing by may accidentally fall in the excavated areas especially during at night (iii) Exposure to hazardous materials and wastes. The community may also be exposed to communicable diseases, vector-borne diseases, and water-borne diseases due to the influx of workers.
	Operation	Certain (5)	Major (3)	Significant (15)	The reuse of sludge in horticulture activities may expose the end-users to excreta-related pathogens and heavy metals that may be present in the sludge.
Greenhouse Gas Emissions	Construction	Certain (5)	Moderate (2)	Medium (10)	Heavy equipment that will be used for the construction are known to emit greenhouse gases such as carbon dioxide.
	Operation	Certain (5)	Moderate (2)	Medium (10)	Wastewater treatment is known to produce greenhouse gases such as methane and nitrous oxide.
Impact of Climate Change	Construction	Likely (3)	Major (3)	Medium (9)	Work must be stopped during extreme weather events to ensure the safety of personnel.
	Operation	Unlikely (2)	Major (3)	Medium (6)	Possible release of untreated wastewater during extreme precipitation.

Environmental and Social Risks and Impact	Project Phase	Risk Assessment			Description
		Likelihood	Consequence	Risk Rating	
Odor	Operation	Likely (3)	Moderate (2)	Medium (6)	Operation of the STP and removal of screenings in the interceptor may generate foul odor and can cause nuisance to nearby community.
Vibration	Construction	Likely (3)	Moderate (2)	Medium (6)	Construction activities may generate vibration that may cause structural damage to the nearby buildings and may also cause disturbance to the activities of the community within AoI.
Social Conflict, GBV, SEA/SH	Construction, Operation	Certain (5)	Major (3)	Significant (15)	During the construction phase of the project, conflicts may arise between labor force and local community, including the risk of SEA/SH and GBV.
ESS5: Land Acquisition, Restriction on Land Use and Involuntary Resettlement					
Resettlement	Construction	Certain (5)	Major (3)	Significant (15)	The project will directly affect 38 PAPs that include eighteen farmers, one owner of a pottery shop, six owners of livestock sheds and thirteen farm workers.
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources					
Biodiversity Flora	Construction	Certain (5)	Major (3)	Significant (15)	Construction of the interceptor will require removal of about 57 trees and shrubs. However, these are common and are not environmentally critical.
ESS7: Indigenous People					
Indigenous People	Construction, Operation			Not applicable	There are no tribal or indigenous people within the AoI.
ESS8: Cultural Heritage					
Cultural Heritage	Construction			Not applicable	There are no cultural heritage, archeological sites or buildings located in the AoI which is listed in ‘Cultural,

Environmental and Social Risks and Impact	Project Phase	Risk Assessment			Description
		Likelihood	Consequence	Risk Rating	
					Tourism, Antiquities and Archives Department – Government of Sindh (GoS) – List of Heritage Buildings' or 'UNESCO World Heritage list'.
ESS10: Stakeholder Engagement and Information Disclosure					
Stakeholder engagement	Construction	Likely (2)	Minor (1)	Low (2)	The project-affected population and sensitive receptors are not aware of the proposed project.

6.2 Anticipated Potential Impact Related to ESS

6.2.1 Impacts related to Assessment and Management of Environmental and Social Risks and Impacts (ESS1)

231. The construction activities of the proposed Malir Basin Interceptor and TP-IV project are anticipated to have high environment and social risks but with minimal significant residual environmental or social risks. This ESIA was developed for the Malir Basin Interceptor and TP-IV project. This contains the identification and assessment of potential impacts relevant to the construction and operation of the project and the corresponding environmental and social management and monitoring plans. The potential impacts of the project to vulnerable groups and identified sensitive receptors were also incorporated in the ESIA.

232. The ESMP contains the mitigating measures that should be implemented to minimize and/or avoid the adverse impacts of the project. However, there is a risk that the contractors may not implement or comply with these management plans during construction.

233. Appropriate E&S personnel are essential to implement, supervise, and monitor the ESMP, OHS Plan, CHS Plan and other plans specified in this document. E&S personnel in the required numbers and with the required skillsets are necessary at PIU, CSC, and Contractors' level. Lack of E&S personnel's capacity or selection of environment non-responsive contractors may result in failure of ESMP implementation and non-compliances. Inadequate resources will lead to major impacts and risk in the physical, biological, and social environment and eventual non-compliance with ESMP requirements.

234. If there are new hazards or risks encountered during the actual construction, the risk assessment should be reviewed and if necessary, be updated, and applicable mitigating measures should be applied.

235. Applicable permits and clearances are required to be secured from government agencies, including the Sindh Environmental Protection Agency (SEPA) and the relevant District Municipal Corporations (DMCs). Without the necessary permissions from these government agencies, the project cannot be implemented. Failure to obtain the required consents, permits, and other appropriate regulatory clearances in a timely manner may result in work stoppages and delays.

6.2.2 Impacts related to Labor and Working Conditions (ESS2)

a) Occupational Health and Safety

236. Construction workers may be exposed to the following risks and hazards when performing construction activities such as excavation, pipe jacking, operation of heavy equipment and machines, labor works, civil works, and others.

- Over-exertion and ergonomic injuries and illnesses due to repetitive motion, over-exertion, and manual handling.
- Poor housekeeping such as excessive waste debris, loose construction materials and liquid spill may cause slips and falls of the workers.
- Physical injuries from falling in excavated areas.

- Accidents can occur when workers come into contact with vehicles or equipment during the mobilization and use of materials and equipment.
- Exposure to chemicals and hazardous materials and wastes
- Eye injury, burn and electrocution from hot work
- During summer season, workers will have to work in extreme hot weather conditions which can bring heat stress
- Potential health and safety risks may also arise from dust, pollutants, noise, and vibration generated from construction activities.
- For the construction of the sewer line from TP-2 to the interceptor, the pipeline will pass along the Manzoor Colony drain. This may expose the workers to vector-borne diseases and foul odors from the sewage in the drain.

237. Operation and maintenance of the interceptor and STP may also pose occupational health and safety risks to the workers.

- Cleaning and maintenance of the inceptors will involve entry into confined spaces which includes manholes, sewers, interceptor, wet wells, digesters, and pump stations.
- Workers can be exposed to the pathogens that the sewage may contain during operation of the STP, repair of leaks and overflows and cleaning of sewers/interceptor.
- Workers may contract water-borne and vector-borne diseases during cleaning and maintenance of the interceptor, sewer lines and STP.
- Solid waste collected from cleaning the interceptor, screening solids and sludge from the STP may also contain pathogens.
- Methane generated from the anaerobic digestion of sludge may lead to fire and explosion if not properly contained, especially since there is a nearby refinery.
- The workers are exposed to hazards of slippery walkways and falling during inspection of the STP tanks.
- The operation of STP may generate foul odors which may cause nuisance to the workers.
- Processing sewage can generate bio-aerosols which are suspensions of particles in the air consisting partially or wholly of microorganisms, such as bacteria, viruses, molds, and fungi. These microorganisms can remain suspended in the air for long periods of time, retaining viability or infectivity.

b) Labor and Working Condition

238. The workers may be exposed to the following labor risks:

- Child labor impact might arise during construction stage, as large number of skilled and unskilled labor will be required by the contractor for the construction activities of the proposed project.
- Forced labor and/or human trafficking.
- GBV might arise due to discrimination made against women by unequal work distribution and unequal pay structure among others.

- SEA/SH against women might occur as a consequence of mixing of men and women at the construction site.
- Labor exploitation such as unpaid and/or incorrect payment of wages by employer, poor working conditions

239. Communicable diseases such as Coronavirus Disease (COVID-19) may be introduced due to influx of outside construction workers. Also, inappropriate camp management may lead to discomfort among workers.

240. The workers may also be exposed to vector-borne and water-borne diseases due to poorly designed and maintained labor camps, sanitation facilities and unsafe drinking water. Communicable diseases such as HIV/AIDS and other sexually transmitted diseases may also spread due to labor influx if the laborers are not medically examined.

6.2.3 Impacts related to Resource Efficiency and Pollution Prevention and Management (ESS3)

a) Resource Efficiency

241. Construction materials include rubble stones, sand, cement, water, and reinforced steel. Almost all the materials to be used are non-renewable and therefore, their sustainable use is necessary. Fuel will be used to operate construction machinery and asphalt and batching plants. Sustainable use of energy resources is very important not only to continue future use but also to help to reduce air emissions/pollutants.

242. O&M activities of the STP and interceptor will also require the use of water for cleaning of the facilities and domestic use of workers. It will also require power to operate the STP and pumping stations.

b) Soil Contamination

243. During the construction phase, spills of fuel, lubricants and chemicals can take place while transferring from one container to another or during refueling. Spills could also occur during maintenance of equipment and vehicles or through leakages from static equipment and vehicles. Excavated materials may also contain heavy metals and may contaminate the soil within the storage area. Improper management and disposal of solid wastes and domestic wastewater generated in the workers' camps may also cause soil pollution.

244. Sewage collected may contain solid waste. Screens are installed in the intake structures of the interceptor and in the inlet of the STP to prevent these solid wastes from entering the treatment system. However, these wastes should be regularly removed from the screens to avoid blockage or clogging at the entry points. These wastes may also contaminate the soil if not properly disposed.

c) Pollution of Water Sources

245. The proposed interceptor alignment is near the Malir River. There are also nearby streams such as the Thaddo Nala, Sukkan Nala, Chakora Nala and Chakkra Nala. The proposed site of TP-IV is also near Korangi Creek. The water quality of these water bodies may get contaminated during construction.

- Domestic wastewater will be generated in the workers' camps. Discharge of untreated wastewater will pollute the nearby water bodies.
- Since the proposed project will entail excavation activities, surface run-off from these areas may increase suspended solids of the nearby water bodies.
- Dewatering activities during rainy season from excavated areas may contain suspended solids and oil and grease, and if disposed of untreated may affect the quality of nearby water bodies.
- Oil spills/leaks from heavy equipment and vehicles may also contaminate the water sources.
- Improper management of solid wastes and hazardous wastes may also contaminate the water bodies.

246. The discharge point for the effluent of TP-IV is in Korangi Creek. If the collected sewage is not properly treated before disposal, this may cause degradation of the water quality of Korangi Creek. Leaks and overflows from the interceptors and/or STP may also cause contamination of ground water and nearby water bodies.

d) Air Pollution

247. Movement of construction vehicles and excavation works for interceptor installation and treatment plant construction could result in generation of dust. Dust could cause nuisance and respiratory diseases to the identified sensitive receptors in proximity to the project sites and reduction of visibility, if adequate mitigation measures are not applied. However, the impacts of dust emissions shall mostly be limited to the work areas and its surroundings. Aside from dust, gaseous emissions from heavy equipment, vehicles and generator sets that will be used in the construction site will produce short-term impacts on the ambient air quality. An increased concentration of carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) may be realized in the ambient air. This impact will only be temporary.

e) Noise

248. Construction activities will involve the use of construction equipment and machinery such as excavators, cranes, power generators, loaders, and dump trucks etc. which will generate high noise levels when in use. The cumulative effects from several machines can be significant and may cause nuisances to the sensitive receptors if adequate mitigation measures are not applied. However, these increased noise levels will prevail only for a short duration during the construction phase.

249. **Table 6-2** lists the estimated noise that will be generated by each construction equipment.

Table 6-2: Noise Generated by Construction Equipment

S. No.	Equipment	Noise dB(A) at 15ft from Source
1	Wheeled loading	90
2	Grader	90
3	Vibration pavement roller	86
4	2-wheel vibration pavement roller	81
5	3-wheel pavement roller	81
6	Tire pavement roller	76

S. No.	Equipment	Noise dB(A) at 15ft from Source
7	Bulldozer	86
8	Wheeled pneumatic dredger	84
9	Sprayer	87
10	Power generator	98
11	Impact drill	87
12	Impact pile driver	112
13	Truck	92
14	Concrete mixer	91
15	Concrete pump	85
16	Mobile lift	96
17	Pneumatic hammer and rock crusher	98
18	Breaker	84
19	Pneumatic spanner	95

Source: Quagliata, A., Ahearn, M., Boeker, E., Roof, C., Meister, L. & Singleton, H. (2018). Transit Noise and Vibration Impact Assessment Manual (No. FTA Report No. 0123).

f) Construction Waste Generation

250. During construction phase, major waste streams will include construction wastes, domestic wastes from construction camps, hazardous wastes including used oil filters, used oils from workshop and small quantities of medical wastes resulting from first aid treatments. Waste from the contractors' camps includes paper, plastic containers, food wastes, kitchen wastes and other domestic solid wastes. Construction wastes include insulation, nails, electrical wiring, rebar, wood, plaster, scrap metal, paper bags, cement, bricks, and excess excavated material. It is estimated that about 1,531,000 cubic meters of excavated materials and 328,200 kg of domestic wastes from the construction camps will be generated during the whole duration of construction.

251. Another important waste stream that might be generated is from sewer pipe laying through Manzoor Colony drain to TP-2 pump room with the interceptor. This work may require dredging of the drain and removing of sewage sludge.

252. Improper disposal of these wastes may cause pollution of soil and water bodies. Storing kitchen and food waste from construction camps can serve as breeding grounds for the disease spreading vectors and rodents.

253. Improper disposal of construction waste can also lead to nuisance and hazards towards the environment and local population.

g) Wastes during Operation

254. During operation, it is estimated that about 240 m^3/day of sludge will be generated in the STP and about 191 kg/day of domestic solid wastes will be generated by the workers. Screenings from the interceptor and STP will also be collected in the intake structures and screens as part pf the maintenance activities.

255. Sludge from TP-IV is expected to contain valuable organic matter and essential nutrients like nitrogen and phosphorus. With this, it is being proposed to reuse the dewatered sludge as soil conditioner and/or fertilizer in horticultural activities. This will reduce the use of chemical and artificial fertilizers for such activities. However, the sludge may also contain heavy metals such as lead (Pb), cadmium (Cd), mercury (Hg), arsenic (As), chromium (Cr), copper (Cu), zinc (Zn), nickel (Ni), selenium (Se), and molybdenum (Mo). If not properly treated, the reuse of sludge may induce soil contamination when applied to the land.

h) Reduced disposal of Untreated Wastewater

256. Over time, the proposed project is expected to help in improving the water quality in Malir River and Korangi Creek by collecting and treating domestic wastewater, thereby decreasing the contamination currently flowing into these water bodies. This reduction of pollution discharges will help remediate the aquatic environment in these water bodies.

257. The Arabian Sea is also poised to benefit from improved water quality in Korangi Creek, since the creek drains into the sea. The proposed wastewater treatment is projected to reduce overall pollution volumes discharged to these connected waters. Lower contaminant loads reaching the Arabian Sea would thereby aid mangrove habitats and aquatic ecology by exposing them to less effluent contamination than present.

6.2.4 Impacts related to Community Health and Safety (ESS4)

a) Employment and Economic Opportunities

258. The project will create significant temporary employment for construction workers, maintenance, support, administrative, security and project management staff. Majority of project staff are expected to be recruited locally from within the native/local workforce. It is expected that around 600 workers are required during the construction period.

259. The O&M of the Malir Basin Interceptor and TP-IV will also require about 193 workers. Qualified local workers will be prioritized during hiring.

260. The influx of workers may also provide business opportunities to the local community to meet the daily requirements of the workers such as selling food, housing rental and other services to the construction workers.

b) Traffic Generation

261. The crossing of the interceptor through major highways (Korangi Link Road, EBM Causeway, Korangi Crossing Road, Baloch Colony Road) may cause severe traffic congestion and/or road closure which will cause significant impact on the road users during excavation and pipe jacking. The delivery of construction materials to the construction site may also increase the traffic within the area.

262. During operation, localized traffic can be experienced in areas near the manholes during inspection, cleaning and/or repair of interceptor. Dewatered sludge from the STP will also be

transported via dump trucks to the end-users. This may also increase the vehicular activities within the site.

c) Road Safety and Damage

263. The construction activities and vehicular movement at construction sites and access service roads may also result in roadside accidents particularly the local communities who are not familiar with presence of heavy equipment and machinery.

264. The construction activities may also deteriorate the existing condition of the roads. The passing of delivery trucks and heavy equipment across the roads may also cause road damage.

d) Disruption and Competition to Basic Services

265. Influx of these workers could affect project areas negatively in terms of excessive utilization of public infrastructure, utilities, housing, and social dynamics if labor camps are not sited properly. The presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education, and social services. This is particularly the case when the influx of workers is not accommodated by additional and separate supply systems.

266. The quality of water resources available in the nearby local communities may also get contaminated due to the construction activities, oil spillage and leakage.

e) Community Health and Safety Risks

267. The local community may be exposed to the health and safety risks associated with the construction activities such as the following:

- Poor storage of materials, equipment, and other obstructions in public areas, including inadequate control of waste materials, may cause slips, trips, and falls.
- Exposure to dust and air emissions from the construction site may cause respiratory distress, especially to the vulnerable groups such as children and the elderly.
- Pedestrians or vehicles passing by may accidentally fall in the excavated areas especially during at night
- Exposure to hazardous materials and wastes
- Generation of noise from the construction activities

268. Unsanitary management of the camp sites and improper management of domestic solid wastes may cause the spread of vector-borne and water-borne diseases among the workers and local communities.

269. Labor workers with different transmittable diseases may cause spreading of those diseases in the local residents. The influx of people may bring communicable diseases to the project area, including STDs, or the incoming workers may be exposed to diseases to which they have low resistance. Workers with health concerns relating to substance abuse, mental issues or STDs may

not wish to visit the project's medical facility and instead go anonymously to local medical providers, this can result in an additional burden on local health resources.

270. During O&M of the interceptor, manholes will be opened to access the interceptor. This is to collect screenings and/or to repair if there is any damage. This may pose a falling hazard to the public if not properly barricaded.

271. Screenings collected from the interceptor and STP may attract vectors and rodents and serve as breeding grounds which may lead to the spread of vector-borne diseases.

272. The anaerobic digestion of sludge will generate methane gas and may cause fire and explosion if not safely handled.

f) Flooding from Overflow in Interceptor and/or STP

273. Blockage of solid waste in the interceptor may cause overflow of sewage along the alignment. Overflow of sewage in the STP may also happen if the influent volume is not monitored and controlled. These may cause localized and temporary flooding in the area.

g) Greenhouse Gas Emissions

274. The Intergovernmental Panel on Climate Change considers wastewater as a source of methane when treated or disposed anaerobically. Production of methane typically increases as temperatures rise. More methane may be produced considering the warm climate in the project areas. Furthermore, the project will use anaerobic reactors, which are significant sources of methane if not properly collected and flared.

275. Another greenhouse gas associated with wastewater is nitrous oxide, which is produced due to the degradation of nitrogen components in wastewater. The interceptors and treatment plant shall collect domestic wastewater, which typically contains human sewage as well as household wastewater.

Table 6-3: Estimated Greenhouse Gas Emissions

S. No.	GHG Emission Generation Source	Estimated GHG Emissions
Construction Phase		
i.	Electricity Generation (Diesel Generators)	Approx. 4,592,084 metric tons of CO_2e
ii.	Raw materials	86,903.6 metric tons of CO_2e (cement) + 39,600 metric tons of CO_2e (reinforcement steel) = 126,503.6 metric tons of CO_2e
Operational Phase		
i.	Electricity (Natural Gas)	68,108.125 kg CO_2e Annually
ii.	Methane Generation	153,000 kg CO_2e per day
iii.	Sludge Transportation	252.737 kg CO_2e per day

h) Impact of Climate Change

276. Influx of stormwater during extreme rainfall may also affect the project since untreated wastewater must be released. More frequent extreme rainfall may likely require more frequent discharge of untreated wastewater to avoid overflow in interceptor and STP.

i) Health Risks from the Reuse of Sludge

277. The users of the sludge for horticultural activities and the consumers of the products where the sludge was reused are exposed to excreta-related pathogens and heavy metals that may be present in the dewatered sludge of the STP.

j) Foul Odor Generation

278. The operation of the STP may generate foul odor if not operated and maintained correctly. Cleaning of interceptors (i.e., removal of screenings) may also emit foul odors. This can be a nuisance to the community.

279. Odor at trickling filter STPs is usually generated due to excessive organic load causing anaerobic decomposition in filter media and due to inadequate ventilation[9]. Complaints could potentially arise once the plant becomes operational, particularly if the trickling filter plant undergoes anaerobic conditions.

- Ponding on Filter Media could happen due to excessive biological growth or foreign matter in or on the filter.
- Breeding of Filter Flies (*Psychoda*) due to inadequate filter media moisture[10].

280. Additionally, odor issues may emerge from the combustion of methane gas released from the sludge digesters.

k) Disturbance and Structural Damages from Vibration

281. Vibration generated by construction activity may cause disturbance to the sensitive receptors such as schools and mosques.

282. Vibration generated by construction activity has the potential to damage structures. This damage could be structural damage, such as cracking of floor slabs, foundations, columns, beams, or wells, or cosmetic architectural damage, such as cracked plaster, stucco, or tile.

l) Social Conflict

283. The community living in and around the project site comprises of people from various ethnic and religious backgrounds. However, no major conflicts were reported in the communities along the religious or ethnic lines. Therefore, there is little chance of any major cultural differences or conflict between the Contractor's workforce and the local inhabitants. Nevertheless, there are generic risks common to this type of project which can cause community unrest or dissatisfaction such as:

[9] https://www3.epa.gov/npdes/pubs/trickling_filter.pdf
[10] ibid

- Jobs being seen to be given to 'outsiders'.
- Lack of communication and information.
- Poor timing or planning of engagement activities.
- Expectations being unrealistically high with regards to project benefits and employment generation due to false or misleading information disclosure.
- Benefits being slow to materialize due to project delays or other reasons.

m) Increased risk of GBV and SEA/SH

284. The influx of workers and service providers into communities may increase the rate of crimes and a perception of insecurity by the local community. Such illegitimate behavior and crimes can include theft, GBV, substance abuse, sexual assault, and human trafficking.

6.2.5 Impacts related to Land Acquisition, Restrictions on Land Use and Involuntary Resettlement (ESS5)

285. The project will directly affect 38 PAPs that include eighteen farmers, one owner of a pottery shop, six owners of livestock sheds and thirteen farm workers.

286. Based on the information provided by the focal persons, visual observations, and public consultations, it is concluded that no AED has been carried out in the zone of impact of the proposed project since October 2018. No AED is expected to be carried out in the project's zone of impact as this zone is clear of any encroachments.

6.2.6 Impacts related to Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS6)

a) Tree Cutting

287. About 57 trees located along the interceptor alignment will be cut to give way to the construction of the interceptor. Details of the trees to be cut are presented in **Table 6-4** below. As shown, there are no trees that are ecologically important as per IUCN.

288. Other than trees, shrubs will be cleared including *Salvadoa persica and Calotropis procera* are growing along the interceptor alignment adjacent Chakora Nala and, *Aerva javanica and Arthrocnemum indicum* growing at TP-IV.

Table 6-4: Trees to be Removed along the Proposed Interceptor Alignment

No.	Species	Trees Count	Coordinates		Common Name	IUCN Status
			N	E		
1	*Azadarichta indica*	5 1 1 1	24.866602 24.872345 24.863805 24.860553	67.121017 67.145104 67.183803 67.194329	Neem Tree	LC
2	*Cocos nucifera*	13	24.864284	67.182503	Coconut	NE
3	*Conocarpus lancifolius*	10	24.800000	67.110659	Damas	LC
4	*Acacia nilotica*	20	24.793175	67.116011	Kikar	LC

No.	Species	Trees Count	Coordinates		Common Name	IUCN Status
			N	E		
5	*Melia azedarach*	1	24.873292	67.155203	Bakain	LC
6	*Phoenix dactylifera*	1	24.870518	67.164871	Khajoor	LC
7	*Pithecellobium dulce*	1	24.860286	67.196279	Jungle Jalebi	LC
8	*Ficus religiosa*	2 1	24.861996 24.865900	67.201476 67.209429	Peepal	LC
Total		**57**				

b) Disturbance to Fauna

289. Habitat of fauna species is expected to be disturbed due to cutting of trees. These fauna species may also be affected due to noise pollution as a result of vehicular movement and installations of machinery during the construction phase. However, by nature, these species may migrate to another habitat.

6.2.7 Impacts related to Indigenous People (ESS7)

290. There are no tribal or indigenous people within the AoI.

6.2.8 Impacts related to Cultural Heritage (ESS8)

291. No impacts on cultural heritage sites are anticipated as there are no cultural heritage, archeological sites or buildings located in the AoI which is listed in 'Cultural, Tourism, Antiquities and Archives Department – Government of Sindh (GoS) – List of Heritage Buildings' or 'UNESCO World Heritage list'.

6.2.9 Impacts related to Stakeholder Engagement and Information Disclosure (ESS10)

292. Before the start of project implementation, awareness shall be provided to the local population through Focus Group Discussions (FGDs), pamphlets etc. regarding the proposed project. Regular interaction shall be kept with the local population by the PIU, CSC, and Contractor's Social Safeguard Teams throughout the construction period to keep them aware about the status of project activities. Important information needed to be disseminated to the people includes the following:

- Overview and objectives of the proposed project;
- Preliminary and/or final detailed design of proposed project components;
- Potential environmental and social impacts (positive and negative) of the project, and the proposed mitigation measures for the perceived negative impacts; and
- Grievance redress mechanism and contact details of the project.

7 Assessment of Cumulative Impacts

293. The simultaneous construction of multiple sewerage and water infrastructure projects, including the Malir wastewater interceptor and 180 MGD sewage treatment plant – TP-IV, in Karachi can have cumulative impacts on the environment, public health, and the urban landscape. These impacts may include increased traffic congestion, air and noise pollution etc. To effectively manage these cumulative effects, a coordinated and holistic approach will be vital, necessitating the active involvement and cooperation of project proponent the Karachi Water and Sewerage Corporation (KWSC) and regulatory body the Sindh Environmental Protection Agency (SEPA).

294. For each project, comprehensive ESA (Environmental and Social Assessment) studies have been diligently conducted. These assessments have meticulously scrutinized the potential environmental and social impacts, offering specific and effective mitigation strategies tailored to each project. Proactive measures, including the implementation of green construction practices, optimized project scheduling to minimize concurrent disruptions, and stringent adherence to emission control standards for construction equipment, have been prioritized as part of these assessments. KWSC will ensure that each project is equipped with precise and targeted solutions to mitigate its unique environmental and social challenges as outlined in the ESAs. To mitigate traffic congestion, local traffic authorities will be taken on board to implement traffic management plans, including alternate routes and temporary traffic controls. Noise and Air Quality mitigation measures such as sound barriers, off-peak construction hours, water sprinkling etc. and active monitoring of noise and dust levels will be made part of the strategy.

295. SEPA, on its part, will ensure rigorous oversight and enforcement of environmental regulations for each project, verifying compliance with prescribed emission limits, noise level restrictions, and water quality standards. Close collaboration between KWSC, SEPA, and other relevant authorities will be essential to streamline permitting processes, expedite approvals, and facilitate the effective management of cumulative impacts.

296. Public engagement is equally crucial. KWSC will engage with local communities, conveying project timelines, potential disruptions, and mitigation efforts. Additionally, community feedback will be actively sought and incorporated into project planning where feasible, throughout the project lifecycle and in line with the project’s Stakeholders Engagement Plan (SEP).

297. In summary, managing the cumulative impacts of multiple infrastructure projects in Karachi requires a multifaceted approach involving proactive planning, robust mitigation measures, regulatory oversight, community engagement, and sustainable urban development strategies. Collaborative efforts among project proponents, regulatory agencies, and the local community will be pivotal to ensure that these projects contribute to the city's growth while minimizing adverse effects on its environment and residents."

8 Environmental and Social Management Plan

8.1 Introduction

298. This chapter presents the Environmental and Social Management Plan (ESMP), which details the mitigating measures that will be implemented to avoid or minimize the potential adverse impacts of the project and the Environmental and Social Monitoring Plan to monitor and evaluate the effectiveness of the actual implementation of the mitigating measures.

299. The main objectives of the ESMP are:

- To provide mitigation measures and a corresponding implementation phase for each impact identified;
- To ensure that all necessary corrective actions are carried out in time to counter any adverse environmental and social impact;
- To ensure the regular monitoring of factors which may affect the safety of the environment under a systematic monitoring approach;
- To define the roles and responsibilities of the project Proponent and Contractor(s) to effectively communicate environmental and social issues among them;
- To provide a procedure for timely action in the face of unanticipated environmental situation;
- To provide a monitoring mechanism in the form of an environmental and social monitoring program, which includes monitoring parameters, monitoring frequency to ensure that all the mitigation measures are completely and effectively implemented;
- To provide estimation of environmental and social cost for the implementation of ESMP;
- To define the requirements necessary for documenting compliance with ESMP and communicating it to all the concerned regulatory agencies; and
- To provide other plans considering the project specific requirements.

8.2 Environmental and Social Mitigation Plan

300. The mitigating measures for the identified environmental and social risks, including risks to vulnerable groups and sensitive receptors, were detailed in the environmental and social mitigation plan. In addition, the followings plans and procedures were also developed for the project to manage the social risks.

- Stakeholder Engagement Plan (SEP)
- Labor Management Procedure (LMP)
- Resettlement Action Plan (RAP)

301. The contractors will be responsible for implementation of measures to avoid or minimize adverse environmental and social impacts during construction. Contractors are required to prepare a Construction ESMP (CESMP) demonstrating the manner in which they will comply with the requirements of the ESMP before mobilization, and obtain approval from the ESC and SC.

Table 8-1: Environmental and Social Management Plan

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
◆ **Pre-Construction Phase**				
Permits, No Objection Certificate (NOC), and Clearances	Applicable permits and clearances are required to be secured from national agencies prior to the start of construction activities.	◆ Coordinate with the national agencies and comply with the requirements. ◆ Undergo ESIA Approval Process in line with Review of SEPA IEE/EIA Regulations 2021 to secure NOC. ◆ Submit formal letters from PD/PIU to the relevant departments requesting permits and approvals for the tree cutting.	PIU, CSC	PIU
Land Acquisition and Involuntary Resettlement	The project will directly affect 38 PAPs that include 18 farmers, one (1) owner of a pottery shop, six (6) owners of livestock sheds, and 13 farm workers	A Resettlement Plan (RP) has been prepared and will be implemented for the PAPs. Compensation and assistance will be paid to the PAPs in accordance with the RP. Construction activities at the interceptors will not commence until all the compensation and assistance have been paid to the PAPs.	PIU, CSC	PIU
Labor Risks	Contractors will hire skilled and unskilled workers. Labor risks may include child and forced labor, discrimination, GBV and SEA/SH.	A Labor Management Procedure (LMP) will be prepared to manage the identified labor risks, such as child and forced labor, GBV and SEA/SH, labor disputes and other community health and safety risks. The LMP details the approach that will be implemented to meet the national requirements such as Sindh Prohibition of Employment of Children Act, 2017 and the objectives of the WB ESS2: Labor and Working Conditions and WB ESS4: Community Health and Safety. The key highlights of the LMP on how to address the issues of child and forced labor, labor influx, GBV, SEA/SH, occupational health and safety, and trafficking will be included in the bid documents for the contractors.	Contractor	PIU

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
Stakeholder Engagement	Awareness of the public regarding the proposed project	◆ A Stakeholder Engagement Plan shall be implemented. ◆ PIU, CSC, and Contractor shall ensure public consultations and participation of stakeholders throughout the project lifecycle. ◆ Stakeholder engagement shall be carried out in a meaningful and inclusive way, providing access to remedy.	PIU, CSC	PIU
◆ **Construction Phase**				
Occupational health and safety	Workers are exposed to occupational health and safety risks of construction activities.	The contractors will be required to prepare and implement an OHS management plan for the construction activities in accordance with national / local regulatory framework, such as 'Sindh Occupational Safety and Health Act, 2017', the WB ESS, specifically 'ESS-2: Labor and Working Conditions, WB Health and Safety Framework and WBG EHS Guidelines on Construction and Decommissioning Activities. The OSH management plan shall include safety protocols and SOPs for various construction activities, OHS personnel, training, OHS risk assessment and preparation of risk matrix, JHAs, inclusion of OHS aspects in method statements, safety audits, reporting, others. The following are to be considered in the OSH program. ◆ Conduct a project H&S risk assessment for all the activities of the entire project prior to the commencement of the works focusing the OHS and CHS. ◆ Designate OHS officer(s) as per the working staff on-site with specified responsibilities to supervise all construction activities at the proposed project site.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ Provide OHS training and basic medical training to specified work staff, and basic medical service and supplies to workers. ◆ Layout plan for camp site, indicating safety measures taken by the contractor (e.g., firefighting equipment, safe storage of hazardous material, first aid, security, fencing, and contingency measures in case of accidents). ◆ Implement work safety measures and good workmanship practices. ◆ Ensure provision of PPEs to all the workers, visitor, and staff in the vicinity of project area. ◆ Ensure provision of sufficient and clean drinking water and sanitation facilities to workers. ◆ Reduce the work hours of workers during extreme hot working environment and heat waves. ◆ Provide proper fuel and chemical storage area. ◆ Prepare emergency response and recovery plan. ◆ The working hours and age of labor and staff will be in compliance with the Sindh Factories Act 2021. Overtime working shift will be allowed to the workers as per prevailing clauses of Sindh Factories Act 2021. ◆ Feasible working conditions, such as healthy environment, workplace safety, provision of recreational activities and adequate medical/first aid facility at site. ◆ Ensure that the site will be restricted for the entry of unauthorized individuals, particularly children, PWDs, and elderly.		

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ Adequate lightning devices, barriers, yellow tape, and safety signage will be posted. ◆ At every workplace, a readily available first aid unit, including an adequate supply of sterilized dressing material and appliances, will be provided. Suitable transport will be provided to facilitate the transfer of injured or ill persons to the nearest hospital. ◆ Providing safe means of access and egress from excavations, such as graded slopes, graded access route, or stairs and ladders ◆ Implement work permit system especially for hazardous activities such as working in confined spaces and excavation		
Labor Conditions	Workers are exposed to labor risks such as the following: ◆ GBV might arise due to discrimination made against women by unequal work distribution and unequal pay structure among others. ◆ SEA/SH against women might occur from mixing of men and women at the construction site. ◆ Labor exploitation such as unpaid and/or incorrect payment of wages by employer, poor working conditions	◆ A Labor Management Procedure (LMP) will be to manage the identified labor risks such as child and forced labor, SEA/SH, labor disputes and others and the community health and safety risks. ◆ The key highlights of the LMP on how to address the issues of child and forced labor, labor influx, GBV, SEA/SH, occupational health and safety, and trafficking will be included in the bid documents. ◆ Gender Action Plan prepared for KWSSIP will be implemented. ◆ A separate SEA/SH Action Plan will be prepared and implemented. ◆ Training will be given to all construction workers, alongside the implementation of strict measures and punishments in case of any sexual assaults, or GBV. ◆ Provide gender-disaggregated bathing, changing, and sanitation facilities. ◆ Construction camps will be built in the designated areas.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ The contractor shall develop a Code of Conduct (COC) for all site personnel. All site personnel shall sign this COC and abide by it. Any violation of the COC will lead to strict punishment including termination of employment. ◆ Use of drugs and alcohol will not be allowed at the work/construction site. ◆ Prohibit carrying weapons into the workplace premises. ◆ Provide appropriate fencing, 24/7 security personnel, check points, and gates at the construction sites to record entry and exit of workers, staff, and visitors.		
	Workers are exposed to health risks of labor relating to HIV/AIDS and other sexually transmitted diseases	To prevent the spread of communicable diseases due to the temporary influx of workers during construction, the following are to be implemented: ◆ Provide surveillance and active screening and treatment of workers; ◆ Undertake health awareness and education initiatives among workers; ◆ Train health workers in disease treatment; ◆ Implement immunization program; and ◆ Provide health service.	Contractor, CSC	PIU, TPV
	Exposure to vector-borne diseases at construction camp dues to unsanitary conditions	◆ Provide hygienic and sanitary contractors' camp with access to safe drinking water and sanitation facilities. ◆ Ensure proper and regular cleaning, housekeeping, and management of the constructors' camp. Provide dedicated cleaning staff for maintaining the cleanliness at the campsites. ◆ To prevent the spread of vector-borne diseases, the following measures will be implemented:	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		○ Maintain the camp sites in sanitary conditions. ○ Implement solid waste management plan. ○ Eliminate unusable impoundment of water. ○ Implement integrated vector control programs ○ Educate project personnel and area residents on risks, prevention, and available treatment. ◆ Ensure implementation of Camp Management Plan, Labor Management Plan (LMP), and Environment Code of Practices (ECP) 14.		
Resource efficiency	Resources that will be used include construction materials, water, and fuel. Construction material to be used for construction activities includes coarse aggregates, fine aggregates, asphalt, cement, reinforced and structural steel. Almost all the materials to be used in the construction are non-renewable and therefore their sustainable use is necessary for future use.	◆ Efficient and well-maintained equipment and machinery will be used. ◆ Implement energy and water conservation measures. ◆ Train workers on energy and water conservation measures. ◆ Plan for reuse of construction waste materials can be formulated. ◆ Use solar panels at camp sites to conserve energy.	Contractor, CSC	PIU, TPV
Soil	◆ Soil erosion from excavation activities. ◆ Soil can be contaminated due to ◆ Improper management of wastes ◆ Oil spill/leaks from heavy equipment and vehicles ◆ Chemical leaks ◆ Disposal of untreated wastewater ◆ Excavated material may also be contaminated.	◆ Stored excavated/fill material will be covered. ◆ The Contractor will be required to reuse the excavated soil for backfilling as much as possible unless the soil is considered not suitable for filling. ◆ Safety Data Sheets will be strictly followed during handling and storage of chemicals.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ All maintenance activities of heavy equipment and vehicles will be done in a designated area with cement flooring. ◆ Non-bituminous wastes from construction activities will be dumped in approved sites, in line with the guidelines for dump sites, and must be covered. ◆ Washing yards will be paved to avoid seepage of runoff from the yard. ◆ Controlling runoff volumes and intercept runoff before it leaves the site. ◆ Confine excavations to the specified spots as per the approved engineering drawings, and avoid unnecessary excavations. ◆ Contractor shall prepare and implement Spill Prevention Plan. A spill kit should be always available onsite. ◆ All the construction vehicles, equipment, and power generators will be regularly inspected, properly maintained to ensure that there are no leakages from their engines and mechanical parts. ◆ Trays will be provided and used during refueling and maintenance of construction vehicles/equipment and under the parked vehicles and equipment if there are any leakages. ◆ Fuels, lubricants, and chemicals to be stored onsite should be in covered bounded areas, underlain with impervious lining. Gensets shall also be placed at impervious floors bunded with parapet walls. ◆ Collected spilled material / contaminated soil shall be disposed-off through SEPA-certified waste handlers.		

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ Ensure implementation of ECP 2: Fuels and Hazardous Goods Management and ECP 5: Soil Quality Management.		
Water sources (river, nullah, groundwater)	◆ Surface run-off from excavated areas may increase suspended solids of nearby water bodies especially during wet season.	◆ Excavated materials/stockpile will not be placed adjacent to the rivers and nullahs. ◆ Storm water runoff originating from stockpiles should be directed to and/or controlled by a suitable sediment trap. ◆ Temporary silt traps or sedimentation basins along the drainage leading to the water bodies will be installed.	Contractor, CSC	PIU, TPV
	◆ Discharge of untreated wastewater from constructors' camp and construction site will contaminate the receiving water body	◆ Wastewater from washing of vehicles or equipment will not be directly discharged in any water source or the storm drainage. ◆ Ensure provision of sanitary toilet facilities in the constructors' camp. ◆ All effluent will be discharged into existing sewerage system as per the requirements of stringent environmental quality standards. ◆ Septic tanks will be constructed to provide primary treatment after which the wastewater will be discharged into existing sewerage network system with the prior approval of KWSC. ◆ Liquid waste from the concrete batching plant will be collected from source by a designated tanker, and taken off-site for proper disposal.	Contractor, CSC	PIU, TPV
	◆ Oil/chemical spills/leakage may impact the water quality	◆ Oils, fuel, and chemicals must be stored at bunded storage areas. ◆ Drainage from fuel storage tank locations, refueling areas, and equipment service areas will be segregated from other runoff; discharge will be routed through an oil/water separator.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ All maintenance activities of heavy equipment and vehicles will be done in a designated area with cement flooring. ◆ Contractor to prepare and implement Spill Prevention Plan, A spill kit should be always available onsite.		
Air	◆ Earth-moving activities and excavation will generate dust. Dust can cause nuisance, reduction of visibility and may cause respiratory diseases	◆ Regular water sprinkling on the site and access roads will be carried out to suppress excessive dust emission(s). The frequency of water sprinkling will be increased in summer season as per the requirement. ◆ Material storage yards will be located at least 500 m downwind from populated areas, nesting place of birds and contractor's camps to minimize the impact of dust emissions. ◆ Storage pile activity (i.e., loading and unloading) will be confined to the downwind side of the storage pile. This practice applies to areas around the storage pile as well as the pile itself. Storage piles will also be located away from downwind site boundaries and sensitive receptors. ◆ Excavated materials will always be covered and will be immediately removed onsite. ◆ Excavated site shall be immediately restored after laying of the interceptor conduit. ◆ Asphalt, hot mix, and batching plants will be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce level of dust emissions. ◆ The vehicles carrying construction materials and the construction material storage areas will be covered with tarpaulin.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ Vehicle speed in the project area will be prescribed not more than 20 kph and controlled accordingly, especially near the sensitive receptors. ◆ Tires of all the vehicles leaving the site will be washed at designated washing area in vehicle parking lots. No earth, mud and dust will be deposited on the public road. ◆ Ensure implementation of ECP 7: Topsoil Management, ECP 9: Air Quality Management.		
	◆ Operation of heavy equipment and vehicles will generate gaseous emissions.	◆ All vehicles, machinery, equipment, and generators used during construction activities will be kept in good working condition, properly tuned and maintained to minimize the exhaust emissions and subsequent impacts. ◆ PPEs (e.g., masks, goggles) suitable for specific jobs will be provided to workers and visitors.	Contractor, CSC	PIU, TPV
Noise	◆ Operation of heavy equipment and vehicles will generate noise. Exposure to too much noise is a hearing hazard to workers and communities.	◆ Stakeholders within AoI will be notified before commencement of excavation operations. ◆ Regular maintenance of the machinery, equipment, and vehicles shall be carried out to minimize the noise levels. All machinery, equipment, and vehicles shall have a definite maintenance schedule and be maintained by the Contractor. ◆ Construction equipment and vehicles will be fitted with effective silencing apparatus where necessary. ◆ Environmental measures, such as noise barriers, shall be constructed for the identified sensitive receptors before commencement.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ Horns will not be used unless it is necessary to warn other road users or animals of the vehicle's approach. ◆ Avoid construction activities during the nighttime near residential areas. ◆ Contractors will comply with submitted work schedule, keeping noisy operations away from sensitive receptors; implement regular maintenance and repairs; and employ strict implementation of operation procedures. ◆ Sensitize truck drivers to avoid hooting, especially when passing through sensitive receptors, such as mosques, churches, residential areas educational institutions and hospitals. ◆ Locating the concrete mixing and materials shipment yards at least 2 km away from sensitive receptors, such as residential areas, schools, and hospitals, will also help reduce local noise levels. ◆ The plants and equipment used for construction will strictly conform to noise standards specified in the stringent environmental quality standards. ◆ Ensure implementation of ECP 10: Noise and Vibration Management.		
Greenhouse Gas	Greenhouse gas emissions from construction activities	◆ **Green Building Materials**: Contractor will use environmentally friendly and low-carbon construction materials, such as recycled aggregates and low-carbon concrete etc. as far as possible, to reduce emissions associated with material production. ◆ **Efficient Equipment**: Contractor to choose energy-efficient construction equipment and vehicles to reduce fuel consumption and emissions during construction activities.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ **Emissions Tracking**: Monitor and record emissions from construction activities to identify areas for improvement and ensure compliance with emissions targets. ◆ **Transportation Optimization**: Optimize transportation routes and reduce the number of trips to minimize emissions associated with material transportation.		
Construction waste	◆ Improper disposal of construction wastes (hazardous and non-hazardous) may cause soil pollution and water bodies. ◆ Improper disposal of construction waste can also lead to nuisance and hazards towards environment and local population. ◆ Storing kitchen and food wastes from construction camps can serve as breeding grounds for the disease spreading vectors and rodents. ◆ Sewage sludge from Manzoor Colony drain will also be removed as part of the sewer pipe laying from TP-II to interceptor.	As part of the CESMP, general (non-hazardous) waste management plans should be implemented at the construction site and camps and should contain the following provisions: ◆ Implement waste segregation (biodegradable and non-biodegradable) policy for all construction and operations personnel. ◆ Provide solid waste handling and storage facilities, such as color-coded trash cans in common areas and strategic locations. ◆ Designate a temporary storage area for domestic and construction wastes. ◆ The recyclable wastes, such as paper, plastics, and metals, shall be sorted accordingly and maximum efforts will be made to recover and recycle excess concrete, spilled concrete dust, sand and aggregate. ◆ The residual and other general solid wastes shall be disposed in their appropriate bins and in accordance with the local solid waste collection schedule. ◆ Waste generated from the camp site will be disposed of at SSWMB- and KMC-approved sites. ◆ Burning of waste will be prohibited.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ Construction workers and supervision staff will be encouraged and educated to practice waste minimization, reuse, and recycling to reduce quantity of the waste. ◆ The contractor will develop specific environmental management plans for asphalt plants and concrete batching plants. These plans will incorporate the general measures as applicable to the entire project but will also have focused mitigations for solid waste from these plants. A hazardous waste management plan should also be formulated and implemented: ◆ Proper containers must be used for each type of hazardous waste that will be generated. The container must also be closed and sealed and be properly labelled. ◆ Do not store incompatible hazardous wastes near each other. ◆ Hazardous wastes storage and labelling shall comply to the national requirements. ◆ The transport, treatment and disposal of hazardous wastes shall only be done by licensed service providers. Dry excavated material shall be reused for backfilling, whereas surplus dry excavated material, as well as wet excavated material, shall be managed and handled through SEPA-certified waste management contractors. Ensure implementation of ECP 1: Waste Management, ECP 2: Fuels and Hazardous Goods Management, and ECP 7: Topsoil Management.		

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
Community Health and Safety	◆ The crossing of the interceptor through major highways and roads may cause sever traffic congestion and possible road closure during construction. ◆ Delivery of construction materials onsite will generate traffic within the AoI. ◆ Excavation, stacking of material and other construction activities along the congested intra city road will also cause traffic congestion during construction phase	◆ The contractor will be responsible for the submission of a final Traffic Management Plan (TMP) to SC for clearance, liaise with Traffic Police Department. The TMP must comprise the following: o Define scope of area that will be affected by construction activities; o Provide sequence of construction operations; o Describe when each phase will commence and finish; o Provide duration of work; and o Note proposed hours of work activity on the site. ◆ The public will be informed early on any closure/diversions of the roads. ◆ The prior notice will be publicized so that the heavy traffic will be managed during this activity along the identified road crossings. The tunnel boring activity will be conducted in fast track and lane wise mode to avoid the complete and lengthy blockage of the roads. ◆ All deliveries, either inbound or outbound of the construction site, may be done during off-peak hours and at designated delivery hubs located near the construction site to prevent blockage of traffic flow along public roads. ◆ Construction vehicles, machinery, and equipment will be parked at designated areas to avoid unnecessary congestions along the roads. ◆ Earth material and pipes will be offloaded and stockpiled at designated areas to avoid	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		unnecessary narrowing and disturbance along the roads. ◆ The traffic control as devised in TMP will be implemented. These control measures will contain details of temporary diversions, details of arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, safety measures for transport of hazardous material and arrangement of flagmen. ◆ Special consideration will be given to the preparation of the traffic control plan for safety of pedestrians and workers at night. ◆ The Contractor will ensure that the diversion and detour is always maintained in running condition, particularly during intense rainfall events to avoid disruption to traffic flow. ◆ All the construction activities including material, and waste and surplus soil stocking will be confined to the road carriageway by the Contractor, to the minimum possible extent. In addition to that proper barricading will be provided. ◆ Contractor will adopt best construction practices, i.e., vertical cutting approach with proper shoring and bracing, to limit the width of trench excavation. ◆ Traffic controls and diversions marked with signs, lights, and other measures (flags) will be provided.		
	◆ Construction activities and vehicular movement at construction sites and access service roads may result in roadside accidents and road damages.	◆ Emergency response plan shall be prepared for any traffic accident during construction. In case of community related accident, compensation shall be paid in accordance with Fatal Accidents Act 1855.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ Plan and manage the construction activities in close consultation with these stakeholders to minimize the vulnerability of above impacts on these sensitive receptors. ◆ Contractor to ensure that all the vehicle drivers and equipment operators have valid licenses and proven competency for their work. ◆ Special arrangements will be made to ensure the accessibility and safety of the educational institutions that cater to toddlers and young kids. Workers will not be allowed to crowd together in the surroundings. Working during peak periods (school start and closure time) will be avoided. ◆ Special arrangements to ensure access to homes, businesses, and hospitals. ◆ The speed of the vehicles will be controlled (at 30 to 40 km/hr) to reduce the probability of severe accidents, debris flows, and dust emission especially to sensitive receptors. ◆ Road damage due to construction vehicles will be instantly repaired and/or compensated after the completion of work. The disturbed area shall be restored to its original conditions. ◆ At work site, public information and caution boards will be provided including contact for public complaints.		
	◆ Quality of water resources available in the nearby local communities may get contaminated due to the construction activities, oil spillage and leakage.	◆ Oils, fuel, and chemicals must be stored at bunded storage areas. ◆ Drainage from fuel storage tank locations, refueling areas, and equipment service areas will be segregated from other runoff; discharge will be routed through an oil/water separator.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ All maintenance activities of heavy equipment and vehicles will be done in a designated area with cement flooring.		
	◆ Exposure to dust and air emissions from the construction site may cause respiratory distress, especially to the vulnerable groups such as children and the elderly. ◆ Exposure to hazardous materials and wastes	◆ Regular water sprinkling on the site and access roads will be carried out to suppress excessive dust emission(s). The frequency of water sprinkling will be increased in summer season as per the requirement. ◆ Material storage yards will be located at least 500 m downwind from populated areas, nesting place of birds and contractor's camps to minimize the impact of dust emissions. ◆ Storage pile activity (i.e., loading and unloading) will be confined to the downwind side of the storage pile. This practice applies to areas around the storage pile as well as the pile itself. Storage piles will also be located away from downwind site boundaries and sensitive receptors. ◆ Excavated materials will always be covered. ◆ Asphalt, hot mix, and batching plants will be equipped with dust control equipment, such as fabric filters or wet scrubbers, to reduce level of dust emissions. ◆ The vehicles carrying construction materials and the construction material storage areas will be covered with tarpaulin. ◆ Vehicle speed in the project area will be prescribed not more than 20 km per hour and controlled accordingly especially near the sensitive receptors. ◆ Tires of all the vehicles leaving the site will be washed at designated washing area in vehicle parking lots to ensure that no earth,	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		mud and dust will be deposited on public roads. ◆ All worksites will be provided with security and public access will be prohibited.		
	◆ Pedestrians or vehicles passing by may accidentally fall in the excavated areas especially during at night	◆ Construction areas shall be properly barricaded and marked with warning tapes. ◆ All worksites will be provided with security and public access will be prohibited. ◆ Barricades will be provided to prevent public access to all areas where construction works are on-going. ◆ Attach warning signs, blinkers to the barricade to caution the public about the hazards associated with the works and presence of deep excavation. ◆ Excavation shall be provided with guard rails and toe boards or similar where it is possible to fall 2 m or more. Barriers shall be placed at least 1 m away from the edge of the excavation. ◆ Minimize the duration of time when the trench is left open through careful planning; plan the work properly from excavation to refilling and road relaying; Reinstate excavations and trenches as soon as the work in that particular section is completed. ◆ Ramps will be placed in front of schools and houses gates so that accidents due to slips can be avoided. ◆ Provide safe pedestrian walkways at the identified sensitive receptor locations to allow safe entry and exit to the visitors, especially women, children, elderly, patients. Walkways will be properly barricaded, where necessary provided with	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		guardrails and made prominent by installing signs and reflective tapes. ◆ Install adequate lighting at excavated areas and trenches during night. ◆ Prepare and implement emergency response plan		
	◆ The local community may be at risk of contracting various communicable diseases.	◆ Labor camp will be established preferably at a reasonable distance from residential areas. ◆ Labor management plan (as per the LMP of KWSSIP-2) will be formulated by the Contractor to minimize the adverse impacts on local communities and workers. Preference will be given to any KWSC facility where the camp can be established without causing any hindrance or disturbance to the workers and residents of that facility. ◆ Training, awareness, and campaigns will be conducted for workers and surrounding communities on awareness and prevention of COVID-19 and HIV/AIDS. ◆ Provide proper and free HIV/AIDS and STDs health screening and counselling for site workers and community members.	Contractor, CSC	PIU, TPV
	◆ Unsanitary management of the camp sites and improper management of domestic solid wastes may cause the spread of vector-borne and water-borne diseases among the workers and local communities.	◆ Provide hygienic and sanitary contractors' camp with access to safe drinking water and sanitation facilities. ◆ Ensure proper and regular cleaning, housekeeping, and management of the constructors' camp. A designated cleaning staff will be provided in the campsites. ◆ To prevent the spread of vector-borne diseases, the following measures will be implemented:	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◦ Maintain the camp sites in sanitary conditions. ◦ Implement solid waste management plan. ◦ Eliminate unusable impoundment of water. ◦ Implement integrated vector control programs. ◆ Educate project personnel and area residents on risks, prevention, and available treatment.		
	◆ Vibration generated by construction activity may cause disturbance to the sensitive receptors such as hospitals, schools, and mosques. ◆ Vibration may cause structural damage, such as cracking of floor slabs, foundations, columns, beams, or wells, or cosmetic architectural damage, such as cracked plaster, stucco, or tile	◆ To minimize vibrations, machines should be mounted on shock-absorbing mountings, such as cork or reinforced concrete foundation or a floating isolated foundation set on piles, depending on the machinery. ◆ Reduce working hours and/or introduce short breaks during working days to lessen the consequences of vibrations. ◆ Plan and manage construction activities in close consultation with the stakeholders of social sensitive receptors to minimize the vulnerability of above impacts on these sensitive receptors. ◆ The working space will be shifted to the other side of the sensitive receptor situated within 5-m to 13-m distance from the center line of the proposed route. ◆ Schedule the major construction activities such as excavation, trenching and pipe laying during off-peak hours to avoid disturbance on educational institutions and hospitals.	Contractor, CSC	PIU, TPV
	◆ During the construction phase of the project, conflicts may arise between labor force and local	◆ Communities will be informed and consulted before commencing works inside or near the communities.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
	community. Use of local resources and products by the construction workers can generate stress on the local resources. Furthermore, difference in cultural values may also cause discomfort to local residents.	◆ An effective GRM has been established for the project to resolve all issues related to the community. A separate Grievance Redress Committee for GBV cases has also been established. ◆ Create awareness among workers on proper sanitation and hygiene practices to endorse proper health and maintain good housekeeping practices at all project sites.		
	◆ The influx of workers may increase the crime rate within the locality including GBV and SEA/SH.	◆ Special arrangements will be made to ensure the accessibility and safety of the educational institutions that cater to toddlers and young kids. Workers will not be allowed to crowd together in the surroundings. Working during peak periods (school start and closure time) will be avoided. ◆ During the construction phase, mobility of workers in the nearby areas will be strictly restricted by the contractor to avoid any inconvenience to the local communities especially women. ◆ Alternative routes for pedestrian will be provided to avoid mixing of women with workers. ◆ Project staff will be trained on the prevention of GBV and SEA/SH. ◆ Develop a Code of Conduct (COC) for all site personnel. All site personnel shall sign this COC and abide by it. ◆ Prohibit drugs, alcohol, weapons, and ammunition on the worksite among personnel. ◆ PIU has prepared a Gender Action Plan for the entire KWSSIP. The relevant aspects of this Plan will be implemented for the proposed project.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
Biodiversity	◆ About 57 trees located along the interceptor alignment will be cut to give way to the construction of the interceptor. ◆ Shrubs will be cleared along the interceptor alignment and within TP-IV site	◆ A tree plantation plan shall be formulated with the recommendations and technical support of concerned Departments (KMC, Park and Horticulture Department, Sindh Forest Department) and shall be implemented during construction phase. ◆ A project-specific Compensatory Tree Plantation Plan shall be prepared by the Contractor based upon the Tree Plantation Plan. ◆ Seed supply, nursery, watering, and any other necessary arrangements will be put in place for maintaining the trees planted under compensatory plantation, for at least five years. Contractor shall be responsible for maintaining the trees during the Contract Period and Defect Liability Period. After that, the trees shall be handed over to the relevant departments that own the land for compensatory plantation sites. ◆ Trees that will be cut is limited to DIA only. ◆ Ensure replacement of cut trees (1:10). ◆ Suitable space for tree plantation shall be identified by the PIU in consultation with Local Government Department, Forest Department, Municipal Corporations, and Cantonment Boards etc. before clearance of trees. ◆ The contractor shall also compensate the cutting of shrubs in the project's DIA through plantation of ornamental shrubs at the areas to be specified by the PIU. ◆ While clearing vegetation and excavation, it shall be ensured that no wildlife gets injured or killed.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ Mangroves present outside the southern edge of the TP-IV site shall be maintained as out-of-bounds area for the construction crew. ◆ Workers shall be provided with adequate knowledge regarding protection of flora and fauna, and relevant government regulations.		
	◆ Disturbance of fauna species due to noise generated and dust emissions.	◆ Ensure implementation of noise and dust mitigating measures as discussed above. ◆ In case of appearance of any endangered/threatened wildlife species, respective regulatory authority must be informed as early as possible.	Contractor, CSC	PIU, TPV
Cultural Heritage Site	◆ Chance finds	◆ Train the workers on chance find procedures. ◆ In case of chance finds, the following measures shall be strictly adopted by the Contractor: o Strictly follow the protocol by coordinating immediately with PIU and Directorate General of Antiquities and Archaeology – Cultural, Tourism, Antiquities and Archives Department (GoS) for any suspicion of chance finds during excavation works. o Stop work immediately to allow further investigation if any finds are suspected. o Request authorized person from the Archaeology Department to observe when excavation resumes for the identification of the potential chance find and comply with further instructions.	Contractor, CSC	PIU, TPV

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ Implement ECP 17: Cultural and Religious Issues.		
◆ **Operation**				
Occupational Health and Safety	◆ Workers can be exposed to the excreta-related pathogens during the removal of screenings and operation and maintenance of the STP. ◆ Fire and explosion from the methane generated in the anaerobic sludge digester. ◆ During inspection and maintenance of tanks, workers are exposed to hazards of slippery walkways and falling. ◆ Foul odors will be generated if the STP is not properly operated and maintained.	◆ An OHS Management System will be established and implemented describing SOPs, roles and responsibilities, training needs, emergency response procedures, and reporting and documenting needs. ◆ An EHS Officer will be designated on site. ◆ Railing around the tanks and pits will be installed. All paths, walkways, staircases, ladders, and platforms will be provided and made suitable for the tasks to be undertaken. ◆ Encourage/require all workers to wash their hands right after activity. Provide access to handwashing facilities with water and soap. ◆ Impose strict use of PPE by all personnel (especially staff working in laboratory/chemical building, maintenance, and workshop). ◆ Conduct toolbox meeting at the start of every shift. ◆ Ensure mandatory and regular training of all employees, including sub-contractors, on Health and Safety Practices for STP and its auxiliary facilities. ◆ Emergency plan (including fire management) shall be developed and implemented. Appropriate fire extinguishers shall be placed at prominent locations. ◆ First aid facilities shall be established onsite. ◆ Ensure availability of vehicles to bring any injured employee to the nearest hospital in case of accidents.	KWSC	KWSC

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ Implement mandatory reporting of all accidents or incidents of near misses and immediate adoption of corrective measures. ◆ TP-IV Management shall provide all the necessary financial and human resources for the implementation and enforcement of OHS plan. ◆ Implement effective and proper housekeeping. ◆ Heat levels shall be monitored, and spot checks shall be done during summer months. ◆ Guardrails shall be installed around all process tanks and pits. ◆ Workers working near water bodies and tanks shall be provided with lifeline, Personal Flotation Device (PFD), rescue buoys, and throw bags. ◆ Valves will be provided in the tanks to prevent accidental flooding during maintenance. ◆ Ensure provision and use of fall protection equipment during work-at-heights (WAH). ◆ Work areas shall be maintained to minimize slipping and tripping hazards. ◆ Monitor flaring of methane. ◆ Provide workers with immunization.		
	◆ Cleaning and maintenance of the inceptors will involve entry into confined spaces. ◆ Workers can be exposed to excreta-related pathogens during the removal of screenings and cleaning and maintenance of the interceptor.	◆ An OHS Management System will be established and implemented describing SOPs, roles and responsibilities, training needs, emergency response procedures, and reporting and documenting needs. ◆ Workers involved in the cleaning and maintenance of interceptors shall be provided with proper PPE, training on how to use it, and hand washing arrangements.	KWSC	KWSC

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
	◆ Workers may contract water-borne and vector-borne diseases during cleaning and maintenance of the interceptor sewer lines.	◆ Include in safety training program for workers, safe handling, and personal hygiene practices to minimize exposure to pathogens and vectors. ◆ Encourage/require all workers to wash their hands right after activity. Provide access to handwashing facilities with water and soap. ◆ Implement a confined spaces entry program consistent with applicable accepted standards. ◆ Provide workers with immunization. ◆ Impose mandatory health and medical check-ups for all sanitary workers working in cleaning pumping stations and sewers. ◆ Positive-pressure self-contained breathing apparatus (SCBA) or positive-pressure air-line units with an emergency egress bottle shall be used in any known or suspected H2S environment. ◆ Appropriate H2S warning signs shall be posted in areas with potential H2S exposure. ◆ Implement work permit system for hazardous activities such as entering confined spaces. Provide 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. prior to entry into a permit-required confined space: o Process or feed lines into the space should be disconnected or drained, and blanked and locked-out. o Mechanical equipment in the space should be disconnected,		

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		de-energized, locked-out, and braced, as appropriate. o The atmosphere within the confined space should be tested to assure the oxygen content is between 19.5 percent and 23 percent, and that the presence of any flammable gas or vapor does not exceed 25 percent of its respective Lower Explosive Limit (LEL). o If the atmospheric conditions are not met, the confined space should be ventilated until the target safe atmosphere is achieved, or entry is only to be undertaken with appropriate and additional PPE. o Before workers are required to enter a permit-required confined space, adequate and appropriate training in confined space hazard control, atmospheric testing, use of the necessary PPE, as well as the serviceability and integrity of the PPE should be verified. o Further, adequate and appropriate rescue and / or recovery plans and equipment should be in place before the worker enters the confined space		
Labor and Working Conditions	Workers are exposed to labor risks such as the following: ◆ Gender-based violence	◆ A Labor Management Procedure (LMP) will be to manage the identified labor risks.	KWSC	KWSC

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
	◆ Discrimination made against women by unequal work distribution and unequal pay structure among others. ◆ SEA/SH against women might occur from mixing of men and women at the project site. ◆ Labor exploitation such as unpaid and/or incorrect payment of wages by employer, poor working conditions ◆ Labor risks may include child and forced labor, discrimination	◆ The key highlights of the LMP on how to address the issues of child and forced labor, labor influx, GBV, SEA/SH, OHS, and trafficking will be included in the bid documents. ◆ Gender Action Plan prepared for KWSSIP will be implemented. ◆ A separate SEA/SH Action Plan will be prepared and implemented. ◆ Training will be given to all workers, alongside the implementation of strict measures and punishments in case of any sexual assaults, or GBV. ◆ Provide gender-disaggregated bathing, changing, and sanitation facilities. ◆ Use of drugs and alcohol will not be allowed at the work/construction site. ◆ Carrying weapons into the workplace premises will be prohibited.		
Soil	Soil contamination may be caused by: ◆ Improper disposal of screenings from interceptor and STP ◆ Improper disposal of solid wastes generated by workers. ◆ Disposal of sludge contaminated with heavy metals.	◆ Develop and implement solid waste management plan. ◆ Provide training to workers on proper solid waste management and disposal. ◆ Develop and implement sludge management plan. ◆ Conduct sludge quality testing at regular intervals before its utilization as fertilizer.		
Water	◆ Disposal of sewage that is not properly treated may cause degradation of the water quality of Korangi Creek. ◆ Leaks and overflows in STP and interceptors can contaminate groundwater and nearby water bodies.	◆ Develop and implement O&M Manual for the STP and interceptor. The manual shall detail the maintenance activities and frequencies to ensure that all project components are working properly. ◆ Conduct regular inspection of the interceptor and STP. ◆ Regularly remove the screenings in the intake structures of the interceptor and STP.		

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ In case of breakdown/malfunctioning of main equipment, use standby equipment, as provided in the design. ◆ Ensure that operators are trained at least once every quarter on the SOPs in case of emergencies and/or plant failure. ◆ Conduct preventive maintenance on a pre-defined frequency with required spare parts available at the premises. ◆ Prepare emergency response procedures and train O&M staff on these procedures.		
Air	◆ A standby diesel generator will be used during maintenance activities. The operation of the generator will have gaseous emission from fuel burning.	◆ Ensure proper maintenance of the genset. ◆ Provide stack with enough height to ensure the dispersion of gas emission. ◆ Use genset with low emissions.	KWSC	KWSC
Noise	◆ The operation of the generator may generate noise.	◆ Ensure proper maintenance of the genset. ◆ If possible, provide enclosure to genset.	KWSC	KWSC
Greenhouse Gas	◆ Greenhouse gas emissions from O&M activities	◆ **Energy Efficiency**: KWSC TP-IV Management to consider installing energy-efficient equipment and systems in the sewage treatment plant to minimize electricity and natural gas consumption. ◆ **Renewable Energy**: Transition to renewable energy sources, such as solar panels or wind turbines, to power the treatment plant and reduce emissions from energy use. ◆ **Methane Capture**: Implement methane capture and utilization system effectively within the sewage treatment process to prevent the release of methane emissions generated during sewage treatment. ◆ **Chemical Reduction**: Explore alternatives to chemicals with high carbon footprints and optimize chemical usage to reduce emissions.	KWSC	KWSC

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ **Transportation Optimization**: Use energy-efficient vehicles and transportation methods for sludge transportation and disposal. Implement route optimization to minimize vehicle travels. ◆ **Wastewater Management**: Optimize sewage treatment processes to reduce energy and chemical consumption while maintaining treatment efficiency. ◆ **Emissions Monitoring**: Continuously monitor emissions from the treatment plant and implement measures to minimize fugitive emissions. ◆ **Carbon Offsets**: Consider investing in carbon offset projects to compensate for unavoidable emissions. These projects can include mangroves forestation, renewable energy development, or methane capture at other sites. ◆ **Lifecycle Assessment**: Conduct a full lifecycle assessment of the treatment plant to identify areas for emissions reduction, including design modifications and operational improvements. ◆ **Public Education**: Educate the community about water conservation and responsible sewage disposal to reduce the overall volume of sewage that needs treatment.		
Climate Change	◆ Climate change may impact the performance of the STP	◆ Incorporate climate resilience features into the design and construction of the facility to withstand extreme weather events and increased rainfall ◆ Ensuring the plant operates efficiently with minimal energy consumption through the use of renewable energy sources and equipment optimization.	KWSC	KWSC

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
		◆ Treatment process must meet strict environmental standards to protect local ecosystems, and water recycling and reuse programs may be considered to alleviate pressure on freshwater resources. ◆ Consider capturing and utilizing methane as an energy source, using technologies to reduce methane emissions, and improving overall plant efficiency. ◆ Incorporating long-term climate change projections into the project's planning and actively involving local communities and stakeholders can help address specific concerns related to climate change impacts, ensuring that the wastewater interceptor and sewage treatment plant not only serves its intended purpose but also contributes to the city's overall resilience and sustainability in the face of a changing climate.		
Wastes	◆ Sludge from the STP will be generated and may contain heavy metals.	◆ Develop and implement sludge management plan. ◆ Conduct sludge quality testing at regular intervals before its utilization as fertilizer.	KWSC	KWSC
	◆ Screenings will be collected in the intake structures. ◆ Solid wastes will be generated by the workers.	◆ Develop and implement solid waste management plan. ◆ Provide training to workers on proper solid waste management and disposal	KWSC	KWSC
Community Health and Safety	◆ Interceptor blockage and breakage or overloading of STP may cause localized and temporary flooding in the area.	◆ Conduct regular inspection and maintenance of the interceptor. ◆ Clean intake chambers periodically to clear any clogging/blockages. ◆ Develop and implement emergency response plan. ◆ Monitor the inflow of sewage in the STP.	KWSC	KWSC
	◆ End-users of sludge for horticultural activities are exposed	◆ Conduct sludge quality test in terms of excreta-related pathogens and heavy	KWSC	KWSC

Environmental Issues/Parameters	Environmental and Social Impacts	Mitigation Measures	Implementation Agency	Monitoring Agency
	to excreta-related pathogens and heavy metals that the sludge may contain.	metals before transporting the sludge for reuse. ◆ Raise awareness to end-users on the safe reuse of sludge. ◆ Conduct Sanitation Safety Planning.		
	◆ Screenings collected from the interceptor and STP may attract vectors and rodents and serve as breeding grounds which may lead to the spread of vector-borne diseases.	◆ Waste material removed from the interceptor and STP shall be disposed through SEPA-certified hazardous waste handlers. ◆ Develop and implement solid waste management plan. ◆ Provide training to workers on proper solid waste management and disposal	KWSC	KWSC
	◆ During cleaning and maintenance of interceptor, manholes will be opened. This may pose falling hazards to the public.	◆ Provide proper barricade and safety signage and warnings. ◆ Barricades will be provided to prevent public access to all areas where maintenance activities are on-going.	KWSC	KWSC
	◆ Fire and explosion due to methane gas from anaerobic digestion of sludge	◆ Monitor flaring of methane. ◆ Do not allow open flames near the digester ◆ Implement OSH program	KWSC	KWSC
	◆ Foul odor generation from STP operations.	◆ Conduct daily inspection of Trickling Filters for signs of ponding, uneven flow distribution, clogging, vibration, leakage, filter flies and unusual odors.	KWSC	KWSC
	◆ In case there is a need to repair pipes or cleaning of interceptor, temporary traffic in the area may be experienced. ◆ Transport of dewatered sludge from STP to end-users will also add to the vehicular activities in the area.	◆ Develop and implement traffic management plan. ◆ Any closure of the roads (especially main roads) and deviations/diversions proposed will be informed to the riders through standard signs and displays. ◆ Conduct repair activities during non-peak hours.	KWSC	KWSC

8.2.1 Construction Management Plan

a) Contractors' Qualification

302. It will be ensured that all contractors and subcontractors hired under the Project are conversant with local and WB E&S requirements. PIU-KWSSIP will give preference to the contractors having ISO certifications (ISO 9001; ISO 14001; and / or ISO 45001) during prequalification or technical evaluation of contractors.

303. Contractors' past performance in Environmental and Social (E&S) management will be a mandatory criterion for shortlisting. The E&S performance track record of contractors will carry significant weight. This criterion is essential to ensure that selected contractors have a proven history of responsible and compliant E&S practices.

304. Contractors will be required to provide documented evidence of their previous projects' E&S performance, including their compliance with relevant regulations, safety records, community engagement efforts, and adherence to E&S management plans. The evaluation will be based on a transparent scoring system, where each contractor's performance will be quantified and considered in the shortlisting decision.

b) Inclusion of ESMP, ESHS and Community Development / CSR Conditions in the Bidding Documents

305. To make Contractors fully aware and responsible for ensuring ESHS compliance, this ESMP with all its requirements, the following conditions and all other relevant conditions in line with 'WB – Procurement of Works & User's Guide – Updated January 2017, will be made part of the bidding documents:

- The Contractor shall obtain (at its cost) an Environmental, Social, Health and Safety (ESHS) Performance Security for compliance with the Contractor's ESHS obligations.
- The Contractor shall be required to declare any civil work contracts that have been suspended or terminated and/or performance security called by an employer for reasons related to the non-compliance of any environmental, or social, or health or safety requirements or safeguard or related to GBV and SEA/SH in the past five years.
- The Contractor shall submit comprehensive and concise Environmental, Social, Health and Safety Management Strategies and Implementation Plans (ESHS-MSIP) which includes but not limited to; Mobilization strategy, Strategy for obtaining consents/permits, Traffic management plan, Waste management plan, workers camp management plan etc. and a Strategy for marking and respecting work site boundaries etc.
- The Contractor shall recruit qualified and experienced Environment, Health, Safety and Social Staff with relevant educational background and experience for each site to manage E&S aspects of the project.
- The Contractor will be contractually bound to disclose the "Recruitment Policy" and follow it. Contractor will hire at least 60% of people who live within close proximity to the Project Area.
- A community development component shall be included in the Contract document, which could involve funding or supporting educational initiatives by the Contractor, like schools, literacy programs, or scholarships for girls and women, introducing skill development, vocational

training, or income-generation programs tailored for women to enhance their economic and social status.

- The ESMP of the Project along with the ECPs and occupational hazards and risks will be included in the contractors' bid documents. The technical specifications of the bid documents will clearly state that the contractor needs to comply with the mitigation and control measures provided in the ESMP, ECPs, OHS Plan, WBG EHS General Guidelines and SEQS.
- Provision related to SEA/SH/GBV will be incorporated in the bidding document.
- The Contractor shall be required to ensure compliance of 'Code of Conduct' signed by each of its employees / workers. The issues to be addressed in the Code of Conduct shall include the following:
    - Compliance with applicable laws, rules, and regulations of the jurisdiction;
    - Compliance with applicable health and safety requirements (including wearing prescribed PPEs, preventing avoidable accidents and a duty to report conditions or practices that pose a safety hazard or threaten the environment);
    - The use of illegal substances;
    - Non-Discrimination (e.g., based on family status, ethnicity, race, gender, religion, language, marital status, birth, age, disability, or political conviction);
    - Interactions with community members with respect;
    - Sexual harassment (e.g., to prohibit use of language or behavior, in particular towards women or children, that is inappropriate, harassing, abusive, sexually provocative, demeaning, or culturally inappropriate);
    - Violence or exploitation (e.g., prohibition of the exchange of money, employment, goods, or services for sex, including sexual favors or other forms of humiliating, degrading, or exploitative behavior);
    - Protection of children (including prohibitions against abuse, defilement, or otherwise unacceptable behavior with children, limiting interactions with children, and ensuring their safety in project areas);
    - Sanitation requirements (e.g., to ensure workers use specified sanitary facilities provided by their employer and not open areas);
    - Avoidance of conflicts of interest (such that benefits, contracts, or employment, or any sort of preferential treatment or favors, are not provided to any person with whom there is a financial, family, or personal connection);
    - Respecting reasonable work instructions;
    - Protection and proper use of property;
    - Duty to report violations of this Code; and
    - Non retaliation against workers who report violations of the Code.

306. Payments to contractors will be linked to environmental, health and safety performance, measured by completion of the prescribed environmental and social mitigation measures in the site specific ESMP (SSESMP) and control measures described in the OHS plan. In addition, for any non-compliance causing damages or material harm to the natural environment, workers, public or private property or resources, the Contractor will be required to either remediate / rectify any such damages in a timeframe specified by and agreed with the CSC or pay the cost (as assessed by IA)

of contracting a third party to carry out the remediation work. For repeated non-compliance the Contractor will be penalized; penalty will be 3% of the total Civil Works in the Instruction of Payment Certificate (IPC). The penalty will be imposed after all contractual instruments are applied and a Non-compliance Report (NCR) is issued by the CSC / Engineer.

c) Criteria for the Selection of Sub-Contractors

307. The Contractor shall ensure that following criteria is followed for the selection of any sub-contractor, to make sure their ability of implementing ESHS requirements:

- All ESF / ESS Requirements applicable on the main Contractor shall also be applicable to the hired Sub-contractors.
- Sub-contractor should have proven experience in providing services for a minimum of 5 years with successful ESHS management.
- The sub-contractor shall provide the following:
    - Details of company information with organization structure, list of workforce with the Curriculum Vitae (CVs) of key personnel, plant and machinery list mentioning year of manufacturing, support agencies, other facilities, and resources;
    - Details of completion of similar type of projects within last five years indicating their brief scope of work, value of work, contractual duration, actual completion of project, client's name, contact details of that client, safety appreciation or compliance certification or inspection of plant and machineries, EHS statistics, Loss Time Injuries (LTI) graph etc.;
    - Details of typical project planning and execution methodology;
    - Details of current commitments – List of all the jobs under execution with the value of the job and percentage completion with particular emphasis on project of similar magnitude carried out;
    - Details of EHS policy, safety manual, safety plan and implementation procedures in-line with internationally accepted practices along with the statistics for last four years;
    - Details of quality assurance and quality control practices currently in place;
    - Details of documents in support of Health, Safety, Environment and Quality (HSEQ) performance;
    - Details of insurance of employee policy, medical evaluation including drug testing policy;
    - Details of safety and security evaluation policy; and
    - Copies of ISO 9001, 14001, Occupational Health and Safety Assessment Series (OHSAS) 18001, or any other accreditation and certification as applicable.

d) Environmental and Social Code of Practices for Construction

308. The environmental and social codes of practice (ECPs) are generic, non-site-specific guidelines for the construction phase. The ECPs consist of environmental and social management guidelines and OHS practices to be followed by the contractors for sustainable management of all

environmental, social, health and safety issues. The ECPs are listed below, and details are presented in **Annexure 7-1.**

- ECP 1: Waste Management
- ECP 2: Fuels and Hazardous Goods Management
- ECP 3: Water Resources Management
- ECP 4: Drainage Management
- ECP 5: Soil Quality Management
- ECP 6: Erosion and Sediment Control
- ECP 7: Topsoil Management
- ECP 8: Topography and Landscaping
- ECP 9: Air Quality Management
- ECP 10: Noise and Vibration Management
- ECP 11: Protection of Flora
- ECP 12: Protection of Fauna
- ECP 13: Road Transport and Road Traffic Management
- ECP 14: Construction Camp Management
- ECP 15: Cultural and Religious Issues
- ECP 16: Construction and Operation Phase Security

e) Site Specific Environmental and Social Management Plan (SSESMP)

309. The Contractor will prepare a SSESMP demonstrating the manner in which they will comply with the requirements of Site-Specific Management Plans, ECPs and the mitigation measures proposed in this ESIA Report. The SSESMP will be submitted before the start of any construction activities and be approved by the Engineer. The SSESMP will form part of the contract documents and will be used as a monitoring tool for compliance. Violation of the compliance requirements will be treated as non-compliance leading to the corrections or otherwise imposing penalty on the contractor.

310. Contractor will be required to prepare SSESMP along with the ECPs, prior to his mobilization and commencement of construction works, for approval of PIU and CSC. The key sub-plans are described below:

- Material Transportation Plan will be prepared by the contractor to prevent accidents during transportation. The plan should address specific details on the site conditions, the exact route to be followed and the conditions of the road. The Contractor will propose alternative routes for review and approval by the Engineer. A commitment must be made by the Contractor to repair the road to its original condition, if any local road is damaged due to the heavy loaded traffic of the Project.
- Pollution Prevention Plan will be prepared as part of SSESMP and implemented by the contractors based on the ECPs and WBG EHS Guidelines. The Plan will be submitted to the CSC for their review and approval before contractor mobilization.

- Construction Camp Management Plan will be prepared as part of SSESMP by the contractor based on ECP 14. The Plan will include the camp layout, details of various facilities including supplies, storage, and disposal. The Plan will be submitted to the CSC for their review and approval before camp establishment.
- Emergency Preparedness Plan will be prepared by the contractor after assessing potential risks and hazards that could be encountered during construction.
- Communication Plan to deal with the interaction of the community, complaints management, workers recruitment, notice of works and workers conduct with locals.

f) Construction Occupational Health and Safety Plan

311. The Contractor will also prepare an OHS plan for managing the identified hazards and control measures. The OHS plan shall comply with the WB ESS2; WBG EHS Guidelines; WB Health & Safety Framework - South Asia Region (SAR); Sindh Occupational Safety and Health Act, 2017; Sindh Labour Acts; ILO Code of Practices, 1992; and Good International Industry Practices (GIIP). Review and update of the OHS plan will be done when there is a change in the scope of construction methodology/technique based on site condition, or following significant OHS hazard or a major accident.

g) Job Hazard Analysis

312. Job hazard analysis (JHA) will be conducted by Contractor for each construction component focusing on job tasks to identify hazards before they occur. It will focus on the relationship between the worker, the task, the tools, and the work environment. After identifying uncontrolled hazards, steps will be taken to utilize hierarchy of control: elimination, substitution, engineering controls, administrative controls, and personal protective equipment, to minimize them to an acceptable risk level. The JHA will be one of the major components of the Contractor's health and safety management system. The JHA will be conducted for:

- Jobs with the highest injury or illness rates;
- Jobs with the potential to cause severe or disabling injuries or illness, even if there is no history of previous accidents;
- Jobs in which one simple human error could lead to a severe accident or injury;
- Jobs that are new or complex to the construction or have undergone changes in construction processes and procedures; and
- Jobs complex enough to require written instructions.

h) EHS in Method Statement

313. The Contractor will include an EHS Chapter in each Method Statement. This EHS section will be based on the JHA and other provisions of OHS Plan and environmental issues of the site and specific to construction methods. This section will be reviewed and approved by the EHS Specialists of the Engineer/CSC. Each revision of the method statement shall also be reviewed and approved by the EHS Specialists.

i) Site Engineer's EHS Oversight

314. EHS shall also be made a key responsibility of site engineers. Training program will be devised by CSC on engineers' oversight in EHS and will be offered by EHS specialists of CSC to address EHS immediately when identified and raise it to EHS specialists if further action is required. The training on engineers' oversight shall convey the following messages:

- Engineers would assume greater responsibility for overseeing the EHS as part of their daily routine work.
- Engineers would review and approve each site's readiness to commence the work as per the design specifications, certifying whether Contractors are meeting the requirements of the Method Statements, and withholding funds from them that are not complied with.
- Engineers would impose financial penalties on the Contractor with non-existent or non-compliant EHS matters.
- Engineers will assist workers in recognizing environment friendly and safe work measures and procedures necessary to protect the natural environment and occupational health and safety of workers and prevent illnesses, injuries, and fatalities during construction.

8.3 Environmental and Social Monitoring Plan

315. The objectives of environmental and social monitoring plan during the construction and O&M phases are as follows:

- Monitor the actual project impacts on physical, ecological, and socio-economic receptors;
- Recommend mitigation measures for any unforeseen impact or where the impact level exceeds the anticipated level in the ESIA;
- Ensure compliance with legal and community obligations including safety during construction and O&M phases;
- Ensure the safe disposal of excess construction materials, solid waste, water and wastewater and gaseous emissions;
- Appraise the adequacy of the ESIA with respect to the project's predicted long-term impacts on the area's physical, ecological, and socio-economic environment;
- Evaluate the effectiveness of the mitigation measures proposed in the ESMP and recommend improvements in ESMP, if required; and
- Compile periodic incidents / accidents data to support analyses that will help to minimize future risks.

316. PIU of KWSSIP will be responsible for all the monitoring activities. All the findings and results in the form of monitoring report will be finally shared with respective SEPA as well as WB as per the reporting mechanism.

8.3.1 Compliance Monitoring

317. The compliance monitoring will be conducted by the E&S Staff of SC. Various aspects of the ESMP compliance monitoring will be to:

- Systematically observe the activities undertaken by the contractor(s) or any other persons associated with the proposed project;
- Verify that the activities are undertaken in compliance with the ESMP;
- Document and communicate the observations to the ESC of PIU, so that any corrective measures, if required, can be taken in a timely manner;
- Maintain a record of all incidents of environmental and social significance and related actions and corrective measures;
- Maintain contact with the communities, solicit their views and concerns, and discuss them during the monthly meetings; and
- Prepare periodic reports of the environmental and social performance of proposed project.

Table 8-2: Environmental and Social Monitoring Plan

S. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
◆ **Construction Phase**						
1	Effluent Quality	pH, temperature, DO, Turbidity, TOC, Total P, TSS; BOD5, COD, Cd, Cu, Fe, Pb, Oil and Grease, fecal coliform	◆ Contractors' camps ◆ Concrete preparation plants ◆ Fuel (Petrol, Oil and Grease) products storage areas ◆ Vehicle and machines repairing and servicing yards	◆ Grab sampling and laboratory testing of water samples by SEPA approved Laboratory for monitoring.	◆ Once before the start of construction by activity monitors and reported; and ◆ On quarterly basis during the construction	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase
2	Drinking Water	SEQS Drinking Water Quality Parameters.	◆ Worker Camps, Office Sites and Kitchen / Mess Areas	◆ Water sampling and laboratory analysis	◆ Once before the start of construction by activity monitors and reported; and ◆ On quarterly basis during the construction.	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase
3	Soil Quality	Total Phosphate, Nitrate, Ammonia, heavy metals	◆ Construction Camp ◆ Equipment washing yards. ◆ Spillage points of fuel, chemicals and lubricants	◆ Sampling and laboratory testing for soil samples.	◆ Once before the start of construction by activity monitors and reported; and ◆ On quarterly basis during the construction.	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase

S. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
			◆ Concrete batching plants			
4	Noise Pollution	Day and nighttime noise monitoring in dBA Leq. as per stringent environmental quality standards	◆ Sensitive Receptors near Interceptor Alignment & TP-IV, 02 Baseline Monitoring Locations and 03 locations at Work sites (to be decided by CSC / PIU)	◆ Monitoring of noise level at site.	◆ Once before the start of construction by activity monitors and reported. ◆ Daily using handheld monitor. ◆ Monitoring and reporting on monthly basis during the construction stage.	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase
5	Air Pollution	◆ Nitrogen Oxide (NO) ◆ Sulphur Dioxide ◆ Carbon Monoxide (CO) ◆ Suspended Particulate Matter (SPM) ◆ Particulate Matter (PM2.5) ◆ Particulate Matter (PM10) ◆ Ozone (O_3) ◆ Lead (Pb).	◆ Alignment & TP-IV and 02 Baseline Monitoring Locations: ◆ Salim Habib University – Korangi Creek ◆ Karachi Public School – Bhittai Colony ◆ Near Reta Plot Residential Settlement ◆ Near River Valley Township	◆ Ambient air quality monitoring.	◆ Once before the start of construction by activity monitors and reported; and ◆ On quarterly basis during the construction.	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase
6	Dust emissions	◆ Dust ◆ Particulate Matter (PM2.5) ◆ Particulate Matter (PM10)	◆ Sensitive Receptors near	◆ Ambient air quality monitoring	◆ Daily monitoring using handheld monitor.	◆ Contractor during Construction Phase

S. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
			Interceptor Alignment & TP-IV and 02 Baseline Monitoring Locations: ◆ Salim Habib University – Korangi Creek ◆ Karachi Public School – Bhittai Colony ◆ Near Reta Plot Residential Settlement ◆ Near River Valley Township		◆ Monitoring and reporting on monthly basis during the construction stage.	◆ Compliance monitoring lies with SC during Construction Phase
7	Ecological Resources	◆ Existing vs Planned Tree Cutting ◆ No. of Trees Planted under Compensatory Plantation Scheme ◆ Growth/Maintenance/Care of planted trees	◆ All Project Sites and Compensatory Plantation Sites	◆ Visual checks to ensure that only marked trees are cut within the project corridor. ◆ Monitoring of Wildlife / birds hunting. Inventory of existing trees, cut trees, and planted trees.	◆ Once before the start of construction by activity monitors and reported; and ◆ On quarterly basis during the construction.	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase
8	Public Infrastructure	Disturbance or damage to public infrastructure	◆ Proposed project routes. ◆ Public infrastructures within the AoI.	◆ Random visits and consultations with vulnerable.	◆ Prior to the start of construction. ◆ Reporting will be done based on RP recommendation.	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with

S. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
			These structures will be verified prior to the start of construction.			SC during Construction Phase
9	Grievances from workers	◆ Numbers of grievances ◆ Types of grievances ◆ Status of girevance	◆ Affected Communities	◆ Community consultations.	◆ Daily ◆ Reporting on monthly basis during the construction stage.	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase
10	Waste Management	◆ Volumes of excavation and spoil generated, reused, sold, stockpiled by location ◆ Waste volumes by type and site ◆ Final disposal of each waste stream ◆ Rate of waste reuse / recycling	◆ All Project Sites, camps, focusing on areas where waste is stored / located	◆ Visual Observations, Monitoring and Audits	Monthly	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase
11	Labor and working conditions	As per the LMP of KWSSIP-2 which include but not limited to OHS, hygiene facilities, appropriate camps area, etc. Grievances from workers	◆ Main project area ◆ Construction camps and Offices. ◆ Equipment yards.	◆ Visual Observations, ◆ Incident/accident register Monitoring and Audits ◆ Grievance Redress/Social Complaint Register	◆ Monitoring and reporting on monthly basis during the construction stage;	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase
12	Occupational and Community	Number of work-relate injuries/illness	◆ All Project Area	Records/Logbooks	◆ Monitoring and reporting on monthly basis	◆ Contractor during Construction Phase

S. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
	Health and Safety				during the construction stage.	◆ Compliance monitoring lies with SC during Construction Phase
13	Social aspects including GBV and other Grievances	Number of related grievances	◆ All Campsites and Project Sites	◆ Visual Observations and consultations ◆ Grievance Redress/Social Complaint Register ◆ Monitoring and Audits	◆ Monitoring and reporting on monthly basis during the construction stage	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase
14	COVID-19	◆ Number of COVID-19 tests ◆ Number of workers vaccinated ◆ Audit of provisions and equipment	◆ Main project area ◆ Construction camps and Offices. ◆ Equipment yards.	◆ Observations and consultations ◆ Grievance Redress/Social Complaint Register ◆ Monitoring and Audits	◆ Monitoring and reporting on monthly basis during the construction stage	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase
15	Chemical Storage and Handling	Leaks and spills	◆ Main project area ◆ Construction camps ◆ Equipment yards.	◆ Visual Observations ◆ Incident/accident register ◆ Monitoring and Audits	◆ Monitoring and reporting on monthly basis during the construction stage	◆ Contractor during Construction Phase ◆ Compliance monitoring lies with SC during Construction Phase
16	Resettlement	Implementation of RP	◆ Entire project area	◆ Visual observation; ◆ Official record of RP activities	◆ Prior the start of construction	◆ SC

S. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
◆ **O&M Phase**						
1	Treated Effluent Quality	TSS, BOD_5, COD, Nitrate, Phosphate, Oil and Grease, Total Coliform	◆ TP-IV Site	◆ Visual checks of laboratory activities ◆ Discrete grab sampling and laboratory testing of water samples by SEPA approved Laboratory for monitoring.	◆ Daily	◆ KWSC during O&M Phase
2	Sludge Quality	◆ Heavy metals ◆ Pathogens (i.e., Total coliform)	◆ TP-IV Site	◆ Visual checks and monitoring of laboratory activities ◆ Discrete grab sampling and laboratory testing of sludge samples by SEPA approved Laboratory for monitoring.	◆ Daily	◆ KWSC during O&M Phase
3	Ambient water quality	◆ pH, BOD, TSS, nitrate, phosphate, oil and grease, total coliform	◆ TP-IV discharge point	◆ Visual checks and monitoring of laboratory activities ◆ Discrete grab sampling and laboratory testing of sludge samples by SEPA approved Laboratory for monitoring.	◆ Quarterly	◆ KWSC during O&M Phase

S. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
4	Sludge Volume	Sludge volumes generated and recycled.	◆ TP-IV Site	◆ Visual inspection ◆ Review of records	◆ Daily	◆ KWSC during O&M Phase
5	Odor Generation	Odor	◆ TP-IV Site	Visual inspection	◆ Daily	◆ KWSC during O&M Phase
6	Waste Management	Volume of screenings, solid and hazardous wastes	◆ Offices and Buildings ◆ TP-IV site ◆ Interceptor site	◆ Visual Observations, Monitoring and Audits	◆ Monthly	◆ KWSC during O&M Phase
7	Labor Management and Working Conditions	As per the LMP of KWSSIP-2 which include but not limited to OHS, hygiene facilities, appropriate camps area, etc.	◆ TP-IV site	◆ Visual Observations, ◆ Incident/accident register Monitoring and Audits	◆ Bi-annually ◆	◆ KWSC during O&M Phase
8	Traffic Safety and Management	As per the TMP which include but not limited to the observation of traffic congestion at bottleneck areas, provision of signs and signal, vehicular inspection, driving safety protocols, etc.	◆ Maintenance sites	◆ Visual Observations, Vehicle Logbooks, Monitoring and Audits	◆ Every activity ◆ Bi-annual reporting	◆ KWSC during O&M Phase
9	Social aspects including GBV and other Grievances	Social and cultural conflicts, SEA/SH complaints, grievances related to livelihood impacts, child abuse, etc.	◆ TP-IV Site	◆ Visual Observations and consultations, Grievance Redress/Social Complaint Register, Monitoring and Audits	◆ Monthly	◆ KWSC during O&M Phase

S. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
10	Occupational health and safety	Accidents and Incidents	◆ TP-IV Site	◆ Visual Observations and consultations ◆ Grievance Redress/Social Complaint Register ◆ Incident/accident register ◆ Monitoring and Audits	◆ Monthly	◆ KWSC during O&M Phase
11	Chemical Storage and Handling	Leakage and spills	◆ TP-IV Site	◆ Visual Observations ◆ Chemical Storage inventory, ◆ Incident/accident register ◆ Monitoring and Audits	◆ Monthly	◆ KWSC during O&M Phase
12	Improvement in Ground Water Quality in the Interceptor AoI	KWSC TP-IV Management	◆ SEQS Drinking Water Quality Parameters	◆ Baseline Monitoring Locations as mentioned in **Section 4.2.3**	◆ Once	◆ One month after initiation of TP-IV Operations
13	Improvement of Health Profile in Interceptor's AoI	KWSC TP-IV Management	◆ Consultations with Communities to check the ratio of changes in water related diseases	◆ Communities from where socio-economic baseline data has been collected (as mentioned in Socio-economic baseline section of this report)	◆ Once	◆ Six months after initiation of TP-IV Operations

S. No.	Parameters / Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility
14	Mangrove Health and Improvement of Korangi Creek Ecosystem	KWSC TP-IV Management in collaboration with the Forest Department	◆ Measurements of mangrove density	◆ Korangi Creek	◆ Annually	◆ First survey to be carried out before start of TP-IV Operations

8.4 Reporting and Documentation

318. Contractor shall prepare monthly reports detailing the progress and efforts of Contractor on the implementation of Project's Environmental, Social, Health and Safety (ESHS) Safeguards Requirements included in the ESA and ESMP. The PIU-ESSU with assistance from CSC and Contractors will also produce quarterly reports.

319. **Contractor's Monthly ESHS Reports:** The monthly reports shall provide detailed account of implementation status on the mitigation measures as suggested in the ESMP and updates on the outcome of the field inspections carried out by the Contractor ESHS Teams and status / results of ESHS Monitoring as required under Monitoring Plans. Report shall also provide details on trainings conducted by the Contractor during the reporting month and details of complaints registered at Project's GRM and actions taken by the Contractor for resolution of complaints.

320. **CSC's Monthly ESHS Reports:** Based on the Contractor's Monthly Reports, the CSC in their Monthly Report shall validate the information provided in the Contractor's report, indicate the gaps, their own field observations, and evaluation of Contractor's performance on implementing project's ESHS safeguards. CSC Monthly Reports shall also provide details on Corrective Action Plans (CAPs), agreed timelines for resolution of active ESHS issues, status of penalties imposed by the CSC on Contractor for continual non-compliances and way forward suggested by the CSC. The report shall also provide expert analysis on the adequacy of trainings organized by the Contractor, advise for the Contractor regarding realignment of training program, independent analysis on GRM activities and details / outcomes of stakeholders engagement activities carried out during the reporting month.

321. **PIU's Quarterly Progress Reports on Environment, Social, Health and Safety Management:** The reports shall be prepared by the PIU with assistance from CSC and Contractors. The report shall provide detailed account of quarterly ESHS Safeguards implementation status, mitigation measures and preventive actions undertaken, environmental and social monitoring activities conducted, details of monitoring data collected, analysis of monitoring results particularly the non-compliances, recommended mitigation and corrective measures, GRM data, stakeholders engagement activities, ESHS trainings conducted, and environmental and OHS regulatory violations observed. The monitoring reports will be submitted to the SEPA as well if required under ESIA Approval Conditions.

322. **PIU Reporting to WB:** PIU shall prepare and submit quarterly monitoring reports to the Bank throughout Project implementation, on the environmental, social, health and safety (ESHS) performance of the Project, including but not limited to the implementation of the ESCP, status of preparation and implementation of E&S instruments required under the ESCP, stakeholder engagement activities, functioning of the grievance mechanism and other aspects that the reporting would need to consider, as relevant. PIU shall also submit to the Bank the Contractor's and CSC's monthly reports on ESHS performance in accordance with the metrics specified in the respective bidding documents and contracts.

323. Moreover, PIU will promptly notify the Bank no later than 48 hours after learning of any incident or accident related to the Project which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers, including, inter alia, cases of BGV

and SEA/SH, and accidents that result in death, serious or multiple injury or other examples of incidents and accidents, as appropriate for the type of operation. Incident report should provide sufficient detail regarding the scope, severity, and possible causes of the incident or accident, indicating immediate measures taken or that are planned to be taken to address it, and any information provided by any contractor and/or supervising firm, as appropriate.

324. **Project's Environmental, Health and Safety Completion Report:** At the end of construction, the PIU - ESSU shall submit a Project Completion Report on ESHS Aspects which will summarize the overall environmental and social impacts / risks occurred during the project implementation, efforts and measures taken for mitigating or offsetting the impacts, constraints / limitations faced during execution for resolving any particular ESHS issues, overall ESHS performance of Contractor and CSC and lessons learnt.

8.5 Indicative ESMP Implementation Costs

325. Detailed cost estimates for Contractor's staffing, implementation of mitigation measures, preventive actions, and monitoring are presented in **Table 8-3**. Total indicative cost of ESMP implementation is about **PKR 45.471 Million**.

Table 8-3: ESMP Implementation Cost

S. No	Description	No	Samples	Frequency/ Months	Rate/Unit	Amount (PKR)
A – Pre-Construction Phase						
1	Air Monitoring (Ambient Air)-24 Hrs as per SEPA standards	1	3	One time	50,000	150,000
2	Vehicles, Generators, and other emitting sources of fumes	1	3	One time	50,000	150,000
3	Noise Quality (24 hours specified in SEQS) – Pre-Construction Phase	2	3	One time	10,000	20,000
4	Wastewater samples collection and Laboratory analysis (SEQS parameters) - Construction Phase	1	3	One time	50,000	150,000
					Total – A	**470,000**
B – Construction Phase (Implementation Phase)						
5	Environmental Engineer	1		18	200,000	3,600,000
6	HSE Officer	2		18	150,000	5,400,000
7	Gender/GRM Officer	1		18	150,000	2,700,000
8	Flag man	8		18	50,000	7,200,000
9	Air Monitoring (Ambient Air)-24 Hrs as per SEPA standards. Purchase of handheld dust monitor.	6	3	Quarterly	50,000	900,000

S. No	Description	No	Samples	Frequency/ Months	Rate/Unit	Amount (PKR)
10	Vehicles, Generators, and other emitting sources of fumes	6	3	Quarterly	50,000	900,000
11	Noise Quality (24 hours specified in SEQS) – Purchase of handheld Decibel meter	1		One time	10,000	10,000
12	Wastewater samples collection and Laboratory analysis (SEQS parameters) - Construction Phase	6	3	Quarterly	50,000	900,000
13	Fixed cost at project sites (PPEs, In-house, Shoes, Safety helmets, Gloves, googles, Harness belts, Jackets, septic tanks, installation of safety barriers)	18		Monthly	500,000	9,000,000
14	Precautionary Boards	18		Monthly	150,000	2,700,000
15	Loader for movement of Safety Equipment with POL and driver	2		Once	1,200,000	2,400,000
16	Provision of First Aid Facility including medicine	18		Monthly	50,000	900,000
17	Capacity Development Trainings: ESHS Management, Occupational & Community Health and Safety, Disease Prevention, Maintaining Community Values – Pre - Construction Phases	18		Monthly	50,000	900,000
18	Fire Safety Equipment, Installation of Noise / Safety Barriers, Signage, Site Waste Management (Bins / Skips) etc.	1		Once	500,000	500,000
19	GRM Misc	18			50,000	900,000
20	Water Sprinklers	Lum Sum				2,000,000
					Total – B	**40,910,000**
					Total Amount (A – B)	**41,380,000**
				Escalation and Contingencies on -B	**10%**	**4,091,000**
					Grand Total	**45,471,000**

9 Information Disclosure, Consultation and Participation

326. Public consultation and information disclosure is an essential component of the EA process and is recognized by development agencies and national governments. This activity provides a platform for project stakeholders to become part of the project development process. This process is in line with ESS-10: Stakeholder Engagement and Information Disclosure.

9.1 Objective of the Consultation

327. The main objective of consultations is to enhance the role of stakeholders as they are given a platform to contribute to the success and sustainability of the project. The specific objectives of the stakeholder engagement exercise carried out for the Malir Basin Wastewater Interceptors and Treatment Plant Project include:

- Inform all stakeholders about the Malir Basin Wastewater Interceptors and Treatment Plant Project, its context and objectives, salient design features and potential social and environmental consequences;
- Facilitate and encourage interaction with project's beneficiaries, including project-affected parties and other-interested parties to encourage project acceptance, sustainability and ownership;
- Adopt an inclusive, participatory, and transparent approach towards stakeholder engagement that provides opportunities for engagement with relevant stakeholders of all backgrounds, regardless of gender, race, ethnicity, income-class, and ability;
- Benefit from the local knowledge for enhancing strategic interventions for public space design and infrastructure improvement; and
- Identify specific community concerns and suggestions on the proposed designs and develop solutions to ensure satisfactory results.

9.2 Proposed Consultation Program and Stakeholders Workshop

328. Stakeholders' consultations shall be done during the construction and O&M phases of the project. Relevant stakeholders shall include, but are not limited to, concerned government departments, local administration, community representatives, and affected persons residing within the AoI of the proposed project. Consultations shall be done at least twice per year, depending on the number of concerns from stakeholders.

329. A stakeholder engagement plan (SEP) was prepared for the entire KWSSIP-2 to satisfy ESS-10. Relevant items such as stakeholders' identification and analysis are included in the SEP. The SEP also details the proposed strategies for information disclosure and consultations with stakeholders including vulnerable groups (see Annexure 9).

9.3 Public Consultations Conducted

330. Various consultation activities were conducted as part of the ESIA process. Below shows the summary of the consultation done while the concerns raised are summarized in annexures. The issues and concerns raised during the consultations were incorporate in the ESIA.

9.3.1 Focus Group Discussion

331. Consultations were done with selected primary stakeholders along Malir River, Chakora and Chakra drains through focus group discussion (FGD). Local and traditional leaders, representatives of the communities, potential vulnerable groups such as women and youth were consulted to solicit their issues and concerns regarding the project.

332. During consultation participation of women was also ensured. Overall, there were 115 male and 72 female participants during the FGDs. In some areas, women were not allowed to participate. Table 9-1 presents the communities consulted.

333. The photos and summary of issues and concerns raised are in Annexure 9.

Table 9-1: Consulted Communities in Malir

S. No	Settlements	Town	District	Household	Population	Number of Participants
1.	Agha Town	Bin Qasim	Malir	400	4,000	10
2.	Hamal Goth	Gadap	Malir	150	1,500	12
3.	Mansehra Colony	Landhi	Malir	5000	45,000	12
4.	Mansehra Colony - 2	Landhi	Malir	5000	35,000	11
5.	Reta Plot	Shah Faisal	Korangi	20000	100,000	10
6.	Roshan Abad	Shah Faisal	Korangi	3000	50,000	9
7.	Mahmoudabad	Jamshed	East	24000	97,000	12
8.	Haji Ahmed Baloch	Shah Faisal	Korangi	13	150	9
9.	Sharafi Goth	Landhi	Malir	800	5,600	8
10.	Jalal Murad Goth	Landhi	Malir	200	1,700	12
11.	Shambay Goth	Landhi	Malir	275	2,000	10

9.3.2 Stakeholder Consultation Workshop

334. PIU - KWSSIP organized a Stakeholder Consultation Workshop on 28th July 2022 at Regent Plaza in relation to information disclosure and stakeholders engagement on KWSSIPP-2 Projects. The main objective of the workshop was to get their feedback at broader level. The stakeholders being invited include relevant Government Departments, NGOs, Academia, World Bank, Sindh Environmental Protection Agency (SEPA), Pakistan Air Force (PAF), K-Electric, Transport and Mass Transit Department, World Wildlife Fund (WWF), Pakistan Telecommunication Company Limited (PTCL), National Refinery Limited (NRL), Karachi Development Authority (KDA), Planning &

Development Board (P&DB) and Local Community representatives. The stakeholders actively participated and provided precious comments, suggestions and shared their views based on their practical experience at different projects. The proceeding of the workshop started with recitation of Holy Quran, followed by welcome address by the Project Director KWSSIP and Project Presentations by the ESIA Consultants about the project interventions. The stakeholder consultation list of the participants and their concerns and suggestions are given as Annexure 9.

9.3.3 Gender Consultation

335. Besides male members, consultations with female members of the communities were also carried out in project area during the ESIA study. Conducting women consultations in the project is a challenging task. However, the process was carried out by holding consultation sessions with women of local communities randomly.

336. A total of six gender consultations were also conducted within the AoI to record views of the females and issues faced by female community related to the project implementation. There was a total of 61 participants in these consultation sessions. The key concerns raised during these consultations and the photos are in Annexure 9.

10 Grievance Redress Mechanism

337. This Section outlines the policy and procedure for documenting, addressing, responding and employing methods to resolve project grievances and complaints that may be raised by the project-affected population or community members arising from environmental and social performance, the engagement process, resettlement and/or unanticipated environmental or social impacts resulting from project activities that are performed and/or undertaken by PIU. The Section describes the scope and procedural steps and specifies roles and responsibilities of the parties involved in addressing the grievances.

338. A GRM is established to address any complaints or grievances arising during the implementation period of the projects. People of the project area may perceive risks to themselves or their property or their legal rights or have concerns about the possible adverse environmental and social impact that a project may have. Any concerns or grievances will be addressed quickly and transparently, and without retribution to the project-affected population or community members or complainant.

339. The primary principle of GRM is that all complaints or grievances are resolved as quickly as possible in a fair and transparent manner.

10.1 Objectives

340. The following are the objectives of the GRM:

- Establish an organizational structure to resolve any grievances from individuals and communities fairly and equitably;
- Provide a platform for the aggrieved individual or community to deliver their grievances;
- Ensure that affected communities and individuals are treated fairly at all times;
- Identify flaws in the operational functions of the project and suggest corrective measures; and,
- Ensure the sustainability of the project.

10.2 Type of Complaints

341. The major complaints that may arise during the execution of the proposed project at site include but not limited to:

- E&S issues (dust, noise, air pollution, social and cultural issues);
- Damage and blockage of public utilities;
- Traffic inconvenience;
- Gender based violence (GBV) and harassment;
- Resettlement issues including loss of livelihood; and
- Issues related to compensation of resettlement impacts.

10.3 Disclosure of GRM

342. The GRM shall be disclosed in the PIU-KWSSIP, the KWSC Head Office, and the KWSSIP website. Establishment of the GRM and Grievance Redress Committees (GRCs) shall be part of

the proposed consultation framework to ensure that the individuals and communities are aware of the existing GRM.

10.4 Structure of GRM

343. A three-tier GRM composed of community GRC, sub-project GRC, and PIU-GRC. The organization of the GRCs is presented in **Figure 10-1**.

344. Gender representation will be ensured by inducting a female member in all GRCs. The mechanism will ensure the access of project-affected population or community members to a GRM that openly and transparently deals with the grievances and makes decision in consultation with all concerned that are consistent with the WB ESF requirements.

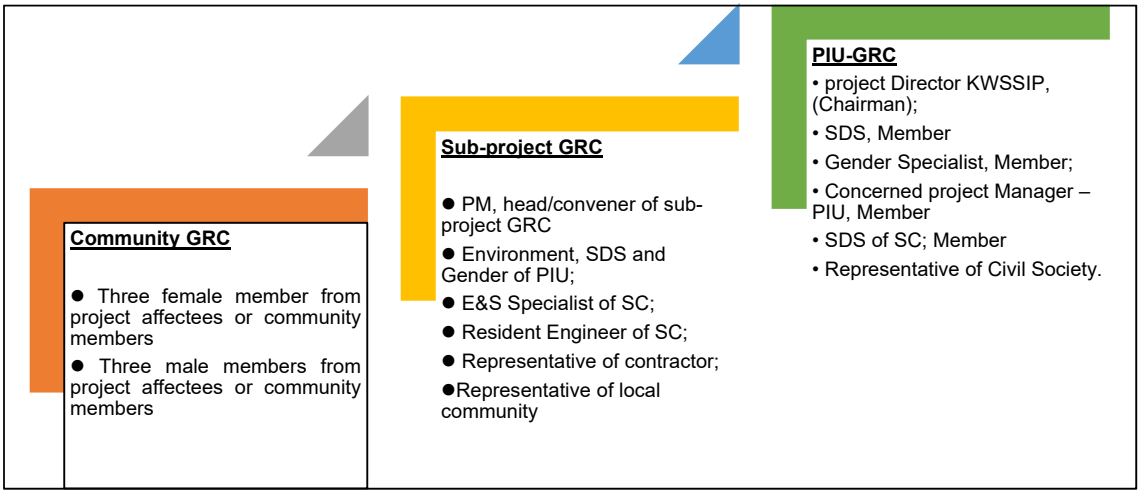


Figure 10-1: Organogram of GRC

10.4.1 Community GRC (Tier 1)

345. The community GRC shall provide a platform for project-affected people or communities to raise their concerns. Resettlement issues at the community level can also be resolved in this tier.

346. It is imperative to establish the community GRC to maintain a good rapport with the community. It will also provide a direct line of communication between the project management and the community members throughout the project implementation.

347. The social development specialist (SDS) of PIU with the assistance of SC will facilitate the establishment of community GRC, which shall be composed of three male and three female members from the project-affected communities.

348. The project E&S and engineering staff will coordinate with the community GRC to review and resolve issues and concerns, preferably within five working days upon receipt of grievances. Complaints that cannot be resolved at the community-GRC shall be forwarded to the next tier.

10.4.2 Sub-project GRC (Tier 2)

349. KWSSIP will constitute a GRC headed by the concerned Project Manager (PM) of each project site, including Malir Interceptor and Treatment Plant Project, to resolve grievances that were not resolved by GRC Tier 1. The sub-project GRC will be composed of the following members:

- Project Manager (PM) as head of sub-project GRC;
- Environment, SDS and Gender specialists of PIU;
- E&S specialists of Supervision Consultant (SC)
- Resident Engineer of supervision consultant;
- A representative (E&S specialist) of contractor (if required); and
- A representative of local community.

350. Representatives from other district government departments may be contacted as required by the sub-project GRC. Environmental Specialists of PIU and SC will only join sub-project GRC meetings related to environmental issues.

351. The sub-project GRC shall meet once a month or when then need arises. Grievances involving all E&S issues, including resettlement issues, shall be reviewed. The sub-project GRC shall perform the following:

- Record, categorize, and prioritize grievances that need to be resolved by the committee and resolve them within ten (10) working days;
- Require aggrieved persons or parties to present evidence of their claims and;
- Communicate its decisions and recommendations on all resolved issues to PIU and the aggrieved persons;
- Forward the unresolved cases and complaints to PIU-GRC within an appropriate timeframe. Recommendations on unresolved cases must also be submitted to PIU-GRC;

- Develop an information dissemination system and provide updates to the aggrieved persons or parties regarding any developments on their grievance;
- Maintain a complaint register accessible to the project-affected community members with brief information about complaints and sub-project GRC decisions and status reports; and,
- Maintain records of all complaints received and corresponding actions taken by the sub-project GRC.

352. Any complaint that cannot be resolved by the sub-project GRC will be forwarded to the next tier – the PIU-GRC.

10.4.3 PIU-GRC (Tier 3)

353. The PIU has already constituted the PIU-GRC, which shall receive complaints that cannot be resolved in Tier 2. The committee is composed of the following:

- Project Director KWSSIP, (Chairman of PIU-GRC);
- SDS, Member
- Gender Specialist, Member;
- Concerned Project Manager – PIU, Member;
- SDS of SC, Member; and
- Representative of Civil Society.

354. Representatives from other district government departments may be invited when required. Environmental Specialists of PIU and SC will only join PIU-GRC meetings related to environmental issues.

355. The PIU-GRC, through the authorized representative, will hear the grievances of the complainant, review any records, explore possible solutions, and request any evidence from the complainant to support their claim. A filed visit may be conducted to validate the evidence and information presented. The PIU-GRC will give its decision within 20 working days upon receipt of the complaint. If the complainant is dissatisfied with the decision, the complaint may refer its grievance to the court of law.

10.4.4 Gender-Based Violence (GBV) Committee

356. Aside from the PIU-GRC, a GBV committee was also established within PIU. The GBV committee is composed of the following members:

- Concerned Project Manager, Head/ Convener of GBV Committee;
- Gender Expert, KWSSIP, Secretary; and
- SDS KWSSIP, Member.

357. GBV Committee will address the issues of GBV/SEA/SH that may have been caused by the project activities during resettlement and project implementation. Service providers and NGOs concerned will also be engaged if necessary.

10.5 Grievance Redress Procedure

358. The intention of GRM is to resolve a complaint as quickly and at as low a level as possible to avoid a minor issue becoming a significant grievance. Irrespective of the stage of the process, a complainant has the option to pursue the grievance through the court as is his/her legal right in accordance with law.

359. Complainants may lodge their grievances through several channels, including online, mail, phone, WhatsApp, e-mail, and complaint boxes. Moreover, PIU has established an e-Portal for filing and tracking progress of complaints lodged online.

360. The PIU e-Portal is an application that may be used to lodge complaints. This will be accessible through a link provided on the PIU KWSSIP website. The e-Portal was made for easier and faster complaint lodging. Any project-affected person or community with access to the internet may use the e-Portal. Each complainant will receive a Grievance Number for easier tracking of their complaints. The complainants will be contacted to ensure that their issues are resolved. Additionally, the portal can differentiate types of complaints for targeted decision-making and action by PIU. The e-Portal allows monitoring of the entire complaint lodging and resolution process.

361. The GRCs will work at site, sub-project and PIU levels as described earlier. The E&S and engineering staff of PIU, in coordination with site staff will inform the project affected population and community members about the GRCs and its mechanism through consultations and by posting at prominent places. The complaints received through any media will be screened by type and category. These complaints will be registered in Community Complaints Register (CCR), where the name and address of complainant, date, description of complaint and action taken will be recorded. The following procedure will be used to redress the grievances:

- First, complaint resolution will be attempted to be addressed at community-GRC through the involvement of the field E&S/engineering staff. The community-GRC shall give decision within five working days of receipt of the complaint. If unsettled, grievance can be lodged to the sub-project GRC by the complainant or by the GRC;
- Sub-project GRC will acknowledge the receipt within two working days of lodging of complaint. Initial review and consultation with the sub-project GRC will be conducted within five working days of receipt of complaint. If required, sub-project GRC will advise the E&S/engineering specialists to conduct field visits in consultation with the aggrieved persons/parties and local community and submit a fact-finding report. Preferably, the fact finding will be completed within eight working days from receipt of complaints. sub-project GRC shall give decision within 10 working days of receipt of the complaint. If unresolved, a grievance will be lodged to the (PIU-GRC) by the complainant or by the GRC; and
- The PIU-GRC shall give decision within 20 working days of receipt of the complaint. If the complainant is still not satisfied, he/she can pursue further by submitting the case to the appropriate court of law.

11 Institutional Arrangements

362. The institutional requirements for the construction and O&M phases of the proposed project are provided in the sections below.

11.1 Institutional Arrangements for Implementation of ESMP during Construction Phase

363. The key players involved during construction phase of the proposed project are the Project Implementation Unit (PIU) as employer / proponent, SEPA, the Construction Supervision Consultant (CSC), Third Party Environmental Consultant (External Monitor) and the Contractor(s). The roles and responsibilities of these organizations are outlined below.

364. The PIU KWSSIP-2 will make Contractors bound through contract documents to implement the ESIA including ESMP and other terms and conditions of the Environmental Permit of SEPA. The whole ESMP will be included as a clause of the contract documents. Construction camps will be established after necessary approvals and submission of SSESMP, Camp Management Plan and other site-specific plans to be developed in the light of the relevant agencies' requirements before commencement of new works. The organizational setup for implementation of ESMP during construction phase is provided in **Figure 11-1**.

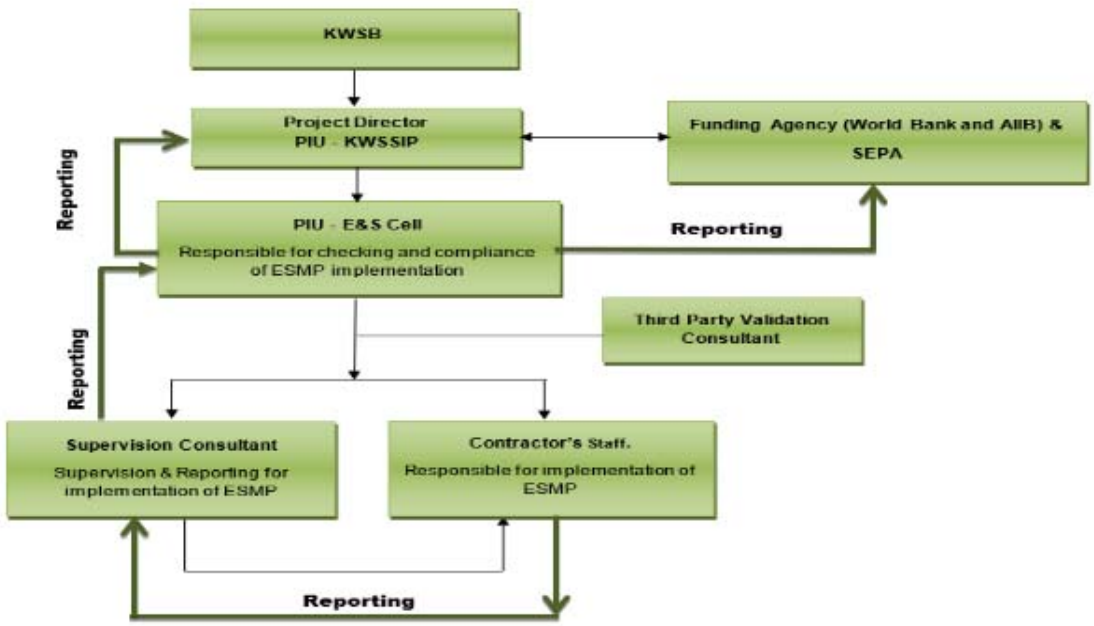


Figure 11-1: Organizational Setup for Implementation of ESMP at Construction Phase

11.1.1 Roles and Responsibilities

a) SEPA

365. SEPA shall be responsible for granting Approval (NOC) for the ESIA Malir Basin Interceptors and Wastewater Treatment Plant Project before initiation of construction activities. SEPA shall also be responsible for providing a separate operational phase approval in the light of Section 14 (2) of SEPA (Environmental Assessment) Regulations, 2021, after the fulfilment of requirements mentioned therein by the KWSSIP.

b) PIU (Project Director)

366. The Project Director (PD) of PIU is the executive head of the entire KWSSIP-2 project. PD is responsible for overall implementation of the project including environmental and social management aspects and hiring of contractors and consultants. PD-PIU shall be responsible for approving the overall project's as well as the ESIA / ESMP budget and finances. These finances will be allocated and approved by the Government of Sindh.

c) Environment and Social Cell (ESC)

367. An ESC has already been established in PIU, which currently consists of five specialists – two environment specialists, two social safeguard specialists and a gender specialist at project preparation stage. One OHS specialist, one gender officer and four E&S officers will be added in project implementation stage. ESC will be responsible for overall implementation of ESMP and other related tasks. They will be responsible for ensuring the ESMPs are included in the contract documents as well as supervision of ESMPs implementation during construction and operations. ESC will arrange environmental and social monitoring and prepare compliance reports and submit them to PD-PIU for further submission to the WB, AIIB and SEPA, to fulfil their monitoring, reporting, and compliance requirements. They will observe and measure environmental and social parameters at the construction sites to evaluate compliance.

368. Furthermore, they shall be responsible for:

- Ensuring the required environmental and social training is provided to the concerned staff;
- Ensuring that all the contractual obligations related to the environmental and social compliance are met;
- Carrying out regular site visits to the construction sites to review the environmental and social performance of the Contractor(s);
- Checking regularly the ESMP implementation status of the project during construction phase is being properly carried out;
- Review of monitoring reports for the progress of environment and social related activities;
- Making sure that the Contractor is implementing the additional measures suggested by the SC in environmental and social monitoring reports;
- Documentation and disclosure of monitoring results and identify necessary corrective and preventive actions in the periodic monitoring reports, and make follow-up on these actions to ensure progress toward the desired outcomes;

- Assisting in the assessment of the livelihood loss and negotiation with the affected for fixation of compensation to be paid for temporary impacts;
- Assisting the Contractor for the timely payments of negotiated prices;
- Assisting the Contractor for obtaining necessary approvals from the concerned departments;
- Overseeing the compliance of all the monitoring programs as given in ESMP;
- Immediately reporting within 48 hours to WB when environmental and social incidents and accidents are occurred;
- Maintaining interface with the other lined departments/stakeholders; and
- Reporting to the SEPA on status of ESMP implementation.

d) Third Party Validation (TPV)

369. The TPV will be carried out through independent E&S Specialists. They will monitor the environmental and social parameters and conduct field surveys at the construction sites to evaluate compliance level. They will be engaged to conduct the external and independent monitoring of the implementation of the ESMP. This external monitoring agency is to carry conduct biannual, annual, and final evaluation of the ESMP implementation and recommend changes if and when necessary to the ESC.

370. Roles and responsibilities of third-party environmental consultant will be:

- Carry out independent monitoring at critical locations during construction phase and monitoring the implementation of ESMP at project area;
- Monitor GRM and resolution of complaints;
- Inform ESC, WB, and AIIB of any significant impacts arising during construction;
- Observe and amend/prepare (if required) of corrective action plans; and
- Monitor plan implementation along with project Implementation Consultant.

e) Construction Supervision Consultants (CSC)

371. PIU will engage CSC for the proposed project. The CSC will conduct day to day monitoring of ESMP implementation and prepare monthly monitoring reports for each site and submit them to ESC. The ESC will review the report, discuss it with the CSC, and finalize the findings. In case of noncompliance from the contractors, the CSC will have the authority to halt the construction activities or impose penalties as per the contract conditions. The CSC will submit the final version of monitoring and evaluation reports to PIU as per periodic reporting mechanism (defined later in the document). PIU will submit these reports to WB for their review and further action. Also, these reports will be submitted to SEPA as per the frequency to be mentioned in the construction phase 'Environmental Approval' requirements. Roles and responsibilities of CSC will be to:

- Review and approve the contractor's management plans;
- Oversee and supervise the performance of the Contractor to make sure that the Contractor(s) is complying with ESMP;

- Ensure that the day-to-day construction activities are carried out in an environmentally and socially sound and sustainable manner;
- Maintain close coordination with the Contractor and ESC;
- Prepare training materials and implementing training programs;
- Supervise and monitor environmental and social activities being performed at site;
- Conduct periodic reporting as mentioned in ESMP; and
- Suggest any additional mitigation measures (if required).

372. E&S team of CSC of the proposed project will consist of the following personnel:

- E&S Team Leader (one specialist – M.Sc. in Environmental Engineering with more than 20 years of professional experience, worked on at least two implementation projects as SC)
- Environmental Specialist (one specialist – M.Sc. in Environmental Engineering with 10 years of professional experience, worked on at least one implementation project SC)
- OHS Specialist (one specialist – M.Sc. in Environmental Engineering with OHS Certification, 10 years of professional experience, worked on at least one implementation project as OHS - SC)
- Environmental Surveyors (two specialists – B.Sc. in Environmental Engineering with and 03 years of professional experience, worked on at least one implementation project SC)
- Social Safeguard Specialist (one specialist – M.Phil. in Sociology with 10 years of professional experience, worked on at least one implementation project SC)
- Gender Specialist (one specialist – M.Phil. in Sociology, Gender Study or equivalent with 10 years of professional experience, worked on at least one implementation project SC)
- Ecologist (one specialist) - MSc Ecology or Associated Field – 06 Years' Experience in preparing Tree Inventory with all essential detailing, safe tree cutting and vegetation removal, supervising compensatory plantation programs, implementing control measures to minimize disturbance to fauna)

373. The same firm may qualify as CSC for other sub-projects under KWSSIP-2. In such case, the above-mentioned staffing requirements will be applicable separately for each sub-project.

f) Construction Contractor

374. Contractors will be bound to appoint site-based Environmental and Social Experts with relevant educational background and experience for each site. The contractors will be responsible for implementation of measures to avoid or minimize adverse environmental and social impacts during construction. Contractors are required to prepare site-specific ESMP (SSESMP) demonstrating the manner in which they will comply with the requirements of ESMP before mobilization and obtain approval from the ESC and CSC. Contractors' Environmental and Social Experts will carry out following activities:

- Prepare SSESMP and obtain its approval from SC;
- Implement mitigation measures as detailed in the ESIA / ESMP, SSESMPs, and associated Environmental Health Safety and Social (EHSS) Plans at each construction site and throughout the project area;

- Contractors will be bound through contract to take actions against all the special and general provisions of the contract document;
- Contractors will make sure the compliance of ESMP recommendations and will also be responsible for effective liaison;
- Provide proper PPEs to the workers and train them for their proper use;
- Prepare and submit the monthly, quarterly, biannually, annually, and final progress reports to CSC;
- Report immediately to CSC and ESC when E&S incidents and accidents occur;
- Conduct environmental and H&S training to the workers / laborers; and
- Coordinate with the CSC and ESC.

375. Appropriate numbers of the following key personnel are required in the contractor's team:

- Environmental Engineer (1 position) – B.Sc. in Environmental Engineering with 5 years of professional experience in project implementation
- HSE Officer (2 positions) – B.Sc. in Environmental Engineering with OHS Certification and 5 years of professional experience in project implementation
- Gender / GRM Officer (1 position) – M.Sc. in Sociology with 05 years of professional experience in project implementation
- Flag man (8 positions) – Valid work experience at project implementation site.

11.2 Institutional Arrangement for Implementation of ESMP during O&M Phase

376. The proposed project will be administrated by the KWSC during the O&M phase. In the organizational hierarchy of KWSC, Deputy Managing Director Technical Services (DMDTS) will be overall responsible for the O&M of water supply and sewerage infrastructure. Chief Engineer of each district will be responsible for the utility services in his respective district. Project operations will be under direct jurisdiction of Engineers and Plant Managers respectively. Monitoring and compliance of operational phase ESMP will be the responsibility of Engineers and Plant Managers for Interceptor and TP-IV. These personnel will report to the DMDTS for the compliance and monitoring of ESMP. The staff will be responsible for the following:

- Coordinating to monitor environmental and social compliance during operation;
- Monitoring and managing compensatory tree plantations at places to be identified by the PIU at execution stage;
- Reporting on the O&M progress of environmental and social compliance to the SEPA;
- Assessing as well as mitigating potential environmental and social impacts of the proposed project operation as identified in Section; and
- Sustaining a working partnership among the SEPA, Forest and Wildlife departments of Sindh, NGOs, and other related public private sector organizations.

11.3 Environmental and Social Management

11.3.1 Construction Stage Site Specific Management Plans

377. Contractor will be required to prepare SSESMP along with the ECPs, prior to his mobilization and commencement of construction works, for approval of PIU and CSC. The key sub-plans are described below:

- Material Transportation Plan will be prepared by the contractor to prevent accidents during transportation. The plan should address specific details on the site conditions, the exact route to be followed and the conditions of the road. The Contractor will propose alternative routes for review and approval by the Engineer. A commitment must be made by the Contractor to repair the road to its original condition, if any local road is damaged due to the heavy loaded traffic of the Project.
- Pollution Prevention Plan will be prepared as part of SSESMP and implemented by the contractors on the basis of the ECPs and WBG EHS Guidelines. The Plan will be submitted to the CSC for their review and approval before contractor mobilization.
- Construction Camp Management Plan will be prepared as part of SSESMP by the contractor based on ECP 14. The Plan will include the camp layout, details of various facilities including supplies, storage, and disposal. The Plan will be submitted to the CSC for their review and approval before camp establishment.
- Emergency Preparedness Plan will be prepared by the contractor after assessing potential risks and hazards that could be encountered during construction.
- Communication Plan to deal with the interaction of the community, complaints management, workers recruitment, notice of works and workers conduct with locals.

12 Conclusion and Recommendations

378. The ESIA reveals that the proposed construction and operations of Malir Basin Interceptor and Treatment Plant (TP-IV) Project will have both negative and positive impacts. The positive E&S impact of the Project includes the improvement of overall sanitation system in the project's catchment area. The project also will have a long-term positive impact on public health in the interceptor/TP-IV catchment area since ongoing disposal of untreated sewage to the sea through Malir River will be regulated and controlled. Contrary to the present situation, all sewage will be discharged into the Korangi Creek after adequate treatment at TP-IV. With the conveyance of sewage through closed conduit interceptor, the ground water quality in the areas located in proximity to Malir River will improve. The overall hygienic condition of the area thereby reducing the incidence of water-borne diseases and positively affecting the health of the population. This in turn will reduce their expenditure associated with healthcare

Construction Phase

379. The identified significant E&S impacts during construction phase are the following:

- Occupational health and safety and labor risks of the workers
- Potential contamination of soil, rivers and groundwater due to improper management of construction wastes, excavated materials and wastewater
- Generation of dust due to excavation activities. At present, dust emissions are evident along the interceptor alignment due to the passing of vehicles in the unpaved roads. The measured $PM_{2.5}$ concentrations in all the selected monitoring stations exceeded the SEQS/WBG limits while one station exceeded the limit for PM_{10}. During construction, mitigating measures should be strictly implemented to ensure that the activities will not worsen the dust emissions within the project site
- Disturbance of sensitive receptors along the interceptor alignment and TP-IV plant due to noise generated by the construction activities. The identified sensitive receptors near the proposed project include the Salim Habib University (Korangi Creek), Karachi Public School (Bhittai Colony), Mohammadi Masjid and M.Y. Clinic (Sidra Street).
- Temporary addition of vehicular traffic and traffic disruption in key roadways including Korangi Link Road, EBM Causeway, Korangi Crossing Road and Baloch Colony Road due to excavation and pipe jacking
- Community health and safety including GBV, SEA/SH issues
- Disturbance to livelihoods is the foremost potential socio-economic impact from the construction of the project, mainly associated with the agriculture being performed in the riverbed. The project will temporarily affect the livelihood of 38 Project Affected Persons (PAPs). The crops cultivated along the alignment of the interceptor could be directly affected due to construction activities. Exact impacts are addressed in the Resettlement Plan (RP).
- There are about 57 trees that will be removed along the proposed interceptor alignment, all of which are not ecologically important as per IUCN.

380. The main E&S monitoring parameters during construction include monitoring of excavation works with disposal, environmental quality monitoring (air, noise and drinking water), occupational and community health and, safety etc. PIU-KWSSIP shall ensure that the Contractor will prepare Construction ESMP, OHS/CHS Plans and other site-specific plans as identified and carry out

regular and effective monitoring of environmental quality parameters as indicated in this ESIA report.

381. To ensure that the mitigation, enhancement and compensation measures as defined in the ESMP are implemented solely and correctly, the ESMP along with adequate budget (Indicative cost of ESMP already provided) will be included in the contract documents of the Project with a separate line items on environmental, social, health and safety management in the BOQ.

382. For effective implementation of the ESMP, inclusion of specific conditions in bidding document such as inclusion of ESMP, Contractor's qualification, submitting ESHS performance security, submission of ESHS-MSIP, Recruitment policy for locals and Workers Code of Conduct especially related to SEA/SH/GBV shall be of vital importance. The timely implementation of ESMP will reduce negative impacts. The ESIA is a living document and will need to be updated by PIU-KWSSIP prior to starting of the intervention in case any significant changes in the project scope of work are anticipated.

Operation Phase

383. During the operational phase, foul odor may be emitted and spread of pathogens and vectors may be observed if the TP-IV plant is not properly operated and maintained. Cleaning and maintenance of interceptors and transportation of sludge for recycling, if not done properly, could also become a source of nuisance to the public and pose health and safety risks to the workers. All these and other associated negative impacts shall however be temporary in nature and can be conveniently mitigated by implementing the ESMP providing a detailed account of mitigation measures to control all the identified potential negative impacts of the project.

384. The sludge produced after treatment at the TP-IV shall be rich in valuable organic matter and nutrients such as nitrogen and phosphorus and shall be recycled after thorough testing and alkaline stabilization for use as a fertilizer and soil improver in city's horticultural and landscaping activities.

385. The Operational Phase Monitoring Plan incorporates a comprehensive set of monitoring parameters designed to validate the positive impacts of the project. These parameters include treated effluent disposal, where the quality of discharged effluent will be regularly assessed to ensure compliance with environmental standards. Sludge management will be monitored to track the recycling and utilization of nutrient-rich sludge as a fertilizer and soil improver. Odour generation, pathogens, and vectors will be continuously evaluated to mitigate potential environmental and health risks. Moreover, the plan focuses on improvement in ground water quality within the interceptor AoI, with regular testing and analysis of groundwater parameters. The Health Profile in the Interceptor's AoI will be closely monitored, tracking changes in public health indicators to validate the project's positive impact on the community's well-being. Additionally, Mangrove Health will be assessed through periodic surveys and measurements of mangrove density, biodiversity, and overall ecosystem health, ensuring the protection and enhancement of the Korangi Creek mangroves. These monitoring efforts underscore the project's commitment to sustainability, environmental responsibility, and community welfare throughout its operational phase.