ENVIRONMENTAL MANAGEMENT FRAMEWORK

Karachi Water Supply and Sewerage Improvement Project (KWSSIP)

DRAFT

Karachi Water and Sewerage Board

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ABBREVIATIONS

µg/m^3	Microgram per Cubic Meter

AERC	Applied Economic Research Centre
BOD_5	Biochemical Oxygen Demand (for 5 day)
BOT	Build Operate Transfer
CBOs	Community Based Organizations
CCMR	Community Complaints Management Register
CCP	Climate Change Policy
CDM	Clean Development Mechanism
CETP	Combined Effluent Treatment Plant
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
CPEMP	Construction Phase Environmental Management Plan
dBA	A Weighted Decibels
EA	Environmental Assessment
ED	Executive Director
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESC	Environment and Social Cell
FGDs	Focused Group Discussions
FI	Financial Intermediary
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIS	Geographical Information System
GRC	Grievance Redress Cell
GRM	Grievance Redress Mechanism
GRR	Grievance Redress Report
HC	Hydrocarbon
HR	Human Resource
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IEE	Initial Environmental Examination
IEPS	Initial Executive Project Summary
IFI	International Financing Institution
Km	Kilometer
km^2	Square Kilometer
KMC	Karachi Metropolitan Corporation
KSDP	Karachi Strategic Development Plan
KWSB	Karachi Water and Sewerage Board
KWSSIP	Karachi Water Supply and Sewerage Improvement Project
M	Meter
MDGs	Millennium Development Goals
MG	Million Gallon
MGD	Million Gallons per Day

Mm	Millimeter
MP	Mitigation Plan
NEQS	National Environmental Quality Standards
NGOs	Non-Governmental Organizations
NOC	No Objection Certificate
NOx	Oxides of Nitrogen
NRW	Non-Revenue Water
O&M	Operation and Maintenance
^{o}C	Degree Celsius
OED	Operations Evaluation Department
OP	Operational Policy
PCR	Project Completion Report
PCRs	Physical Cultural Resources
PDOs	Project Development Objectives
PGA	Peak Ground Acceleration
PKR	Pak Rupee
PM_{10}	Particulate Matter of 10 micrometer Diameter Particle Size
$PM_{2.5}$	Particulate Matter of 2.5 micrometer Diameter Particle Size
PMU	Project Management Unit
PPIAF	The Public Private Infrastructure Advisory Facility
PPP	Public Private Partnership
PR	President's Report
PSHA	Probabilistic Seismic Hazard Assessment
RED	Regional Environmental Division
REDD	Reducing Emissions from Deforestation and Forest Degradation
RO	Reverse Osmosis
SAR	Staff Appraisal Report
SDS	Safety Data Sheet
SEPA	Sindh Environmental Protection Agency
SEQS	Sindh Environmental Quality Standards
SME	Small and Medium Enterprise
SPDB	Sindh Planning and Development Board
STC	Short Term Consultant
TDS	Total Dissolved Solids
TM	Task Manager
TMP	Traffic Management Plan
TORs	Terms of References
TPP	Tree Plantation Plan
TPV	Third Party Validation
TSP	Total Suspended Particulates
US EPA	United States Environmental Protection Agency
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

EXECUTIVE SUMMARY

Background

The World Bank is providing support to Karachi for the improvement of water and sewerage services and the governance through water supply and sewerage improvement project. The proponent of the project is the 'Karachi Water and Sewerage Board (KWSB)'. The proposed Project builds on analytical work and consultations that the Bank has carried out on the status of the water and sewerage services in Karachi. Recent analysis and projection carried out in the context of project preparations indicated that, with committed implementation of the right reforms, KWSB could experience a turn-around in the short to medium term. The scope of the assessment also covers service delivery to *katchi abadis* (informal settlements).

The Project: Karachi Water Supply and Sewerage Improvement Project (KWSSIP)

The title of the project is 'Karachi Water Supply and Sewerage Improvement Project (KWSSIP)'. World Bank support to KWSB is envisioned to be provided through a phased project with an overlapping timeframe (Three phase commencing in 2019, 2021 and 2026), under programmatic engagement over a period of 12 years. The first and second phase will concentrate on improving water and wastewater services, building technical and managerial capacity, expanding service to the city's most indigent residents, and reforming the institutional and regulatory frameworks to enable private sector investments. The third phase will continue to support capital investment and capacity building needs, and also provide the menu of financial instruments to design, promote and encourage the required private sector investment. Depending on the findings of a PPIAF (The Public Private Infrastructure Advisory Facility) financed Water Resources Option Study (currently under procurement) the first phase would also finance feasibility studies, designs and/or transaction advice to develop new water resources for Karachi. This could include a pilot desalination plant or/and a pilot wastewater treatment plant for reuse on a build-operate-transfer (BOT) basis, with industrial and/or domestic bulk water customers as the principal off-takers, or/and additional bulk water supply from the Indus River. The required investments could be supported by the project in phase 2 and/or 3.

Project's Development Objectives (PDOs)
The proposed Project's Development objectives are to: (i) raise KWSB's operational capacity to deliver to all of its customers safe and reliable water service on a sustainable and predictable basis; (ii) restore KWSB's operation to financial stability; and (iii) establish an enabling environment for future private sector investments in water supply and wastewater treatment.

Project's Goals
All selected project activities will support the following five goals identified as priority for KWSB:
(i) 24/7 safe and reliable water supply for all customers; (ii) majority of wastewater is collected and safely disposed; (iii) KWSB's operations become financially sustainable; (iv) KWSB operates under a modern and effective governance framework; and (v) KWSB improves the enabling environment for private sector investments.

Components of the Project

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

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

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

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

Environmental Management Framework (EMF)

In compliance with Environment Assessment OP4.01 triggered by the KWSSIP, inter alia, Environmental Management Framework (EMF) is prepared by KWSB to ensure the compliance of environmental safeguard requirements of the national laws and World Bank's safeguard policies by the project components and activities. The project activities are not yet defined and/or locations are unknown at present.. Therefore, the EMF sets out the policies, strategies, procedures and institutional requirements to screen the activities when the scope of activities will be defined and locations will be identified. Further, EMF establishes the environmental documents required for these activities and the approval and clearance procedures to be followed. The EMF will be used by KWSB during designing, construction and operational phases of the project components to ensure safeguard compliance and mitigate environmental impacts at all the stages of the project as per the environmental management plan provided in the framework.

This EMF has been prepared using primary and secondary information collected through literature review, reconnaissance survey. Consultation with stakeholder institutions will be conducted after the approval of the draft EMF by KWSB management. This framework will be followed once the projects are identified and their details are available. This framework will also discuss the stakeholder engagement and involvement throughout the project life cycle and mechanism to disclose project information to them and redress the grievances of the affected community.

Environmental Baseline

Karachi is located just above the tropical zone on the coast of the Arabian Sea at 24º45" to 25º15" north, and 66º37" to 67º37" east at about 20 m above sea level (airport weather station). (EIA Red Line) Karachi is bounded by Hub-River (Balochistan Province) on West, Badin District on East, Dadu District on North and Arabian Sea on South. The weather of the Karachi can be characterized by dry, hot and humid conditions and in general terms it is moderate, sunny and humid. There is a minor seasonal intervention of a mild winter from mid-December to mid-February followed by a long hot and humid summer extending from April to September, with monsoon rains from July to mid- September. The level of precipitation is low for most of the year. The humidity levels usually remain high from March to November, while very low in winter as the wind direction in winter is North Easterly.

Karachi covers an area of approximately 3,600 km^2, comprised largely of flat or rolling plains, with hills on the western and northern boundaries of the urban sprawl. The city represents quite a variety of habitats such as the sea coast, islands, sand dunes, swamps, semi-arid regions, cultivated fields, dry stream beds, sandy plains, hillocks.

Indus River and Hub Dam on Hub River are the two major sources of surface water for Karachi. Karachi obtains its drinking water from the Indus River about 120 km to the east and the Hub River about 56 km in the west. Some limited groundwater is extracted for private use in the Karachi area, but groundwater resources in the Karachi area are limited. The aquifers close to the coastal belt are mostly saline and unusable for domestic purposes. Aquifers near the Hub River are well developed and serve as sources of water for agriculture and domestic use. (EIA Red Line)

The city has experienced over the last three decades, the augmentation of the water supply system including water source, bulk conveyance system and distribution network, however, has consistently lagged behind the fast growing water demand of the city due to the significantly large population growth rates (4 to 5% per annum). Consequently, most of the areas are facing serious water supply shortages. (The Study on Water Supply and Sewerage System in Karachi in the Islamic Republic of Pakistan, Karachi Water and Sewerage Board, JICA)

Four drainage systems are said to encompass Karachi city, the Lyari, the Malir, the Budnai, and small streams referred to collectively as the coastal basin. The Malir River Basin and the Lyari River Basin contribute about 80% of the surface runoff from the city. Thus, the natural drainage system of Karachi city includes mainly the tributaries of the Malir and Lyari Rivers.

Emission of untreated effluent from industries that do not meet the Sindh Environmental Quality Standards (SEQS) result in considerable environmental pollution and degradation. Untreated wastewater from most of the polluting industries does not comply with the SEQS. There are about 24 large and small industrial complexes in the province. The main reasons for pollution in coastal waters are indiscriminate discharges

of untreated industrial and domestic effluent, shipping traffic, mechanized fishing fleet and oil terminals at Karachi harbor.

Although the weather of Karachi is arid and rainfall is low and highly variable, whenever torrential rain comes and heavy rainfall occurs within a short duration, surface runoff intensifies. Heavy showers take place in the city either due to the effects of tropical storms usually in June, which rarely affect coastal areas but bring heavy showers for short periods and cause flooding. Karachi is located in a moderate earthquake zone.

World Health Organization (WHO) included Karachi amongst the top 20 polluted cities of the world with respect to outdoor ambient air pollution levels measured as PM_{10} and $PM_{2.5}$. Annual mean concentrations of PM_{10} and $PM_{2.5}$ in Karachi are 273 µg/m^3 and 117 µg/m^3, respectively.

Malir River and its adjoining sites in the east are densely populated with wide variety of vegetation in the form of natural foliage consisting diversity bushes, shrubs, trees including agricultural products such as crops, vegetables and fruits. No endangered fauna exist in the eastern boundaries section, however, some avian fauna, sparrows of diversity genera, crows, cuckoos, and wild and domesticated pigeons exist.

In terms of the number of populations, Karachi is one of the ten largest cities in the world. The population of Karachi is about 16 million (2017) as per Pakistan Bureau of Statistics Population Census 2017. It is a very dense city with population density of about >20,000 people/km^2. The increase in population is putting heavy pressures on the physical, infrastructural, financial and institutional systems of the city. A large segment of Karachi's population, roughly 40%, is afflicted with poverty. The living conditions of the deprived section and its economic wellbeing are therefore a major concern, as these impact the environment and growth potential of the city.

The severe air, water and solid waste pollution in the city constitutes a serious health risk to a large proportion of residents. Large proportion of the city's population lives in katchi abadis or slums with very poor infrastructure and comparatively less access to basic services. Those katchi abadis close to the main water supply source are getting good water supply.

The Pakistan Social & Living Standards Measurement Survey of 2014-15 showed a 76% literacy rate for the urban areas of Sindh. The literacy rate for Karachi is 82%. The overall literacy rate for urban areas in Pakistan was 76% (Literacy for Population above 10 yr and Older).

Karachi is the financial capital of Pakistan and plays a pivotal role in economic and industrial activities. Karachi, benefiting from its status as the country's principal port, and its capital until 1959 has emerged as the main industrial and commercial center. Until the 1970s, the city's industrial expansion was driven by traditional industries such as food processing, textiles and garments, but in the 1980s a number of modern chemicals, electronic and automotive industries began to make an increasingly important contribution to industrial growth. However, owing to a deteriorating law and order situation resulting in production shutdowns and payment of extortion to various agencies, the increase in the cost of production through higher energy costs, power outages resulting in loss of output, the last 20 years have witnessed the physical shifting of small enterprises to the Punjab (the origin of most of the small-scale manufacturers) and medium-scale enterprises to Dubai (because of a secure location and employer-friendly labor laws), there has been a continuous decline in manufacturing activity.

Regulatory Review

This section documents three sets of laws, policies and strategies i.e. national, provincial, and World Bank Safeguard Policies.

National Laws, Policies and Strategies

The national laws, policies and strategies relevant for the environmental safeguard of the project activities include National Environmental Policy, 2005, National Sanitation Policy 2006, Climate Change Policy of Pakistan 2012, National Water Policy, Pakistan Climate Change Act, 2016, , The Canal and Drainage Act 1873, Pakistan Penal Code, and The Antiquities Act 1975., and.

Provincial Policies, Strategies, and Laws

The provincial policies, strategies, and laws relevant for the environmental safeguard of the project activities include: Sindh Strategy for Sustainable Development, 2007, Sindh Sanitation Policy 2017, Sindh Drinking Water Policy 2017, Karachi Strategic Development Plan 2020, Karachi Water and Sewerage Board Act, 1996, Sindh Environmental Protection Act 2014, Sindh Environmental Protection Agency (Review of IEE and EIA Assessment) Regulations, 2014, The Sindh Local Government Act 2013, and The Sindh Wildlife Protection Ordinance, 1972.

World Bank Safeguard Policies

The proposed projects trigger the World Bank safeguard policies including Environmental Assessment OP 4.01, Natural Habitats OP 4.04 and Physical Cultural Resources OP 4.11.

Potential Environmental Impacts and Mitigation Measures

Major environmental impacts of the project activities shall arise during the construction activities. These impacts may include i) loss of top soil, air pollution, soil erosion, and loss of aesthetic of the area due to clearing of the land for campsites and for construction activities, ii) loss of natural habitats and biodiversity, iii) loss of Physical Cultural Resources (PCRs) at the project sites, iv) air pollution resulting in poor visibility, loss of vegetation, property damages, acid rain, soil contamination and health implications on workers and nearby community due to dust emissions and stack emission of generators and vehicular emissions, v) soil and water contamination, odor, health implications (due to breeding of mosquitos and flies), and nuisance due to improper treatment and disposal of sanitary wastewater from construction camps, vi) nuisance, health implications on workers and community (due to breeding of mosquitos and flies), if solid waste is not disposed and treated properly, vii) soil contamination due to improper disposal of hazardous solid waste and improper placement of oily parts, rags, chemicals, and lubricants, viii) nuisance, health implications on workers and nearby community, loss of biodiversity due to noise from the construction activities, machineries and vehicles, ix) safety hazards for workers and community, x) traffic congestion at or around construction sites due to construction activities.

The operational phase impacts arising from water supply and water treatment plants, sewerage system, wastewater treatment plants, desalination plant may include i) soil and water contamination due to leakages in the sewers, ii) odor and outbreak of diseases due to leakages, and damaging of sewers and malfunctioning of disposal pumps, iii) water borne diseases (if water is not properly treated), iv) shortage of water supply, v) water contamination due to damaging pipelines, vi) health implications on workers and nearby community and loss of biodiversity due to noise, vii) fish damage from seawater intake from desalination plant, viii) seawater contamination due to discharge of brine, chemical cleaning solutions and sludge from water pretreatment, containing chemicals and salts from desalination, ix) contamination of aquifer due to leakage of underground pipelines from desalination plant, x) soil contamination due to chemicals spillage and leakages, xi) health implications for workers and nearby community due to air emissions, odor and breeding of mosquitos/flies from wastewater treatment plant operation, xii) surface water (receiving bodies) contamination due to improper functioning of the wastewater treatment plant, xiii) soil contamination due to storage of oily parts and rags on unpaved floors, spillage and leakage of chemicals/lubricants/fuel on soil and improper disposal of sludge, xiv) nuisance at the areas due to sitting of the wastewater treatment plants, xv) depletion of energy resources due to energy use during operational phase, xvi) sludge from the cleaning of screens of interceptors.

The mitigation measures during construction activities include i) campsite management, ii) avoidance of clearing vegetation and restoration of the site by planting trees/crops, iii) protection of natural habitats, iv) protection of Physical Cultural Resources (PCRs), v) suppression of dust emission, vi) control of stack and vehicular emissions, vii) safe disposal of sanitary wastewater, viii) safe disposal of domestic solid waste, ix) safe disposal of hazardous and construction waste, x) soil pollution control, xi) noise abatement measures, xii) protection of workers from health and safety hazards, xiii) protection of community from accidents and safety hazards, xiii) traffic management and xiv) restoration of campsites.

The mitigation measures during operational phase of the water supply and water treatment plants, sewerage system operations, wastewater treatment plants and desalination plant include i) maintenance of sewerage system and disposal pumps, ii) ensuring proper functioning of water treatment facilities, iii) maintenance of water supply pipelines and pumping facilities, iv) noise abatement measures at project sites, v) improved design of seawater intake at desalination plant, vi) disposal of brine, back washes and sludge after treatment at desalination plant, vii) environmental monitoring of underground pipelines, viii) soil

pollution control, ix) protection of workers from health and safety hazards, x) protection of community's health, xi) ensuring proper functioning of the wastewater treatment plants, xii) landscaping to improve aesthetic of the sites, xiii) energy auditing and implementing energy efficiency measures at plants.

Stakeholder Consultations

KWSB recognizes the importance of early and continuing engagement and meaningful consultation with stakeholders. KWSB will engage the stakeholders, including communities, groups, or individuals affected by proposed projects, and with other interested parties, through information disclosure, consultation, and informed participation in a manner proportionate to the risks to and impacts on affected communities. At this point in time, the detail about the project/subprojects and their exact locations are not known, therefore, it is not possible to engage community and carry out the consultation for those projects which are unknown. However, KWSB will organize consultation workshop with the stakeholder institutions to share the draft EMF and finalize the EMF in the lights of the recommendations made by the participants. Major participants of the workshop will be representatives of Karachi Metropolitan Corporation, six District Municipal Corporations, NGOs, Community Based Organizations (CBOs) etc. After the project locations are identified and details are available for each component of the project, Focused Group Discussions (FGDs) shall be carried out by KWSB with the directly affected stakeholders.

KWSB prepares IEEs/EIAs for all the new projects as per the requirements of SEPA 2014. IEEs/EIAs were prepared by outsourced consultants. KWSB successfully secured no-objection certificates of all the project implemented by KWSB in the recent past and are under implementation at present. KWSB capacity for conducting environmental assessment and monitoring was not enough. KWSB will establish an environmental cell within Project Implementation Unit (PIU) of KWSSIP. Districts management are involved mostly in rehabilitation of infrastructure activities, IEEs/EIAs for such activities were not required by SEPA. Accordingly, no environmental assessment exercises were conducted in the past at district management level. Environmental assessment and monitoring capacities are non-existent at the districts management level. Some Community representatives reported that communities were facing dilapidated environmental conditions with very low level of water supply and sanitation services. Communities living along the main drains and rivers are facing serious environmental issues and generally public health is at low level. Most of the representatives of the communities reported that water supply was intermittent, erratic, and contaminated. During rainy reasons, most of the area was flooded by rain and sewerage water that led to serious health issues and inconvenience to the communities.

For all Category A and B projects proposed for International Bank for Reconstruction and Development (IBRD) or International Development Association (IDA) financing, during the environmental assessment (EA) process, KWSB will consult project affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and takes their views into account. For Category A projects, KWSB will consult these groups at least twice: (a) shortly after environmental screening and before the terms of reference for the EA are finalized; and (b) once a draft EA report is prepared. The public consultation or public hearing is also one of the requirements of the Sindh Environmental Protection Agency (SEPA) to consult public to get their views on the submitted Environmental Impact Assessment (EIA) report to the SEPA before final approval and award of construction phase NOC from SEPA.

Environmental Management Framework (EMF)

The Project Implementation Unit (PIU) established under KWSB will implement the KWSSIP project. KWSB will establish Environmental and Social Cell (ESC) under PIU which shall take care of the environmental and social safeguard requirements of the project components. The ESC will be responsible for preparing two types of environmental and social documents. One of these documents will be prepared for the compliance of provincial environmental requirements and submitted to Sindh Environmental Protection Agency (SEPA) for acquiring No Objection Certificate (NOC) and other types of documents will be prepared for the compliance of safeguard requirements of the World Bank and submitted to World Bank Safeguard Staff for review, approval and for further action.

Under World Bank's Operational Policy 4.01 (Environmental Assessment), the bank requires Environmental Assessment (EA) of projects proposed for Bank financing to help ensure that these are environmentally sound and sustainable, and thus to improve decision making. First step of the environmental assessment is the screening. Environmental screening is the responsibility of the World Bank Task Manager (TM), with advice and assistance from the Regional Environmental Division (RED). Screening is carried out at the time

of identification. The environmental screening of each proposed project shall be carried out to determine the appropriate extent and type of EA required. The Bank classifies the proposed project into one of four categories of A, B, C and FI, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. After the screening process and classification of the category of the project, the type and extent of the EA required is decided and executed. KWSB will prepare Terms of References (TORs) for the EA or other analysis and hire the necessary experts to carry it out.

The Sindh Environmental Protection Agency Review of the IEE and EIA Regulations, 2014 categorizes development projects into three schedules, according to their anticipated potential environmental impact for the preparation of Environmental Impact Assessment (EIA), Initial Environmental Examination (IEE), and Screening and checklists as per the schedule.

Grievance Redress Mechanism

KWSB will respond to concerns and grievances of project affected parties related to the environmental and social performance of the project in a timely manner. For this purpose, KWSB will develop and implement a grievance redress mechanism (GRM). The KWSB will establish a Grievance Redress Mechanism (GRM) to facilitate the resolution of community complaints and grievances. Under this mechanism, a Grievance Redress Cell (GRC) will be established in the Project Implementation Unit. At least there will be one focal person for GRM at each construction sites during construction phase. This member will be directly accessible to the community for the registration of complaints and their resolution. The GRM will communicate with the public and particularly the affected community through print and electronic media and during public consultations and community engagement events. This cell will maintain a Community Complaints Management Register (CCMR), at the site, for logging complaints and grievances. All written and oral grievances will be recorded in the Register. For operational phase GRM, the respective Engineers and Plant Managers of the utilities and plants respectively will be responsible for maintaining community complaints in the CCMR and their resolution. Android based GRM Application (GRM App) will also be established and launched to make GRM effective, easy and accessible to everybody for lodging complaints.

Budget

The tentative budget under different cost head is proposed. Total estimated budget for the compliance of environmental safeguard requirements is about Rs. 181.6 million.

1.0 INTRODUCTION

This chapter provides background of the project and its components which are being proposed to be financed by the World Bank, profile of the proponent and the Environmental Management Framework (EMF) for these projects. In compliance with Environment Assessment OP4.01 triggered by the KWSSIP, inter alia, EMF is required for the World Bank financed projects to ensure compliance of environmental safeguard requirements of the national laws and World Bank's safeguard policies for those project activities that are not defined and/or whose locations are unknown at the time the Bank appraises the project. Therefore, the EMF sets out the policies, strategies, procedures and institutional requirements to screen the activities when their locations are identified and/or defined, the environmental documents required for these activities and the approval and clearance procedures to be followed.

1.1 Background

Karachi, a megacity, is the economic capital of Pakistan. According to the recently released provisional 2017 National Census data, the population of Karachi division is reported to be 16 million (Pakistan Bureau of Statistics). General impression of the Karachi residents is that the population is under reported. It is Pakistan's main seaport and international trade hub and contributes about 11-20 percent (World Bank) to the national Gross Domestic Product (GDP). It is also among the world's least livable cities. The city ranks in the bottom ten cities (out of 140) in the 2017 Global Livability Index, performing poorly in the dimensions of livability, health, environment, safety and education. Green and open spaces, as a share of the city's land area, are declining and high-density luxury apartments are perceived as displacing public spaces for the middle and lower classes. The city is also very dense, with more than 20,000 persons per square km. From 2001 to 2013, the urban footprint expanded by more than a quarter with signs of sprawl, without the accompanying investments in services and infrastructure. Migration is the primary growth factor, and the city is characterized by pockets of ethnically homogenous zones within a heterogeneous city.

Karachi, like all megacities, has grown so quickly that it struggles to deliver basic infrastructure services, including potable water supply and wastewater collection and treatment. The water and sewerage utility, Karachi Water and Sewerage Board (KWSB) is finding it very hard to deal with the challenging reality on the ground. There is a huge unmet demand for water (550 MGD current capacity versus an estimated demand of 1,200 MGD); a high non-revenue water percentage (50-60 percent); very large financial losses (estimated at PKR 569 million/US$5.4 million per month); and significant outstanding arrears (estimated at PRK 32 billion/US$305 million). Most of KWSB's 1.1 million customers get water through the piped network on an irregular basis, and some just 2-4 hours every other day. There is currently no sewage treatment, as the city's sewage treatment facilities are dilapidated and not working, resulting in an estimated 475 MG of sewage/day being discharged into the Arabian Sea via the storm water network. The utility has not made significant capital investment for more than a decade, and the last investment project financed by an international financing institution (IFI) dates to the mid-1990s. Most of its infrastructure is worn out and operating far below its rated capacity.

The World Bank is providing support to Karachi for the improvement of water and sewerage services and the governance through Karachi Water Supply and Sewerage Improvement Project (KWSSIP). The proposed Project builds on analytical work and consultations that the Bank has carried out over the past two years on the status of the water and sewerage services in Karachi. Recent analysis and projections carried out in the context of project preparations indicated that, with committed implementation of the right reforms, KWSB could experience a turn-around in the short to medium term. The scope of the assessment also covers service delivery to *katchi abadis* (informal settlements).

1.2 The Proponent: Karachi Water and Sewerage Board (KWSB)

The proponent of the project is the 'Karachi Water and Sewerage Board (KWSB)'. KWSB was established in 1981. It is a service-based consumer-oriented organization responsible for production, transmission and distribution, cost recovery of potable water to the citizen of Karachi, managing sewerage system within the city to ensure hygienic environment, development of scheme to cover short falls in services and collection of revenues for sustained economic viability. (www.kwsb.gos.pk). Later in 1983, Government of Sindh supported the establishment of KWSB by promulgating the Sindh Local Government (amendment) Ordinance of February 1983 leading to creation of KWSB within Karachi Metropolitan Corporation (KMC). In the year 1996, a new Act called the Karachi Water & Sewerage Board Act 1996 was enacted, which served to separate KWSB from KMC and placed them under the Government of Sindh as an autonomous body. Karachi Water & Sewerage Board is the biggest water & wastewater utility of the Country. Water is being supplied to Karachi from a distantly located water source through bulk conveyance system comprising of a complex network of canals, conduits, siphons, multi-stage pumping and filtration. In the past, KWSB has successfully implemented a number of water supply projects, including those supported by the World Bank.

1.3 The Project: Karachi Water Supply and Sewerage Improvement Project (KWSSIP)

World Bank support to KWSB is envisioned to be provided through a phased project with an overlapping timeframe (Three phase commencing in 2019, 2021 and 2026), under programmatic engagement over a period of 12 years. The first and second phase will concentrate on implementation of reform road map, improving water and wastewater services, building technical and managerial capacity, expanding service to the city's most indigent residents, and reforming the institutional and regulatory frameworks to enable private sector investments. The third phase will continue to support capital investment and capacity building needs, and also provide the menu of financial instruments to design, promote and encourage the required private sector investment

Depending on the findings of The Public Private Infrastructure Advisory Facility (PPIAF) financed Water Resources Option Study (currently under procurement) the first phase would also finance feasibility studies, designs and/or transaction advice to develop new water resources for Karachi. This could include a pilot desalination plant or/and a pilot wastewater treatment plant for reuse on a build-operate-transfer (BOT) basis, with industrial and/or domestic bulk water customers as the principal off-takers, or/and additional bulk water supply from the Indus River. The required investments could be supported by the project in phase 2 and/or 3.

1.3.1 Components of the Project

There are following three components of the project:

Component-1: Reforms

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

Component-2: Securing Sustainable Water Supply and Sanitation

The water supply and sewerage system improvement will be carried out under this component. Various activities will be carried out for the maintenance of the existing and the installation of new water supply and sewerage infrastructure.

Component-3: Project Management and Studies

Under this component, various feasibility studies and tender documents of water resources projects will be prepared for the KWSB for phase 2 and 3.

1.4 Environmental Management Framework (EMF)

In compliance with Environment Assessment OP4.01 triggered by the KWSSIP, inter alia, Environmental Management Framework (EMF) is required for the World Bank financed projects to ensure compliance of environmental safeguard requirements of the national laws and World Bank's safeguard policies for those project activities that are not defined and/or whose locations are unknown at the time the Bank appraises the project. Therefore, the EMF sets out the policies, strategies, procedures and institutional requirements to screen the activities when their locations are identified and/or defined, the environmental documents required for these activities and the approval and clearance procedures to be followed. The EMF will be used by KWSB during designing, construction and operational phases of the project components to ensure safeguard compliance and mitigate environmental impacts at all the stages of the project as per the environmental management plan provided in the framework.

This EMF has been prepared using primary and secondary information collected through literature review, and reconnaissance survey. KWSB will organize a stakeholder institutions consultation workshop to finalize the EMF. This framework will be followed once the sub-projects are identified and their details are available. This framework establishes the requirements and procedures for the stakeholder engagement and involvement throughout the project life cycle and mechanism to disclose project information to them and redress the grievances of the affected community.

1.4.1 Objective and Scope of EMF

The main objective of the document is to provide a framework for the environmental assessment and mitigation of potential environmental risks and impacts of the proposed project components on surrounding environment and community. The framework outlines approaches for management of safeguards issues and impacts that are common to these project aspects such as (but not restricted to) waste management, grievance redress mechanism, monitoring and evaluation, etc.

EMF is an instrument that examines the risks and impacts when a project consists of a program and/or series of subprojects, and the risks and impacts cannot be determined until the program or subproject details have been identified. The EMF sets out the principles, rules, guidelines and procedures to assess the environmental risks and impacts. It contains generic measures and plans to reduce, mitigate and/or offset adverse risks and impacts, provisions for estimating and budgeting the costs of such measures, and information on the agency or agencies responsible for addressing project risks and impacts, including on its capacity to manage environmental risks and impacts. It includes information on the area in which subprojects are expected to be sited, including any potential environmental vulnerabilities of the area; and on the potential impacts that may occur and mitigation measures that might be expected to be used. Further site investigations will be carried out while preparing sub-project specific environmental assessments.

1.4.2 Structure of EMF

The EMF consists of ten chapters. The brief of each chapter is given below:

	Executive Summary	*Provides general summary of the EMF contents and key findings.*

1	**Introduction**	*Background of the project and their brief description, information of the proponents, introduction of the EMF, its objective and structure, and study team.*
2	**Project Description**	*Detailed description of project and its components*
3	**Environmental Baseline**	*Description of environmental baseline of the entire project area.*
4	**Regulatory Review**	*Brief description of the national, provincial and World Bank laws, policies, strategies, guidelines, codes and procedures for the categorization, screening, environmental assessment and compliance of the proposed project/subprojects. This chapter establishes that how the various requirements have been or will be complied with during the planning and implementation stages of the subprojects.*
5	**Potential Environmental Impacts and Mitigation Measures**	*Description of potential generic environmental risks and impacts (direct, indirect/induced and cumulative) to be caused by the project's construction and operation phases on surrounding environment and community. Description of mitigation measures as per mitigation hierarchy (avoidance, minimization or reduction, mitigation, compensate/offset).*
6	**Stakeholder Consultation**	*Describes the objective, process, and outcome of the stakeholder consultations carried out during the EMF preparation.*
7	**Environmental Management Framework (EMF)**	*Description of institutional arrangements for the implementation of EMF and environmental management of the project and sub-projects.*
8	**Grievance Redress Mechanism**	*Description of the Grievance Redress Mechanism to be adopted by the proponent to facilitate resolution of any community complaints and grievances about the project's environmental performance, in line with the requirements of* World Bank.
9	**Public Consultation Framework**	*Description of requirements of stakeholder consultation and engagement throughout the project lifecycle and disclosure of project information*
10	**Budget**	*Estimated budget for executing the EMF, monitoring cost etc.*
	Annexes	*Generic EMP, checklists, Terms of Reference of the Environmental Specialist for the project*

2.0 PROJECT DESCRIPTION

This chapter describes detail of the components of the project 'Karachi Water Supply and Sewerage Improvement Project (KWSSIP)'.

2.1 Project's Development Objectives (PDOs)

The proposed Project's Development objectives are to: (i) raise KWSB's operational capacity to deliver to all of its customers safe and reliable water service on a sustainable and predictable basis; (ii) restore KWSB's operation to financial stability; and (iii) establish an enabling environment for future private sector investments in water supply and wastewater treatment.

2.2 Project's Goals

All selected project activities will support the following five goals identified as priority for KWSB:

(i) provision of 24/7 safe and reliable water supply for all customers; (ii) majority of wastewater is collected and safely disposed; (iii) KWSB's operations become financially sustainable; (iv) KWSB operates under a modern and effective governance framework; and (v) KWSB improves the enabling environment for private sector investments.

2.3 Description of Project Components

The description of the project components is given below:

Component-1 **Reforms** *1. Study on Institutional Reforms and Capacity Building in HR* 1.a. Design and provide technical assistance and training to KWSB 1.b. Design and implementation of an institutional reform program 1.c. Upgrading of HR system including software and hardware ***2. Study on Communication Strategy and Capacity Building in Development*** 2.a. Design and implementation of a communication program 2.b. Develop and implement customer relation strategy including training and construction of 6 service center ***3. Study on GIS and Capacity Building in Asset Management*** 3.a. Implementation of a GIS system	This component will support reform elements such as the design and implementation of a communication program, a GIS system, an inclusive customer services and relations regime, regional customer service centers, a stakeholder identification and engagement program, an institutional reform program which will look into regionalizing of service delivery and accountability and into outsourcing options, a customer identification survey, a new billing and collection system prioritizing large customers first, a tariff study, a new HR system, a Non-Revenue Water (NRW) control program, a meter maintenance program, an asset management program, a sewerage condition assessment, an hydraulic model, an energy audit, a water wastage reduction program, a monitoring program for industrial discharge into the sewer system and for illegal storm-water connections to the sewer system, and a strategy to improve services to areas which are currently not served or under-served by KWSB. In addition, the component would finance the strengthening of the Katchi Abadi cell (informal settlements department) and NGOs and CBOs working in these katchi abadis.

3.b. Design and implementation of an asset management program ***4. Study on Revenue Management and Customer Care*** 4.a. Conduct customer identification survey 4.b. Improve billing and collection system including tariff study ***5. Study on NRW Reduction and Metering Best Practices*** 5.a. Design and implementation of a NRW control program 5.b. Design and implementation of a meter maintenance program ***6. Study on Social Sector Policy and Katchi Abadi*** 6.a. Strategy for and strengthening of the Katch Abadis cell NGOs/CBOs working in Katch Abadis 6.b. Preparation and implementation support for gender action plan ***7. Monitoring of Industrial Discharge into the Sewerage and Storm Water System; Condition Survey and Rehabilitation Design*** 7.a. Monitoring of industrial discharge into sewerage and storm water system 7.b. Priority sewer lines condition survey and rehabilitation design (including trenchless) ***8. Study on Financial Management Best Practices***	
Component-2 **Securing Sustainable Water Supply & Sanitation** ***1.*** *Improve Water Supply in at least 3 Low Income Communities (additional communities be included in Phase 2 & 3)* ***2.*** *Malir Basin Wastewater Interceptors* ***3.*** *Priority Sewer Network Rehabilitation*	To increase the overall amount of treated water available for Karachi. This component will support : (i) installation and replacing of water meters for large customer and commencing the same for domestic customer, (ii) the rehabilitation of priority water supply areas in the network and piloting district metering areas (DMAs) in areas where 24/7 supply can be provided, (iii) the rehabilitation of priority areas in the sewer network, (iv) improving water supply in at least 3 low income communities (katchi abadis), and (v) reducing energy consumption at pumping stations.

4. *Priority Water Network Rehabilitation including Meter Installation to Reduce NRW* **5.** *Viability Gap Financing for PPPs for Desalination and/or Wastewater Reuse (Phase 2)* **6.** *Reducing Energy Consumption* **7.** *26 Sewage Suction and Jetting Trucks* **8.** *Rehabilitation of All 20 Wastewater Pumping Stations (Phase 2)* **9.** *Increase Water Production: Desalination, Wastewater Reuse, K4 Phase 2A (Phase 2)* **10.** *S IV (Wastewater Collection & Treatment) (Phase 3)*	This component will support KWSB in upgrading the water supply and sanitation services in selected katchi abadis. In the initial phase, KWSB will test different technical approaches, including water ATMs, installation of metered house connections, improved bulk water supply etc., and institutional options including outsourcing operations fully or partially to CBOs and NGOs, or outsourcing of bulk water supply (by pipes or by tanker) to private entities. These efforts will be accompanied by an intensive stakeholder consultation and outreach program. There are areas in Karachi where the water delivered to customers by private tanker or by KWSB is contaminated. The project will finance the development and implementation of a household water quality communication and improvement program. As an interim measure, this program will test and promote household solutions to treat and keep the water clean such as boiling, filtering, chemical and UV treatment. Component 2 will also finance reducing energy consumption at pumping stations, depending on the outcome of a study to be conducted during project preparation.
Component-3 **Project Management and Studies** **1.** *Preparing Specific Safeguard Documents for Phase 1 and 2* **2.** *Contract Management Consultant Water Supply Investments* **3.** *Contract Management Consultant Sewerage Investments* **4.** *Feasibility & Tender Documents for this Project* **5.** *Conduct Energy Audits* **6.** *PPP Options Study for NRW Reduction* **7.** *Options Study and/or Transaction Advice for PPP Operation and Investment for Desalination and/or Wastewater Reuse* **8.** *Groundwater Institutional Review and Groundwater Mapping* **9.** *Feasibility & Tender Documents for Phase 2* **10.** *Project Management Cost for KWSB*	Based on the findings of a Water Resources Option Study, this component will support the preparation of feasibility studies and tender documents needed by KWSB for phase 2 & 3. The Bank is conducting PPIAF financed study for a Water Resources Options for Karachi which will include sources such as reclaimed wastewater for industrial use and desalination. In case the study finds reclaimed wastewater or desalination to be viable, this component may finance feasibility studies and transaction advice and supervision for PPP options to bring in private investments. Different PPP options for NRW reduction will also be studied during project preparation and early implementation and, depending on their nature, the implementation of these options can be supported by the project. In addition, this component will finance a groundwater institutional review plus a mapping of fresh and saline aquifers. This component will also finance KWSB's cost for project management and monitoring, a training needs assessment for KWSB staff and Board members and the implementation of the training program. The training program will include study tours to utilities

	which have implemented reforms or are in the process of doing so.

2.4 Key Results

The key results to measure progress toward achievement of the PDOs include the following:

- **Number of people in the utility's service territory receiving more reliable access to improved water services (corporate results indicator);**
- **Percent of monthly system-wide end user water samples that meet WHO potable water quality standards;**
- **Establishment of modern and enabling utilities institutional framework;**
- **Percent of operating and maintenance costs recovered from customers;**
- **Decrease in customer receivables and outstanding debt; and**
- **Preparation of tender documents for one significant private sector investment in either desalination, non-revenue water reduction or wastewater treatment.**

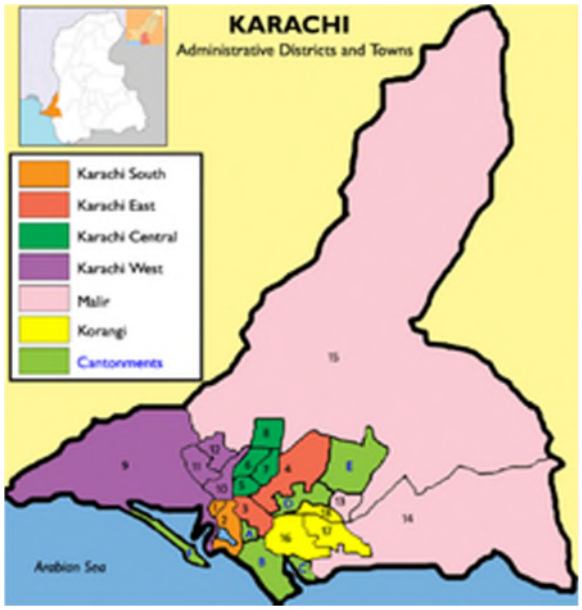
3.0 ENVIRONMENTAL BASELINE

This chapter describes the environmental baseline of the entire area for the proposed project/subprojects including physical, biological, socioeconomic conditions and cultural aspects relevant to project.

3.1 Physical Environment

The map of the Karachi is presented in Figure 1.

Figure 1: Map of Karachi



3.1.1 Climate

Karachi is located just above the tropical zone on the coast of the Arabian Sea at 24º45" to 25º15" north, and 66º37" to 67º37" east at about 20 m above sea level (airport weather station). Karachi is bounded by Hub-River (Balochistan Province) on west, Badin District on east, Dadu District on north and Arabian Sea on south. The climate of the Karachi can be characterized by dry, hot and humid conditions and in general terms it is moderate, sunny and humid. There is a minor seasonal intervention of a mild winter from mid-December to mid-February followed by a long hot and humid summer extending from April to September, with monsoon rains from July to mid-September. The level of precipitation is low for most of the year. The humidity levels usually remain high from March to November, while very low in winter as the wind direction in winter is northeasterly.

3.1.2 Temperature

Table 1 and Table 2 show the mean monthly temperatures of the Karachi for the thirteen years (2001-2013). For the eleven years (2001-2011), the annual mean minimum temperature ranged between 21.0 and 22.5ºC and averaged at 21.8ºC at Karachi Airport Meteorological Station. The annual mean maximum on the other hand ranged between 32 and 33ºC and averaged at 32.6ºC. Cool weather can prevail during the night from November through March; however daytime temperatures are generally hot. Temperatures may reach 40ºC during May (considered the hottest month), and extreme temperatures of greater than 45ºC are not uncommon.

Table 1: Mean Monthly Maximum Temperature

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

Source: Pakistan Meteorological Department, **NA** Not Available

Table 2: Mean Monthly Maximum Temperature

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	11.5	14.9	19.6	23.8	28.1	29.0	27.1	26.5	25.9	24.4	18.6	15.8	22.1
2002	12.8	13.8	19.5	23.9	27.0	28.2	29.6	25.6	24.8	22.5	17.7	14.9	21.7
2003	12.7	16.9	19.8	24.2	26.5	28.2	23.6	27.0	25.3	20.9	15.2	12.0	21.0
2004	12.9	14.5	19.1	24.8	27.3	28.8	27.5	26.3	25.3	22.4	18.0	15.4	21.9
2005	12.3	11.3	20.3	23.0	26.4	28.3	27.2	26.6	26.6	22.9	18.9	13.0	21.4
2006	11.7	18.1	19.6	24.5	27.5	28.5	28.3	26.3	26.8	25.7	19.4	14.0	22.5
2007	13.0	17.3	19.7	24.7	27.6	28.6	NA	NA	NA	NA	NA	NA	21.8
2008	10.1	11.1	19.6	24.0	27.3	29.1	27.9	26.8	26.6	23.8	17.6	14.9	21.6
2009	14.7	16.5	20.8	23.8	27.6	28.7	28.1	27.5	26.5	22.6	17.0	13.9	22.3
2010	12.2	14.7	21.3	25.1	28.0	28.2	28.3	27.2	25.8	23.9	17.4	11.1	21.9
2011	11.0	14.5	19.7	23.1	27.1	28.8	27.8	28.6	26.5	NA	NA	NA	NA
2012	11.2	11.9	19.1	24.5	27.2	28.0	27.9	26.9	26.4	22.7	18.6	14.2	21.5
2013	11.6	15.1	19.2	24.2	27.1	29.3	28.0	26.6	25.5	25.4	18.1	13.0	21.9

Source: Pakistan Meteorological Department, **NA** Not Available

The warm season lasts from March 25 to July 13 with an average daily high temperature above 34ºC. The hottest day of the year is May 5, with an average high of 36ºC and low of 26ºC. The cold season lasts from December 18 to February 7 with an average daily high temperature below 27°C. The coldest day of the year is January 10, with an average low of 13°C and high of 25°C.

3.1.3 Precipitation

As this region falls in the semi-arid climatic zone, the rainfall in Karachi is extremely low and erratic. Best estimate of annual rainfall of Karachi is 212 mm. The Figure 2 shows the annual distribution of precipitation of Karachi and Table 3 shows the last thirteen years precipitation data recorded at Karachi Airport station.

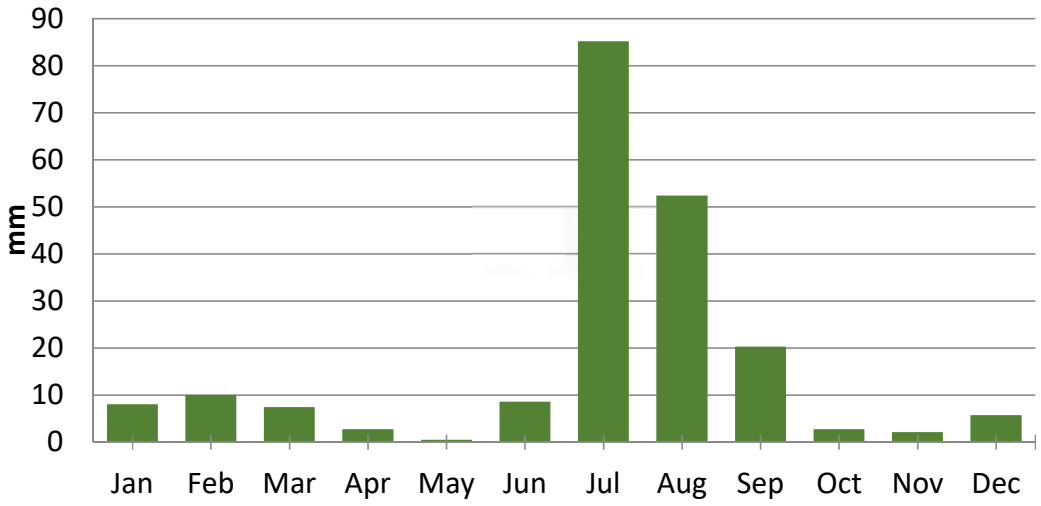
3.1.4 Humidity

Despite arid conditions, humidity is relatively high throughout the year. The average annual relative humidity is 75.9% and average monthly relative humidity ranges from 60% in December to 85% in August. Table 4 presents details of humidity and dew point temperature of Karachi.

3.1.5 Wind

Karachi weather is considered pleasant and is famous for its breeze from the sea. The onshore winds from the Arabian Sea contribute to humid conditions. The wind speed has highest velocities during the summer months, when the direction is south-west to west. During winter, the wind blows from north to northeast, shifting southwest to west in the evening hours. The wind usually carries sand and salt resulting in severe wind erosion and corrosion. Tropical cyclones are formed in the Arabian Sea in the pre-monsoon season, mostly in the month of June. Figure 3 shows the wind rose for Karachi.

Figure 2: Annual Distribution of Precipitation



Source: Pakistan Meteorological Department

Table 3: Monthly Precipitation (mm) at Karachi Airport

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	0.0	0.0	0.0	0.0	0.0	10.6	73.6	16.2	NA	0.0	0.0	0.0	33.46
2002	0.0	2.4	0.0	0.0	0.0	NA	NA	52.2	NA	0.0	0.5	0.4	13.87

2003	6.4	21.8	0.0	0.0	0.0	16.3	270.4	9.8	NA	0.0	0.2	0.0	54.15
2004	13.7	0.0	0.0	0.0	0.0	NA	3.0	5.6	NA	39.3	0.0	4.3	13.18
2005	6.6	12.8	NA	0.0	0.0	NA	NA	0.3	54.9	0.0	0.0	17.1	18.34
2006	NA	0.0	NA	0.0	0.0	0.0	66.2	148.6	21.9	0.0	3.1	61.3	60.22
2007	0.0	13.2	33.4	0.0	0.0	110.2	NA	NA	NA	NA	NA	NA	52.26
2008	8.0	Tr	1.1	0.0	0.0	0.0	54.0	37.5	Tr	0.0	0.0	21.0	24.32
2009	3.0	Tr	0.0	Tr	0.0	2.6	159.9	44.0	68.9	0.0	0.0	1.5	55.68
2012	0.2	0.0	0.0	0.0	0.0	Tr	Tr	8.1	121.0	0.0	0.0	22.8	152.1
2013	Tr	20.0	2.8	30.0	0.0	Tr	5.5	105.4	4.0	1.2	0.0	0.0	168.9

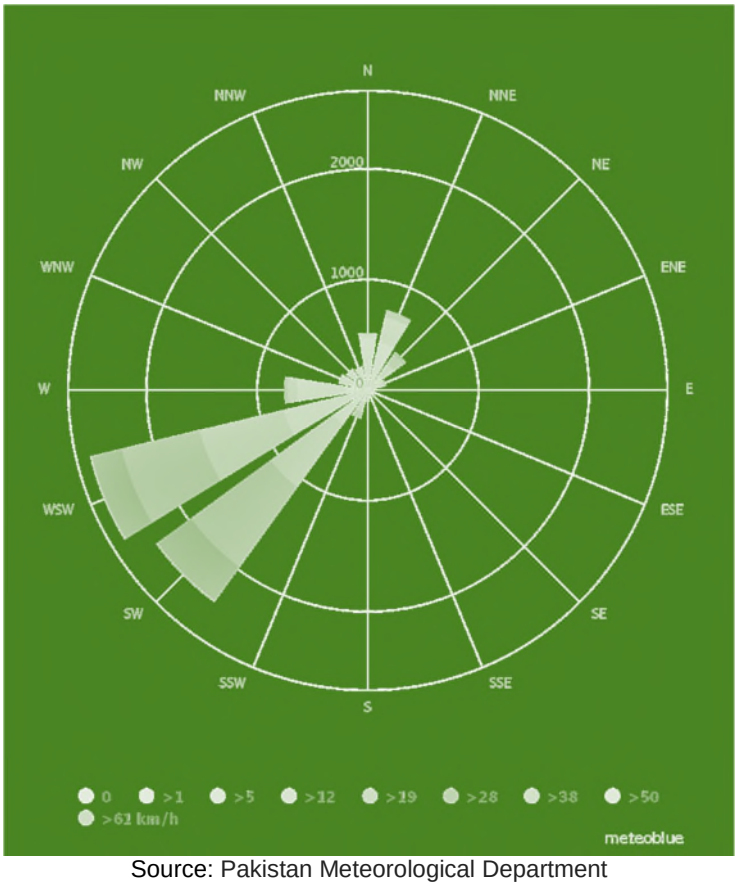
Source: Pakistan Meteorological Department, **NA** Not Available, **Tr** Trace

Table 4: Humidity and Dew Point Temperature of Karachi

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.
Relative Humidity (%)	61	70	77	79	83	83	83	85	84	79	67	60	75.9
Avg. dew Point ºC	12.2	15.4	20.2	23.2	26	27.5	26.6	25.7	25	23.5	18.6	13.4	21.5

Source: Pakistan Meteorological Department

Figure 3: Wind Rose of Karachi



Source: Pakistan Meteorological Department

3.1.6 Topography

Karachi is located in the south of Sindh, on the coast of the Arabian Sea. It covers an area of approximately 3,600 km^2, comprised largely of flat or rolling plains, with hills on the western and northern boundaries. The city represents quite a variety of habitats such as the sea coast, islands, sand dunes, swamps, semi-arid regions, cultivated fields, dry stream beds, sandy plains, and hillocks. The hills in Karachi are the off-shoots of the Kirthar Range. All these hills are devoid of vegetation and have wide intervening plains, dry river beds and water channels.

Classified according to physiographic features, Karachi City District can be divided into three broad categories: Hilly Region (Mountain Highland), Alluvial Plain (Piedmont Plain) and Coastal Areas (Valley Floor). The greatest height of the region is 76 m that gradually decreases to 1.5 m above mean sea level along the coastline. The Karachi Harbor is a sheltered bay to the south-west of the city, protected from storms by the Sandspit Beach, the Manora Island and the Oyster Rocks.

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

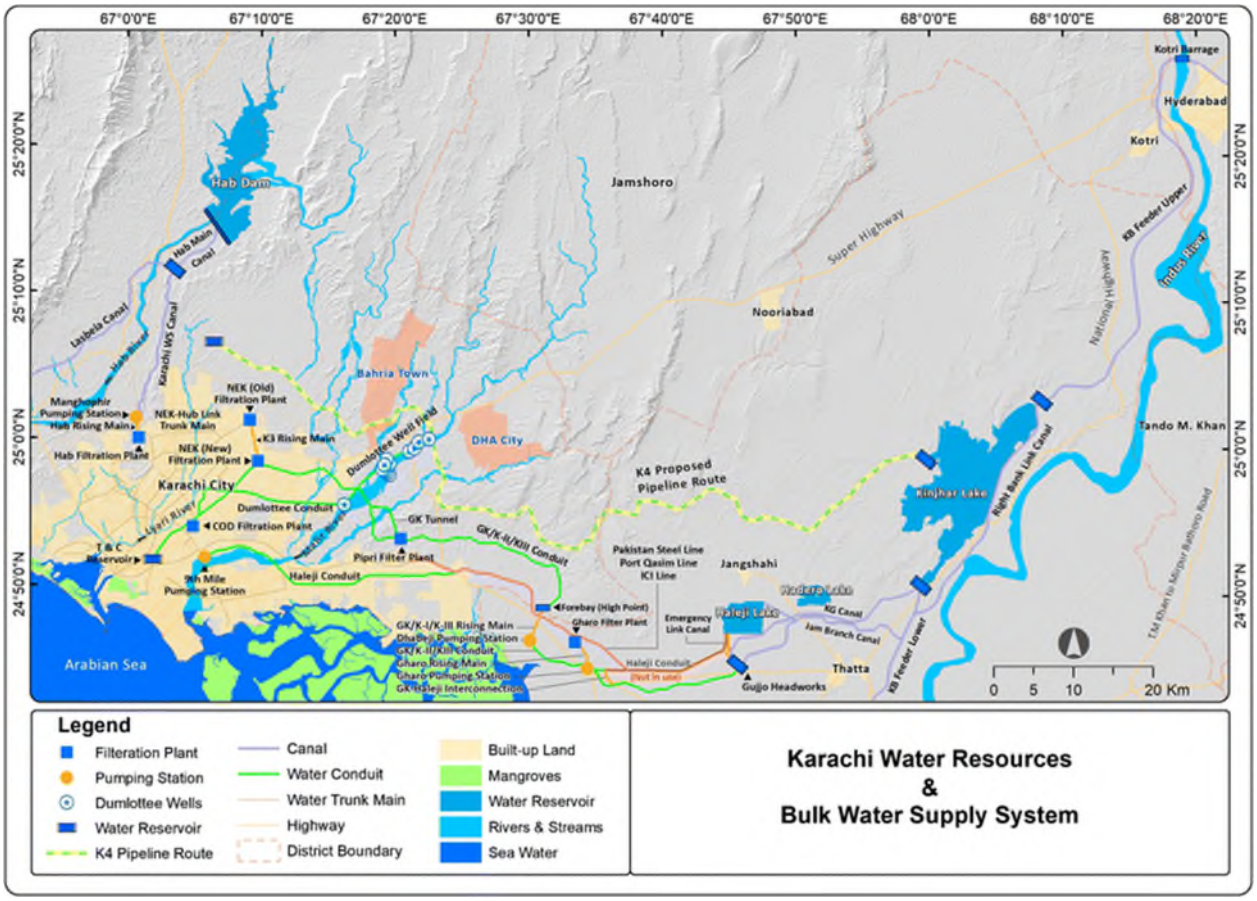
Karachi is the part of major synclinorium stretching from Ranpathani River in the east to Cape Monze in the west, Mehar and Mole Jabal (Mountains) in the north. Within the synclinorium, a number of structures such as Pipri, Gulistan-e-Jauhar, Pir Mango and Cape Monze are exposed. The presence of concealed structures under the Malir River valley, Gadap and Maripur plains can fairly be deduced. Rock aggregates, sand, limestone and clay are some of the potentials for gainful utilization. Gulistan-e-Jauhar, member of the Gaj formation, offers groundwater potential for limited use. The area is underlain by rocks of sedimentary origin ranging in age from Eocene to Recent. (Geological Survey, Preparatory Survey (II) on Karachi Circular Railway Revival Project, Final Report, JICA, 2013)

The vacant land accounts for only 7% of all land and housing is the biggest user of land (with about 37% of the total), while roads and open spaces are also significant. Most of the developed areas are concentrated in the inner ring towns of Saddar, Jamshed, Lyari, Liaquatabad, Gulshan-e-Iqbal and Gulberg. These towns contain the most diverse mix of land uses and include most of the governmental and regional-scale industrial and commercial activities. (Karachi Strategic Development Plan 2020)

3.1.7 Water Resources

The map of water resources and bulk water supply system for Karachi is shown in Figure 4.

Figure 4: Water Resources & Bulk Water Supply System of Karachi



The description of the water resources of Karachi is as under:

a) Surface Water

Indus River and Hub Dam on Hub River are the two major sources of surface water for Karachi.

1) Indus River

The Indus River, the main source of water for Karachi, is severely constrained by dry season demand, but has abundant wet season discharges. Except during the summer flood season, very little water escapes to the sea. Water from the Indus River is distributed over the Sindh Province through three barrage systems, namely, Guddu, Sukkur and Kotri. Urban and industrial water for Karachi is taken from the Kotri Barrage and discharged through the Kalri Baghar Feeder Upper (KB Feeder Upper) to Kinjhar Lake. Kotri Barrage is the lowest barrage on the River Indus. Kinjhar Lake is a natural reservoir, the storage of which has been increased by constructing nearly 20 km of embankments having a maximum height of 9 m. The lake has a catchment area of 910 km. The supply from the River Indus comes via canals from Kinjhar, Haleji, Gharo and through conduits to the Dhabeji pumping station. The water is then distributed via conduits and distribution mains.

2) Hub Dam

The Hub Dam is a multi-purpose dam (municipal, industrial and irrigation purposes) constructed on the Hub River approximately 56 km to the north-west of Karachi city. The construction of the dam started in September 1963 and completed after 18 years in September 1981. The catchment area of the dam extends across two provinces namely Sindh and Balochistan, covering a total area of 8,730 square km. There has been an agreement between the two provinces that, at the Regulator located at the

end of the Hub Main Canal, 63.3% of the total flow from the dam will be diverted to the Karachi Water Supply Canal (Sindh) while 36.7% to the Lasbela Canal (Balochistan).

b) Groundwater

As stated above, Karachi obtains its drinking water from the Indus River about 120 km to the east and the Hub River about 56 km in the west. Some limited groundwater is extracted for private use in the Karachi area, but groundwater resources in the Karachi area are limited. The aquifers close to the coastal belt are mostly saline and unusable for domestic purposes. Aquifers near the Hub River are well developed and serve as sources of water for agriculture and domestic use. The aquifers are estimated to lie at depths of 50-100 m. (EIA Red Line Report)

In the later half of the 19th century, water for Karachi was supplied from the Dumlottee Well Field, located on the banks of Malir River in the Dumlottee area about 30 km to the northeast of the city. A number of large diameter shallow wells constructed in the Malir river alluvium provided about 8 MGD of water to Karachi through a gravity conduit. For many years since then, the well field remained as the main source of supply for Karachi. However, the supply from this system has gradually decreased over time. The water is supplied a few months after the rainy season. The system is almost dry in the rest of the year.

Excessive quarrying of sand from the river bed of Malir River combined with the extensive use of groundwater by farmers in the area is considered to be the main reason for the depletion of the well yield. Dumlottee Well Field is no longer a reliable source of supply for Karachi.

1) Groundwater Recharge Sources

Five possible water-sources are contributing to the groundwater recharge in Karachi. The first possible source is the rainfall. As the city of Karachi suffers from deficit of precipitation (only rainfall), the contribution to shallow groundwater storage from rain is very little. However, rainfall in the hinterlands and other areas surrounding Karachi may significantly contribute to the groundwater flow-system. The two freshwater sources are the Hub Lake/Hub Dam and the Indus River. Water from Hub Dam and the Indus River is piped to various residential zones in Karachi for drinking and irrigation purposes. The spring water discharges into Malir River and Layari River and the municipal/industrial waste effluents added to these rivers are also contributing to groundwater storage as a fourth recharge source. Seawater intrusion along Karachi coast is the fifth possible source.

During the past several years, a number of pumping wells has been installed to meet requirements for the irrigation-water supply (to raise vegetables, fruits, dairy and poultry) and drinking-water supply for Karachi. Excessive pumping of groundwater and continuous lowering of water-table is likely to result in intrusion of seawater into the Malir Basin under natural seepage conditions and under artificially induced conditions of recharge of saline seawater in the coastal aquifer(s) of Karachi. (Geological Survey, Preparatory Survey (II) on Karachi Circular Railway Revival Project, Final Report, JICA, 2013)

2) Groundwater Quality

Physico-chemical data of shallow groundwater (depth less than 30 meters) shows that the shallow wells, located in the vicinity of coast and in the proximity of polluted rivers, have relatively higher values of electrical conductivity, salinity and population of coliform bacteria. The shallow groundwater is moderately saline, representing electrical conductivity values in the range of 1.1 to 1.9 mS/cm and salinity in the range of 1 ppt. The pH of shallow groundwater varies from mildly acidic (~6.3) to mildly alkaline values (~7.9). Areas with quite poor sanitary conditions have relatively low

values of pH (~6.3 to 6.8). Shallow groundwater below 20 meters is slightly reducing. The dissolved oxygen is in the range of 1.5 to 7.9 mg/l. Turbidity of shallow groundwater varies between 3.6 NTU and 95 NTU. The concentration of HCO_3 - (356 – 514 ppm, n=4), Cl- (82 - 169 ppm, n=4) and $SO4^{-2}$ (38-117 ppm, n=4) in shallow groundwater is very reasonable.

In general, deep groundwater is mostly saline and has high electrical conductivity (range: 1.9-19.1 mS/cm) and salinity (range: 1.7-7.4 ppt), as compared to shallow groundwater. Based on hydro-chemical data of water samples collected from pumping wells, it is assumed that the shallow mixed deep groundwater discharged by large-scale pumping wells mainly represents the deep groundwater from confined aquifer

The hydro-chemical and stable isotope results indicate that the confined aquifer hosts a mixture of rainwater from hinterlands and surrounding regions around coastal Karachi, as well as sea trapped water / seawater, through intrusion under natural infiltration conditions or under induced recharge conditions.

Source: Geological Survey, Preparatory Survey (II) on Karachi Circular Railway Revival Project, Final Report, JICA

c) Water Supply System

The city has experienced over the last three decades, the augmentation of the water supply system including water source, bulk conveyance system and distribution network has consistently lagged behind the fast growing water demand of the city due to the significantly large population growth rates (4 to 5% per annum). Consequently most of the areas of the city faced serious water shortages. People are obliged to spend money on ground-level tanks, booster pumps, roof-top storage tanks and water filters and even then water is boiled prior to drinking. Many households are compelled to use secondary sources of water such as shallow wells or tanker supplies just to meet their basic needs.

The water supply system of the KWSB supplies bulk water to the citizen of Karachi City from the Indus River, Hub Dam and Dumlottee Wells through the Greater Karachi Bulk Water Supply System, Karachi Water Supply Canal and Dumlottee Conduit respectively. About 33% of the total water supply is without filtration. From filtration plants and reservoirs, water is supplied through the water trunk mains and distribution pipelines. The detail of the water filtration plants is given is Table 5.

Table 5: Detail of Filtration Plants in Karachi

Location	Gharo		COD		Pipri			NEK Old	NEK New	Hub
Number of Plants	1	2	1	2	1	2	3	1	1	1
Year of Construction	1943	1953	1962	1971	1971	1978	2006	1978	1998	2006
Rated Capacity MGD	10	10	70	45	25	25	50	25	100	80

Source: KWSB

A total of 139 distribution pumping stations are being operated and managed by the KWSB. Some of the consumers install individual small suction pumps and suck water from distribution pipes forcibly. This is the one of reasons of serious water supply situation which makes low water pressure and water shortage, and also problems of water quality aggravation such as sewerage contamination caused by negative pressure in the pipes. There is no water meter on individual service connection. Consumers pay water tariff on the basis of plot size hence they pay no attention to any wastage. Awareness for the usage

and storage of water is very less in many parts of Karachi. In order to complement the Supply to water starved areas and to attend acute and chronic water shortages, six Water Hydrants are operating in Karachi outsourced by KW&SB, which are providing water through tankers on specified / regulated rates to the citizens and at the same time a subsidized supply of tankers is also going on under the instructions of the Chief Minister GoS for the supply of free tankers to the poor and deprived areas mainly in district west, Karachi.

3.1.8 Sewerage System

Four drainage systems are said to encompass Karachi city, the Lyari, the Malir, the Budnai, and small streams referred to collectively as the coastal basin. The Malir River Basin and the Lyari River Basin contribute about 80% of the surface runoff from the city. Thus, the natural drainage system of Karachi city includes mainly the tributaries of the Malir and Lyari Rivers. While these are perennial streams, in stream flow is intermittent, and fresh water inflow depends on rainfall and runoff; both rivers also intercept discharges from sewer lines and outfalls and carry sewage to the sea from all parts of the city. The Budnai Basin and the Coastal Basin are minor basins. The Malir River flows from the east towards the south and center, and the Lyari River stretches from north of the city to the southwest ending in the Arabian Sea.

Drainage channels collect surface runoff through hundreds of small/large side channels and lined nullahs (drains) that serve as important components of the drainage network. These are generally dry built channels and streambeds that flow into the main rivers described above. Whenever a heavy rain takes place, the huge amount of runoff that course through these channels may cause the rivers to overflow their banks and spread over adjacent floodplains. In any event, the drainage network of the city is severely stressed due to increased runoff from paved surfaces, and encroachment on drainage channels.

The Lyari River is an ephemeral stream having a substantial catchment area starting from as far back as the Badra range of hills, some 100 km north of the city. Its catchment covers an area of 700 km^2, out of which, approximately 150 km^2 is in the metropolitan area. The river is the main contributor to an estimated amount of 200 MGD of sewage that enters the Arabian Sea. A large number of industries including leather tanning units, pharmaceuticals, petrochemicals, refineries, chemical, textile, paper and pulp, engineering works and thermal power stations, located along the river, regularly discharge their untreated industrial waste, including the waste flows from the SITE industrial estate in Orangi that flows via the Orangi Nullah to the Lyari and thence to the ocean.

Malir River is shorter with a smaller drainage area. It is ephemeral and is constituted from two major tributaries, the Mol and Khadeji, as well as some minor tributaries. Khadeji is a perennial stream that originates at Khadeji falls and gains flow as it travels across the Malir Basin. The Malir and Khadeji River basins include dry hill torrents and flow depends upon precipitation during rains. Once the Malir enters urban space, it receives large amounts of industrial effluent from the Korangi industrial area, and discharges into the sea.

The wastewater quality of Malir and Lyari river is given in Table 6.

Table 6: Wastewater Quality of Malir and Lyari Rivers

Parameters (mg/l) except pH	Malir	Lyari (Mean Values)
Ph	7.41 - 8.45	7.49

Temperature ^{o}C	32 - 33	27
Total Dissolved Solids (TDS)	1,478 – 33,820	2,361
Biochemical Oxygen Demand (BOD)	180 – 320	343
Chemical Oxygen Demand (COD)	506 – 1,413	552
Zinc	0.6 – 1.39	0.32
Lead	2.19 – 6.77	0.23
Cadmium	1.71 – 2.6	0.12

Source: Physico-Chemical Profile of Malir River and Chinna Creek (Sadia Tariq et al.), Impact of Orangi Nala Industrial Effluents on Sewage Water of Lyari River, Karachi, Pakistan (Yasmin Nergis et al.)

The existing coverage of the sewerage system is only about 30% for the Karachi. The existing sewerage system has a number of problems. These include low sewage flows received at existing sewage treatment plants, resulting from the inadequate provisions of sewer trunk mains and the malfunctioning of pumping facilities, deterioration of water quality in rivers and canals, and clogging of waterways caused by damping of massive rubbish. The detail of the sewage treatment plants is given in Table 7.

As per KSDP 2020, more than 380 MGD wastewater is discharged daily. Only about 90 MGD is treated at existing wastewater treatment plants. According to KWSB sources, almost 441.32 MGD raw sewage gets into the sea without required level of treatment from Karachi via 11 drains. Existing sewerage facilities for sewage collection and its treatment are far from sufficient in quantity to serve the large population of Karachi city. Additional sewage collection system including branch sewers, trunk sewers and pumping stations need to be constructed to improve living environment of the citizen. In the same manner, existing sewage treatment plants need to be extended and new plant(s) has to be implemented to treat all the generated sewage to improve water qualities of public water bodies, especially of Arabian Sea.

Table 7: Summary of Sewage Treatment Plants of Karachi

	TP-1 (SITE)	TP-2 (Mahmoodabad)	TP-3 (Mauripur)
Drainage Area	F.B. Area, Liaquatabad, Nazimabad & North Nazimabad, Part of Orangi Town, Pak Colony etc.	Old City Areas, Clifton Societies, Mahmoodabad, Part of Azam Basti, Dada Bhai, Sadder, Malir	Old Lyari, Garden East and West, Gulshan-e-Iqbal, PIB Colony, Soldier Bazar, Baldia, Nazimabad, North Karachi
Site Area	120 acres (48.6 ha)	120 acres (48.6 ha)	545 acres (221 ha)
Year of Construction	1960/1995 (rehabilitated)	1960/1996 (rehabilitated)	1998
Treatment Process	Trickling Filter Process	Trickling Filter Process	Anaerobic + Facultative Pond
Capacity (MGD)	51	46	54
Present Flow Rate (MGD)	25	24	30-35
Effluent Quality	BOD 80.8 mg/l SS 76.4 mg/l	BOD 100 mg/l	BOD 75 mg/l SS 69 mg/l

Source: KWSB

a) Wastewater Pollution

Untreated wastewater is one of the major source of surface and groundwater contamination. Most of wastewater discharges from municipal and industrial sources do not meet the Sindh Environmental Quality Standards (SEQS). This indiscriminate discharges of untreated wastewater results in considerable environmental pollution and degradation. Major infectious diseases outbreaks were sourced by the contamination of fresh water resources. Most sewage flows into the nullahs and rivers which run as open sewers through the built-up area, causing highly obnoxious, insanitary conditions with serious health risks and unpleasant environment for the residents of adjoining neighborhoods.

There are numerous unauthorized settlements along most of the sewage channels where poor segments of society live. These are vulnerable to being exposed to water borne diseases, especially children. Besides causing health impacts, sewage overflow also damages already dilapidated infrastructure of Karachi, particularly roads.

The heavy metal accumulation (especially Pb) in seafood is linked to anemia, kidney failure and brain damage in humans. Mangroves and other ecological assets of the coast of Karachi are under serious threats due to exposure to the seawater contamination. Coastal ecological areas especially mangroves are habitats to invertebrate fish, shrimps, crabs, birds and reptiles.

Other major impacts of marine pollution as seen in Karachi include loss of biodiversity, dislocation of coastal communities, loss of livelihood, loss of fisheries, and degradation of beaches and recreational places.

The industrial estates of Karachi, namely Sindh Industrial Trading Estate (SITE), Landhi Industrial Trading Estate (LITE), Korangi Industrial Area (KIA), and West Wharf Industrial Area, among others, discharge effluents mainly into the Lyari and Malir rivers, which, passing through mangroves of Korangi Creek, finally drain into the Arabian Sea. SITE represents about 50% of the industrial discharges into sea.

Many of the above mentioned industrial estates intend to or are in the process of establishing large scale effluent treatment plants. Due to paucity of land, capital and technical resources, very few industrial units have installed individual wastewater treatment plants. Therefore, almost all of the industrial effluent goes into the sea practically untreated.

3.1.9 Flooding

Although the climate of Karachi is arid and rainfall is low and highly variable, whenever torrential rain comes and heavy rainfall occurs within a short duration, surface runoff intensifies. Heavy showers take place in the city either due to the effects of tropical storms usually in June, which rarely affect coastal areas but bring heavy showers for short periods and cause flooding. As the result of a tropical storm (6 June 2010) Karachi received 130 mm rain within a day which caused huge surface runoff. The heavy monsoon rain mostly occurs in July and August and is the main cause of flooding in the city. However, its reoccurrence is estimated to occur at between about 3 to 5-year intervals. Flood affected areas of the city and areas susceptible to flooding include the old city areas such as Kharadar, Mithadar, Bunder Road, Ram-swami and Arambagh.

3.1.10 Seismology

Karachi is located in a moderate earthquake zone. Pakistan falls into three seismic zones. Zone-III is the most severe and Zone-I the least. The Karachi Building Control Authority has placed Karachi in Zone-II. Based on the actual events, past observations of fault movement and other geological activities, Karachi is situated in a region where moderate earthquakes may occur of magnitude 5.0 to 6.0 equivalent to intensity between VII and VIII on Modified Mercallis Scale (M).

The seismic zoning for Karachi was revised after the 2005 earthquake. Probabilistic Seismic Hazard Assessment (PSHA) carried out for revision of seismic provisions of the Building Code of Pakistan shows that Karachi falls in Zone 2B. The Zone 2B has Peak Ground Acceleration (PGA) in the range of 0.16 g to 0.24 g for a return period of 475 years and is considered to be at 'Moderate' risk of a major earthquake event.

3.1.11 Ambient Air Quality

World Health Organization (WHO) included Karachi amongst the top 20 polluted cities of the world with respect to outdoor ambient air pollution levels measured as PM_{10} and $PM_{2.5}$. Annual mean concentrations of PM_{10} and $PM_{2.5}$ in Karachi are 273 µg/m^3 and 117 µg/m^3, respectively.[1] WHO revised standard for safe concentration levels for PM_{10} is 20 µg/m^3 and for $PM_{2.5}$ is 10 µg/m^3. In Karachi, PM_{10} concentration level is about 14 times and $PM_{2.5}$ concentration level is about 12 times higher than the WHO standards. Highest level of $PM_{2.5}$ concentration happens during November to February due to reduced wind speed. During this period, $PM_{2.5}$ concentrations reach in the range of 120–180 µg/m^3 (12-18 times the WHO standards). In 2007, Encyclopedia of Earth, ranked Karachi as the most polluted city in terms of Total Suspended Particulates (TSP), and fourth most polluted mega city according to the multi-pollutant index ranking.[2] In Karachi, the concentration levels of carbon monoxide (CO), oxides of nitrogen (NO_x), and sulfur dioxide (SO_2) are within the permissible limits established by US EPA. The concentrations of hydrocarbons (HC) are higher than the permissible limits (0.25-2.8 as compared to 0.24 permissible limits).[3] Higher level of air pollution has resulted in substantial increase in respiratory tract infection. Major contributors towards air pollution in Karachi are vehicular traffic, industry and ambient dust.

3.2 Biological Environment

3.2.1 Flora

Karachi can be divided into following four sections with respect to flora and fauna of the area:

- **Eastern Boundaries**
- **Southern Boundaries**
- **Northern Boundaries**
- **Western Boundaries**

Eastern Boundaries: Malir River and its adjoining sites in the east are densely populated with wide variety of vegetation in the form of natural foliage consisting diversity bushes, shrubs, trees including agricultural products such as crops, vegetables and fruits. This section is extended from Memon Goth till Shah Faisal Korangi vicinities besides Malir River. The wild Kekar, Neem and Oak trees are also found here.

Southern Boundaries: Southern boundaries of Karachi city are surrounded by rocky and barren mountains which are very hot in summer and are grown mostly by diversity vegetation characteristic of Sindh region including bushes, shrubs, and wild Kekar trees. Most vegetation are

[1] WHO, "Public Health, Environmental and Social Determinants of Health: Ambient (Outdoor) Air Pollution in Cities Database 2014".
[2] Gurjar Bhola R., "Air Quality in Megacities", The Encyclopedia of Earth", September 2014
[3] ibid 1

shade less trees which are selectively consumed by domesticated animals such as goats etc. At some areas, commercial vegetables are also grown but large areas are unproductive.

Northern Boundaries: Northern boundaries of Karachi city are surrounded by High Seas of Indian Ocean which starts from Bin Qasim area up to Manora, Keamari and consisting large variety of Mangrove vegetation in the coastal corridor. Mangroves are natural vegetation developed usually besides shoreline in closed seas and are significant sanctuaries and breeding places for wide variety of aquatic organisms.

These mangroves are under stress due to industrialization, decreased freshwater discharges, and urban sprawl. Major functions of mangroves are: protection of inland areas from the effects of climatic stress, breeding and spawning of marine fisheries, and livelihood to the coastal communities. Major issue is the depletion in mangrove cover, which is going down both in quantity and quality. The industrial units propping up along the coast, especially in the Port Qasim Industrial Area, often cut sizable numbers of mangroves. However, very low real effort is visible in alternative and compensatory plantation of mangroves, as promised by proponents during environmental approval process. Furthermore, with declining quality and quantity of fish catch, the fisher-folk is opting to other means of livelihood, thereby reducing their traditional economic reliance on mangroves. This results in cutting of mangroves by the local communities as well, especially during fuel shortage.

Western Boundaries: Western boundaries of Karachi city are surrounded also by High Seas of Indian ocean as well as Stationery sea water referred to as closed sea. It is virtually consist of West Wharf and nearby coastal areas including Hawksbay and Mauripur sections. Most of this region is consist of large variety of Mangrove vegetation in the coastal corridor.

Ecological risk of high order has been induced by land clearance and removal of natural vegetation from the plains during the urban sprawl to make room for agriculture and urbanization. These zones include extensive flat alluvial plains, covered by relatively similar vegetation, mostly small trees and dwarf shrubs. Tall, clump-forming desert grasses are common. Signs of extensive drought damages done by land clearing activities are apparent and hence the natural vegetation that has survived in these areas has adapted to harsh conditions.

3.2.2 Fauna

Eastern Boundaries: No endangered fauna exist in this section, however, some avian fauna, sparrows of diversity genera, crows, cuckoos, and wild and domesticated pigeons exist. Among creeping fauna, snakes of few types also exist in this section.

Southern Boundaries: The soil is sandy and rocky in appearance grown by wild Kekar trees and bushes having no valuable significance except cattle grazing for domesticated animals such as goats and cows. Snakes of some variety are encountered in this section. There is no characteristic avian fauna except Collard Dove and Wild pigeon is reported. No significant faunal regime exists in this region.

Northern and Western Boundaries: The high and closed seas of Karachi in the northern and western corridors are enriched with large variation of aquatic organisms in the form of large variety of fishes, shrimps, prawns, lobsters, crabs, turtles etc. Sea snakes are also encountered in closed sea sections. Among avian fauna Egret, Seagulls, and White Storks are most common species. Migratory faunal regimes are encountered in winter in closed sea sections or in isolated islands that mainly consisting of Flying Ducks, Pelicans and Flamingos.

The impoverished as well as degraded environment resulting from non-availability of surface as well as groundwater and discharge of untreated wastewater into Lyari and Malir Rivers has

irreversibly reduced the biodiversity of the indigenous as well as introduced vegetation and hence it offers very little chance for the survival/growth of fauna in Karachi.

Water availability is the main constraint for the distribution of many animal species. Large wild mammals are virtually absent in the areas within Karachi. There are a number of characteristic bird species that have adapted to the agricultural environment in the outskirts and suburban areas. These include Indian Roller, Common Mynah, Pigeon, and House Sparrow.

3.3 Overview of Socioeconomic Condition

3.3.1 Population

In terms of the number of population, Karachi is one of the ten largest cities in the world. The population of Karachi is about 16 million (2017) as per Pakistan Bureau of Statistics. It is a very dense city with population density of about >20,000 people/km^2. The increase in population is putting heavy pressures on the physical, infrastructural, financial and institutional systems of the city.

A large segment of Karachi's population, roughly 40%, is afflicted with poverty. The living conditions of the deprived section and its economic wellbeing are therefore a major concern, as these impact the environment and growth potential of the city.

Karachi is Pakistan's most diverse city in terms of ethnicity, linguistic identity, and religious affiliation. While most of the population belongs to Islamic sects, the city also houses a sizeable proportion of non-Muslim communities including Christians, Hindus, and Zoroastrians. Mohajirs form the largest ethno-linguistic and political group (almost 50%) followed by Pashtuns (25%).

Apart from in-migrants from Pakistan's provinces, a large number of migrants from Afghanistan, Bangladesh and other South Asian countries have settled in the city. With an average monthly household income of Rs. 15,000, there is considerable variation in income distribution. Roughly 75% of the households fall in the category of poor and low-income groups and 25% constitute the middle and high income groups.

3.3.2 Health

The severe air, water and solid waste pollution in the city constitutes a serious health risk to a large proportion of residents. Large proportion of the city's population lives in katchi abadis or slums with very poor infrastructure and access to basic services.

It is estimated from the World Bank study 2015 that in Karachi health cost related to air pollution is in the range of Rs. 30-40 billion every year. It was reported that 23% of the patients admitted in Civil Hospital were infected by respiratory tract infection.[4] Table-8 presents estimated annual cases of morbidity from PM ambient concentrations in Karachi in 2009.

Table 8: Estimated Annual Cases of Morbidity [PM Ambient Concentration in KHI-2009]

Activity	Number of Incidences
Chronic Bronchitis	145,185
Hospital Admissions	26,686
Emergency Room Visits	523,498
Restricted Activity Days	81,838,293

[4] IUCN-Pakistan, "Sindh Strategy for Sustainable Development", 2007

Lower Respiratory Illness in Children	1,353,000
Respiratory Symptoms	260,459,264

Source: The World Bank, "Sustainability and Poverty Alleviation: Confronting Environmental Threats in Sindh,Pakistan", 2015

3.3.3 Education

The Pakistan Social & Living Standards Measurement Survey of 2014-15 showed a 76% literacy rate for the urban areas of Sindh. The literacy rate for Karachi is 82%.The overall literacy rate for urban areas in Pakistan was 76% (Literacy for Population above 10 year and older).

3.3.4 Economy

Karachi is the financial capital of Pakistan and plays pivotal role in the nation's economic and industrial activities. . Karachi Strategic Development Plan 2020 (KSDP-2020) describes the Karachi's economy as follows:

Karachi is the main industrial and commercial center of Pakistan. However, owing to a deteriorating law and order situation resulting in production shutdowns and payment of extortion to various agencies, the increase in the cost of production through higher energy costs, power outages resulting in loss of output, the last 20 years have witnessed the physical shifting of small enterprises to the Punjab (the origin of most of the small-scale manufacturers) and medium-scale enterprises to Dubai (because of a secure location and employer-friendly labor laws), there has been a continuous decline in manufacturing activity. Despite these setbacks, Karachi has witnessed a substantial increase in the trade and services sectors. The financial services sector has seen the induction of a large number of international banks, the emergence of exchange companies, and a boom in the stock market. As the largest city and the transportation, trade and financial gateway to the outside world, Karachi's economic fate is closely tied to that of the nation.

It is estimated that city generates about 20% of the national output, creates more than 30% of value added in manufacturing, and accounts for 25% of national tax revenues. More importantly, the city provides jobs for a large population – 40% of national employment in large-scale manufacturing is based in Karachi. Karachi's economic underpinnings include industries in seven major concentrations namely the Sindh, Korangi and Landhi Industrial Estates, Federal 'B' Area, North Karachi, the Export Processing Zone, and Port Qasim. One of the Karachi's key comparative advantages is the low cost of labor. The low wage work force lives primarily in Katchi Abadis (squatter settlements) that run along water ways and on government owned land in pockets throughout the urbanized area. Many poor people work near where they live, which reduces commuting costs and helps keep wages low. Inflation in Karachi is the lowest among all of the large cities (population in excess of 500,000) in Pakistan with the exclusion of Faisalabad.

4.0 REGULATORY REVIEW

This chapter briefly describes the national, provincial and World Bank laws, policies, strategies, guidelines, codes and procedures for the categorization, screening, environmental assessment and environmental compliance of the proposed project/subprojects. This chapter states that how the various requirements need to be complied during the planning and implementation stages of the subprojects.

4.1 National Laws, Policies and Strategies

This section briefly describes different policies and strategies, and laws of the Government of Pakistan relevant for the proposed projects mentioned in the previous chapters.

4.1.1 National Environmental Policy, 2005

The National Environmental Policy provides an overarching framework for addressing the environmental issues facing Pakistan, particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification, natural disasters and climate change. It also gives directions for addressing the cross sectoral issues as well as the underlying causes of environmental degradation and meeting international obligations.

Following policy measures are relevant to KWSSIP:

Water Supply and Management

To provide sustainable access to safe water supply and effectively manage and conserve the country's water resources, the government may:

- Promote appropriate technologies for rain water harvesting in rural as well as urban areas.
- Promote metering of water consumption to discourage the indiscriminate use of water for industrial and municipal purposes.
- Enact Water Conservation Act and relevant standards to foster water conservation.

Air Quality and Noise

- Enact the National Clean Air Act.
- Ensure reduction and control of harmful emissions through regulatory programs.

Waste Management

- Introduce discharge licensing system for industry.
- Encourage reduction, recycling and reuse of municipal and industrial solid and liquid wastes.
- Provide financial and other incentives (reduction/elimination of tariffs, low interest loans, appreciation certificates and awards) for technology up-gradation, adoption of cleaner technology, implementation of pollution control measures and compliance with environmental standards.

4.1.2 Climate Change Policy of Pakistan 2012

Climate Change Policy (CCP) establishes that urban areas in Pakistan are already affected by short-term climate changes. In the long term, it is predicted that urban areas located in the irrigated plains and coastal areas will be significantly affected by climate changes. It is predicted that due to climate changes, changes in hydrological cycle (intensive and erratic monsoon rains, flash floods, increased availability of water due to increased melting of glaciers in the short term;, and decrease in water availability in the long term due to decrease in glacier flows) and increase in temperature will affect urban areas. 50 cyclonic storms developed in the northern Arabia Sea

during 1946-2004. Four storms hit the coast of Karachi resulted in heavy downpours, flash-floods, and loss of life and property.

CCP predicts that due to climate change, extreme weather events such as heat and cold waves, heavy or too little precipitation, and strong winds will occur more frequently and will cause health impacts in urban areas, for example, diarrheal diseases because of insufficient clean water availability for drinking and personal hygiene. It is predicted that vector-borne diseases such as malaria and dengue fever may increase. Similarly, extreme weather events will express themselves in the form of natural disasters such as floods, droughts, landslides, and urban flooding. It is assessed that Karachi will be exposed to the above mentioned climate change impacts.

CCP recommends the following actions: develop city-specific strategic plans, prepare and enforce legislation for water resource management in industry and domestic sectors with special focus on groundwater, adopt water efficiency measures and technologies, adopt rain harvesting measures, avoid excessive groundwater pumping, reuse wastewater after treatment, take flood protection measures, assess the health vulnerabilities of communities and build their capacities, develop proper disaster management system, redesign and upgrade drainage capacity of cities, strengthen early warning systems, develop enabling mechanisms for the adoption of climate change adaptations and mitigation measures; and conduct awareness campaigns to underscore the importance of conservation and sustainable use of water resources. At present, most of these adaptations are not in practice in Karachi.

CCP recommends the following measures relevant to KWSSIP:

Cities should update town planning design principles for lowering carbon footprints, ensure proper land use planning and encourage vertical instead of horizontal expansion, install wastewater treatment plants, segregate solid waste at source, develop municipal infrastructure in the periphery of urban areas, and conduct hazard mapping and zoning of areas before construction.

Generally, the implementation of CCP is nominal due to limited interprovincial coordination; low capacity of provincial departments, and city authorities; and low level of budgetary allocation for climate smart city development.

4.1.3 National Sanitation Policy 2006

The National Sanitation Policy aims at providing adequate sanitation coverage, an environment necessary for healthy life. The primary focus of sanitation is on the safe containment of excreta away from dwellings and workplaces by use of sanitary latrines and the creation of an open defecation-free environment. It emphasizes safe disposal of liquid and solid wastes and promotes good health and hygiene practices in the country. The basic principles established by the policy are the following: sanitation should be a fundamental human right, schemes should be based on simple cost-effective technologies, and institutional coordination for the installation and O&M of schemes is required. The policy envisaged that sanitation, environment, housing, water, and city and regional planning should be evaluated under an effective institutional and financial framework. It recommends that sanitation schemes should be financed through local resources and implemented by strengthened local and community institutions with the involvement of the Government, private sector, and NGOs. It recommends that installation and O&M of sanitation schemes should be institutionally synchronized. The policy states that needs of women and children should be covered as priority. KWSSIP activities for the sanitation of Karachi are in line with the sanitation policy guidelines.

4.1.4 National Water Policy 2009

The objective of the National Water Policy is to take cognizance of the emerging water crisis and provide an overall policy framework and guidelines for a comprehensive plan of action. This policy is a national framework within which the provinces can develop their master plans for sustainable development and management of water resources.

Following objectives of National Water Policy, among others, address environmental concerns:

- Promoting sustainable consumption and production patterns throughout the water sector from exploitation to utilization

- Augmentation of the available water resources of the country through judicious and equitable utilization via reservoirs, conservation and efficient use

- Promoting behavioral change to reduce wastage of water by raising public awareness through media campaigns and incorporating water conservation lessons in syllabi/curricula at primary, secondary and tertiary levels

- Treatment and possible reuse of waste water - domestic, agricultural and industrial

- Promoting appropriate technologies for rain water harvesting in rural as well as urban areas

- Regulating groundwater withdrawals for curbing over-abstraction and promoting aquifer recharge

- Climate change impact assessment and adaptation for sustainable water resources development and management

Following policy measures address environmental concerns:

Comprehensive Regulatory Framework
The Federal government must play a leading role in facilitating regulations to ensure the efficient and sustainable utilization of ground water, industrial uses, and waste water management. Food security, water security and energy security being inextricably linked, so the regulatory framework must address all the associated issues comprehensively, including ground water contamination, waste treatment, and open defecation (WASH).

Planning Principles
- Efficiency and conservation will be promoted at all levels
- Environmental Sustainability must be ensured

Conservation of Water
The Water Conservation Plans shall include: Conservation of Water: re-use and recycling of municipal and industrial waste water effluent after appropriate treatment at source adoption of rainwater harvesting technology

Industry
The Water Policy accordingly classifies Industry as an important user of water, and the provision of its water needs shall be facilitated. A study shall be undertaken for enactment of legislation to formally allow and define the use of water abstraction licenses and water rates for industrial use.

Industry shall be required to carry out in-house treatment of their wastewater before transfer to municipal sewer as per NEQ standards and the "Polluter Pays" principle shall be strictly enforced.

Existing rules shall be strengthened for effective monitoring/control of pollution as per international standards. The standards of effluent disposal shall be strictly enforced.

Demand Management

It is recognized that fresh water, being a finite resource, cannot fulfill unlimited demand of numerous users. Demand Management of various uses shall, therefore, be accorded high priority.

Demand Management Plans shall be prepared for all uses, specifying measurable targets, and shall be rigidly enforced.

Water use efficiency in all sectors shall be vigorously pursued, and towards this end all avenues like professional, administrative, legal, technologies transfer and research application coupled with appropriate economic and financial incentives shall be explored.

Under National Water Policy, National Water Council is proposed whose responsibility would be to implement the policy measures through different water related public sector organizations.

4.1.5 Pakistan Climate Change Act 2016

The Prime Minister established Pakistan Climate Change Council which coordinates and supervises the enforcement of the provisions of the Act, monitor implementation of the international agreements relating to climate change, approve and monitor implementation of comprehensive adaptation and mitigation policies, strategies, plans, programs, projects and other measures formulated by the authority to meet Pakistan's international obligations, monitor the implementation of National Adaptation Plan and its constituent provincial and local adaptation action plans, approves guidelines for the protection and conservation of renewable and non-renewable resources, species, habitats and biodiversity adversely affected or threatened by climate change.

The Minister In-charge of the Federal Government shall establish the Pakistan Climate Change Authority to exercise the powers and perform the functions under the Act. The functions of the authority shall be to formulate comprehensive adaptation and mitigation policies, plans, programs, projects and measures designed to address the effects of climate change, establish institutional and policy mechanism for implementation of Federal and provincial adaptation and mitigation policies, plans, programs, projects and measures, prepare suitable adaptation and mitigation projects for submission to international and local institutions for funding, including Clean Development Mechanism (CDM), Global Environmental Facility (GEF), Green Climate Fund and Adaptation Fund, prepare National Adaptation Plan and its constituents provincial and local adaptation plans, carry out Technology Need Assessment and prepare Climate Change Technology Action Plan in accordance with international best practices, prepare projects for funding under the Reducing Emissions from Deforestation and Forest Degradation (REDD) Mechanism, prepare guidelines for the protection and conservation of renewable and non-renewable resources, species, habitats and biodiversity which are adversely affected or threatened by climate change, advise Government regarding appropriate legislative, policy and implementation measures and actions relating to disaster preparedness, capacity building, institutional strengthening and awareness raising in relevant sectors affected by climate change, advise the Government regarding implementation of international conventions, design, establish and maintain a national registry and database on greenhouse gas emissions etc.

4.1.6 The Canal and Drainage Act 1873

The Canal and Drainage Act 1873 (CDA) focuses on construction and maintenance of drainage channels and defines powers to prohibit obstruction or order their removal. It briefly addresses issues relating to environmental pollution. Section 70(5) of the CDA clearly states that no one is allowed to "corrupt or foul the water of any canal so as to render it less fit for the purposes for

which it is ordinarily used." In addition, Section 73 of the CDA gives power to arrest without warrant or to be taken before the magistrate a person who has willfully damaged or obstructed the canal or "rendered it less useful."

4.1.7 Pakistan Penal Code

The Penal Code discusses offences where public or private properties and/or human lives are affected due to intentional or accidental misconduct of an individual or body of people. The Code defines the penalties for violations concerning pollution of air, water bodies and land. In the context of this program, the Penal Code can provide a basis for the infrastructure projects to coordinate activities with the local authorities to ensure that construction and operation activities do not become a cause of public nuisance or inconvenience.

4.1.8 The Antiquities Act, 1975

This Act defines how to repeal and reenact the law relating to the preservation and protection of antiquities. The federal government may, by notification in the official Gazette, declare any antiquity to be a protected antiquity for the purposes of this Act. A contravention of any provision of this Act or the rules shall, where no punishment has been specification provided, be punishable with rigorous imprisonment for a term which may extend to six months or with a fine which may extend to PKR 5,000, or with both.

4.2 Provincial Policies and Strategies, and Laws

This section briefly describes different laws, policies and strategies of Sindh province for the environmental compliance of proposed projects mentioned in the previous chapters.

4.2.1 Sindh Strategy for Sustainable Development, 2007

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

Planning and Development Department Government of Sindh is responsible for the overall coordination of SSSD. The SSSD recommends that the rehabilitation and extension of water supply and sanitation networks, effective water and wastewater quality monitoring and treatment to comply with SEQS, improved coordination among stakeholders (public agencies, private sector, and residents) for the effective management of air pollution, consultation based infrastructure planning and development with main focus on minimizing traffic and pollution hazards, and conducting environmental impact assessment of all the major projects. In addition, the SEPA should be strengthened for effective monitoring of pollution, especially in the case of industries.

SSSD recommends for the sustainable development and environmentally complying operations of industries: incentive mechanisms for reducing pollution; awareness raising of industrialists and stakeholders; promote cleaner production; enforce pollution charges as per SEPA 2014; prepare baseline of all industrial estates and sites to establish the pollution levels, waste disposal practices, air emissions, generation of hazardous waste for the preparation of environmental management plans for complying SEPA 2014; preparation of EIAs for all industrial development and infrastructure projects.

4.2.2 Sindh Sanitation Policy 2017

The vision of the policy is to provide the population of Sindh the better sanitation service and to make sure that the entire population of Sindh has access to a safely managed sanitation service and sanitary environment that is also nutrition sensitive and hygienic.

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

The policy is built upon thirteen principles including i) alignment with the goals and targets of the Sindh Development Goals (SDGs) for sanitation, ii) adherence to the pursuit of total sanitation as outlined in Pakistan Approach to Total Sanitation (PATS), within the province, iii) safely managed sanitation services for all persons in Sindh province, iv) prioritize the areas that pose the greatest risk to human health namely hygiene awareness and excreta disposal, v) recognizing that inadequate and unsafe water supply and sanitation as major cause of diarrhea and nutritional deficiency in children, vi) increase access to high quality nutrition sensitive services, including access to water, sanitation facilities and hygiene, vii) integrating key hygiene actions (safe drinking water, hand washing with soap, safe disposal of excreta, and food hygiene) and essential components in all nutrition programs, viii) promoting community led approaches to strengthen the demand for safely managed improved sanitary conditions, ix) identification and marketing of affordable (in terms of designs as well as availability of water) and cost effective technical solutions, x) ensuring the sustainability of the services by mobilizing and engaging existing structures, xi) envision of component sharing model in the National Sanitation Policy, xii) the role of women as an integral component of behavioral change communication strategies and project planning, implementing and monitoring, xiii) establishing and maintaining an independent monitoring and evaluation system to track progress.

4.2.3 Sindh Drinking Water Policy 2017

The vision of the policy is to provide safely managed drinking water whose supply is adequate, well maintained and sustainable and to enhance public awareness about health, nutrition and hygiene related to safe drinking water.

The main principles of the policy are aligned with the National Drinking Water Policy 2009 and sustainable development goals. These principles are mainly based upon access to safely managed drinking water to every citizen, water allocation for drinking purpose as the priority over other uses, removing the existing disparities in coverage of safe drinking water and addressing the needs of the poor on priority basis, recognizing the cause of diarrhea and nutritional deficiency in children due to inadequate and unsafe water supply and sanitation, increase the access to high quality nutrition sensitive services (including access to water, sanitation facilities and hygiene), integration of key hygiene actions (safe drinking water, hand washing with soap, safe disposal of excreta, food hygiene) as essential components in all nutrition programs, realizing the fact that access and availability of safe drinking water affects all aspects of life of a citizen, ensure women participation in planning, implementation, monitoring and operation and maintenance of water supply systems, delegation of responsibilities and resources to local authorities for the provision of safe water supply, development of supportive policy framework to encourage alternative options through stakeholders, promotion of execution of component sharing model for government programs and projects to ensure financial sustainability and development and use of low cost technologies in water and sanitation.

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

The specific objectives address mainly the introduction of legislative measures to create enabling environment, involvement of community in the water supply systems, development of district level drinking water availability plans, enhance the coverage of the safely managed drinking water in the province, development of criteria for installation of new drinking water supply schemes, standardized service delivery models for both urban, and rural drinking water supply schemes to improve efficiency and mechanisms for reuse, recycle and recharge of wastewater for other municipal and productive uses, ensuring the compliance of all the drinking water supply schemes and municipal discharges with the environmental quality standards, installation of water treatment plants at existing drinking water supply schemes, development of water safety plans for all drinking water supply systems, develop and sustain regular drinking water quality monitoring and surveillance and remedial action, increase public awareness about water related diseases, nutrition and hygiene, ensuring drinking water supply projects to be nutrition sensitive, institutionalize Water, Sanitation & Hygiene (WASH) in school and institute adaptation measures and disaster risk reduction and mitigation strategies to minimize the impact of climate events on drinking water supply systems.

4.2.4 Karachi Strategic Development Plan 2020

The vision of Karachi Strategic Development Plan 2020 (KSDP) is to *"transforming Karachi into a world class city and attractive economic center with a decent life for Karachiites"*. The objectives of KSDP-2020 are: (a) design future growth of Karachi based on its strengths and potential; (b) sustainable growth by integrating various development activities under holistic vision; (c) identification of social, economic, environment, and urban infrastructure issues; (d) development of strategic framework for city development; and (e) establish collaborative institutional arrangement with the participation of stakeholders and citizens.

Implementation of the KSDP-2020 is provided a legal coverage under Section 40 of the Sindh Local Government Ordinance 2001 (SLGO). SLGO makes it mandatory for all the development agencies in Karachi to follow the plan for planned and coordinated development of Karachi. KSDP proposes the establishment of new industrial parks or zones. KSDP recognizes that higher level of air pollution persists in the city due to automobile and industrial emissions, open burning of solid waste, and other domestic and commercial emissions. Hazardous industrial waste is burned in substandard incinerators resulting hazardous emissions.

KSDP recommends renewal and maintenance of current buildup areas rather than spatial expansion.

4.2.5 The Karachi Water and Sewerage Board Act, 1996 (KWSB Act)

Under KWSB Act 1996, board was established for supply of water and disposal of sewerage in the Karachi Division.

Powers and Functions of the Board: The Board shall i) sanction the fees and levy for water connections, water supply to tankers and sewerage connections and collect the charges, ii) reduce, suspend or disconnect the water supply and impose surcharges, if dues are not paid within the due time, iii) make regulations with the approval of the Government, iv) undertake construction improvement, maintenance and operation of water works and sewerage works, v) assess the position of water supply from time to time and regulate water supply, vi) review the

existing schemes or prepare new schemes relating to water works and sewerage work and undertake execution with the approval of Government, vii) regulate, control or inspect water connection, sewer lines and service lines, viii) produce and supply of potable water, ix) place, maintain aqueducts, conduits, sewers etc.

Supply of Water and Execution of Schemes: The Board shall i) be responsible for the bulk production of potable water and its distribution, ii) ensure that the water supplied by it is duly filtered, treated and tested and is fit for human consumption, iii) arrange retail distribution of water within its jurisdiction excluding the areas receiving water supply through constituent Bodies, iv) supply water to any person or authority in the area or areas notified under this Act (subject to availability), v) continue to make bulk water supply to the constituent Bodies (Karachi Port Trust, Cantonment Board of Karachi, Sindh Industrial & Trading Estate, Karachi Pakistan Steel Mills, Defense Service or any other body or organization notified by Government) at such rates and subject to such terms and conditions as may be determined by the Board, vi) continue to execute the Hub Dam Water Supply Stage I and Phase-IV of the Greater Karachi Bulk Water Supply Stage I and Sewerage Disposal Projects, vii) have right to place and maintain aqueducts, conduits and lines of mains, drains, sewers or pipes, over, under, along or across any immovable property without acquiring such property, and to enter on such property for the purpose of examining, repairing, altering or removing any aqueducts, conduits or lines of mains, sewers or pipes.

4.2.6 Sindh Environmental Protection Act 2014 (SEPA 2014)

SEPA 2014 is the overriding environmental legislation in the province of Sindh. SEPA 2014, Section 35 states that the provisions of this Act shall have effect notwithstanding anything inconsistent therewith contained in any other law in force for the time being.

After the 18th Constitutional Amendment, environmental management has been delegated to the provincial governments. The environmental management of the province is mainly governed under the SEPA 2014, which is a replica of the Pakistan Environmental Protection Act of 1997 with some amendments. The law is comprehensive and provides the basic framework for environmental management of the province. The main focus of the law is on sustainable development, protection, conservation, rehabilitation, and improvement of environment. It instructs the provincial government to establish the Sindh Environmental Protection Council. Under the law, Environmental Impact Assessment/Initial Environmental Examination (EIA/IEE) is essentially required for all the projects before commencing any construction activity. It prohibits specified discharges and emissions. Sindh Environmental Quality Standards are an essential part of the law. The SEPA empowers the provincial government to issue notices and to enforce the Act for the protection of the environment.

SEPA 2014 is comprehensive with respect to its legal coverage for ensuring environmental compliance by all types of interventions in rural and urban areas and economic development sectors. Provisions of Section 11 establish that the law is universal and it is applied to all sources of pollution and threats to natural resources. The priority of SEPA is environmental compliance by industry, with more emphasis on industry located in urban setups. On the other hand, regulatory focus of SEPA on rehabilitation projects of water supply, sanitation, roads, and urban spaces, and small and medium enterprises (SMEs) is nominal.

SEPA 2014 has established the Sindh Environmental Quality Standards (SEQS). These are discharge standards and are applicable at the point of discharges of emissions. SEQS are relevant for wastewater treatment plants and landfills activities. SEPA 2014 states that noncompliance with SEQS and not paying pollution charges will invoke implementation of punitive sections of the Environmental Protection Order and penalties to every noncomplying person, corporate body, Government agency, local authority, or local councils. Cases challenged by the parties will be settled by the Environmental Magistrates and Tribunals, and if required, the cases

can also be appealed in the higher courts. Standards for the following types of effluent and emissions are specified in the SEQS and may be relevant to the specified projects:

1) Municipal and liquid industrial effluent parameters (32) for discharge to inland waters, sewage treatment facilities, and the sea

2) Industrial gaseous emissions (16) into the atmosphere

3) Motor and vehicle exhaust and noise (3 to 5)

4) Ambient air quality (9)

5) Drinking water quality (33)

6) Noise standards for residential, commercial, industrial, and silence zones

Ambient standards will be highly relevant to the project activities. SEPA 2014, under Section 6 (1) (g) states *where the quality of ambient air, water, land or noise so requires, the Agency may, by notification in the Official Gazette establish different standards for discharge or emission from different sources and for different areas and conditions as may be necessary; Provided that where these standards are less stringent than the Sindh Environmental Quality Standards; prior approval of the Council shall be obtained.*

SEPA 2014 instructs the proponents of projects to conduct and submit IEE or EIA study, according to the size and impacts of the subprojects of the Program. In the context of the KWSSIP, IEEs/EIAs will be required for new water supply and sanitation schemes, and wastewater treatment plants. Section 17 of SEPA 2014 establishes that, "no proponent of a project shall commence construction or operation unless he has filed with the Agency an IEE or EIA, and has obtained from the Agency approval in respect thereof." Under SEPA 2014, public participation through public hearing is essential part of IEE/EIA reports approval. Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2014, stipulate the complete approval system for IEEs and EIAs.

a) Sindh Environmental Protection Agency (Review of IEE and EIA Assessment) Regulations, 2014

This document sets out the key procedural requirements for conducting an IEE and EIA. The document lists the responsibilities of proponents and duties of responsible authorities and provides schedules of proposals for determining whether the project requires IEE, EIA or screening under Schedules I, II, and III respectively and lays down the procedures for Environmental Approval and for filing the case with the SEPA to receive the NOC.

The Regulations also provide the necessary details on the preparation, submission, and review of IEEs and EIAs. The following is a brief step-by-step description of the approval process:

1. To determine whether a subproject is categorized as requiring an IEE, EIA or screening as per three schedules.
2. An EIA, IEE or screening is conducted according to the requirements outlined in the SEPA guidelines.
3. The fee (depending on the cost of the subproject and type of report) is submitted along with the EIA or IEE document.
4. IEE/EIA is also accompanied by an application in the format prescribed in Schedule V of the Regulations.

5. The SEPA conducts a preliminary review of the report and replies within 15 days of the submission. It either (i) confirms completeness; (ii) asks for additional information, if needed; or (iii) returns the report and asks for additional studies, if necessary.
6. The Agency shall make every effort to carry out its review of the environmental checklist within thirty days, IEE within sixty days, and of the EIA within four months of issue of confirmation of completeness under regulation 9.
7. The SEPA accords its approval, subject to certain conditions:
8. Before commencing construction of the subproject, the proponent is required to submit an undertaking accepting the conditions.
9. Before commencing operation of the subproject, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of IEE.
10. An EMP is to be submitted with a request for obtaining confirmation of compliance.
11. The EPAs are required to issue confirmation of compliance within 20 days of receipt of the request and complete documentation.
12. IEE/EIA approval is valid for three years from the date of operational phase NOC.
13. After completion of construction, a monitoring report is to be submitted to the SEPA, followed by annual monitoring reports, during operations.

In the case of wastewater discharges in the canal system and use of wastewater for irrigation purposes, Section 11 of SEPA 2014 establishes that “no person shall discharge or emit or allow the discharge or emission of any effluent or waste in excess of SEQS” and “if the water is conforming SEQS, it can be used for irrigation purposes, otherwise not.”

4.2.7 The Sindh Local Government Act 2013

Under the Sindh Local Government Act 2013 (SLGA), Chapter VI, land use planning; implementation of building by-laws; management of environmental and health hazards; food adulteration; provision and maintenance of water supply schemes and public sources of drinking water; and mobilization of communities for the upgrade of local infrastructure (transportation, landscaping, and removal of encroachments) are the responsibilities of municipal corporations/committees.

Under Chapter VI, the district council is responsible for the overall welfare of the population (health and safety); improvement and maintenance of district main transportation routes including removal of encroachments and other local infrastructure (such as open spaces, graveyards, public open spaces); assistance to relevant authorities in the provision of relief services in the case of natural calamities (fire, flood, hailstorm, earthquake, and epidemic); control over land use and spatial planning (including agriculture, industry, commerce, residential, and so on); and enforcement of municipal laws.

Under the second and fourth Schedules, both municipal committees and union councils are responsible for the management of dangerous and offensive articles and their trade.

Under the Sixth Schedule Part-I and Part-II of the Act, it is an offence and the Local Government (LG) can take the offender to court for discharging of chemicals in any drain, public watercourse, and public land that is likely to cause public health hazards; industry and commercial concerns disposing affluent in the water supply and sewerage system; adulteration of eatables and drinkables items; cultivation of agriculture produce or crop by irrigating with sewer water or any such liquid; and dumping of solid waste and refuse in a place other than a landfill or dumping site, establishing a brick kiln, lime kiln, charcoal kiln, or pottery within such distance of the residential area as may be specified by the Council, dyeing or tanning skins within such distance of any

commercial or residential areas as may be specified by the local government, and damaging or polluting physical environment, inside or outside private or public premises, in a manner to endanger public health.

4.2.8 The Sindh Wildlife Protection Ordinance, 1972

The ordinance requires the protection of wildlife species declared as protected and game animals. Ordinance declares certain areas as national parks and game reserves where hunting and spoiling of its natural landscape and environment is prohibited.

4.3 World Bank Safeguard Policies

The proposed projects trigger the following World Bank safeguard policies:

- Environmental assessment OP 4.01
- Natural Habitats OP 4.04
- Physical Cultural Resources OP 4.11

4.3.1 Environmental Assessment OP 4.01

This policy requires environmental assessment (EA) of projects proposed for World Bank financing to help ensure that these are environmentally sound and sustainable, and thus to improve decision making. The EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The Bank favors preventive measures over mitigatory or compensatory measures, whenever feasible.

The EA takes into account the natural environment (air, water, and land); human health and safety; social aspects (including physical cultural resources) and trans-boundary and global environmental aspects. EA considers natural and social aspects in an integrated way. It also takes into account the variations in project and country conditions; the findings of country environmental studies; national environmental action plans; the country's overall policy framework, national legislation, and institutional capabilities related to the environment and social aspects; and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements. The EA is initiated as early as possible in project processing and is integrated closely with the economic, financial, institutional, social, and technical analyses of a proposed project.

As per the policy, the Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of the environmental assessment. The Bank classifies the proposed projects into one of four categories of A, B, C and FI depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

4.3.2 Natural Habitats OP 4.04

The conservation of natural habitats like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development.

The Bank does not support projects that, in the Bank's opinion, involve the significant conversion or degradation of critical natural habitats. Where feasible, Bank-financed projects to be sited on lands already converted (excluding any lands that in the Bank's opinion were converted in anticipation of the project). The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs. If the environmental assessment indicates that a project would significantly convert or degrade natural habitats, the project includes mitigation measures acceptable to the Bank. Such mitigation measures include, as appropriate, minimizing habitat loss (e.g. strategic habitat retention and post-development restoration) and establishing and maintaining an ecologically similar protected area. The Bank accepts other forms of mitigation measures only when these are technically justified.

4.3.3 Physical Cultural Resources OP 4.11

This policy addresses physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower's national legislation, or its obligations under relevant international environmental treaties and agreements.

The borrower addresses impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment process.

5.0 POTENTIAL ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

This chapter describes potential generic environmental risks and impacts (direct, indirect/induced and cumulative) to be caused by the project's construction and operation phases on surrounding environment and community. It also describes mitigation measures as per mitigation hierarchy (avoidance, minimization or reduction, mitigation, compensate/offset).

5.1 Project Activities

Table 9 describes type of project and associated activities which could result into potential environmental risks and impacts.

Table 9: Project Activities

#	Project	Activities
1	Sewerage system rehabilitation Priority sewer network rehabilitation	i) Laying new pipelines a) Clearing of the area (cutting of tress, bushes, crops etc.) b) Excavation c) Bedding d) Laying of pipelines d) Joining/welding e) Backfilling ii) Repair and maintenance of old pipelines a) Excavation b) Removal of pipelines c) Laying of pipelines d) Joining/welding e) Backfilling f) Road Restoration by the respective agency
2	Water supply improvement Priority water network rehabilitation	i) Laying new pipelines a) Clearing of the area (cutting of tress, bushes, crops etc.) b) Excavation c) Bedding d) Laying of pipelines d) Joining/welding e) Backfilling ii) Repair and maintenance of old pipelines a) Excavation b) Removal of pipelines

		c) Laying of pipelines d) Joining/welding e) Backfilling
3	Malir basin wastewater interceptors	a) Clearing of the area (cutting of tress, bushes, crops, garbage etc.) b) Excavation c) Bedding d) Laying of pipelines d) Joining/welding e) Backfilling f) Temporarily diversion of feeder wastewater pipelines/creeks g) Waste generation from cleaning of screens (operational phase) h) Operation of disposal pumps (operational phase)
4	Desalination plant	a) Construction of desalination plant (Reverse Osmosis-RO based) b) Operation of RO plant i) Disposal of brine
5	Wastewater treatment Wastewater treatment for reuse S IV wastewater collection and treatment	a) Construction of wastewater treatment plant b) Operation of treatment plant i) disposal of sand and grit ii) disposal of sludge iii) disposal of effluent of plant or re-use

5.2 Potential Environmental Impacts

Table 10 presents environmental aspects and potential impacts of the project activities.

Table 10: Environmental Aspects and Potential Impacts

#	Project	Activities	Environmental Aspects	Potential Environmental Impacts
1	Sewerage system rehabilitation Priority sewer network rehabilitation	i) Laying new pipelines a) Clearing of the area (cutting of tress, bushes, crops etc.) b) Excavation c) Bedding d) Laying the pipelines d) Joining/welding e) Backfilling ii) Repair and maintenance of old pipelines a) Excavation b) Removal of pipelines c) Laying the pipelines d) Joining/welding e) Backfilling	**Construction Phase** <u>Vegetation</u> loss of trees, plants, crops etc. due to clearing of land for camp sites, laying pipelines and building infrastructure <u>Natural Habitats</u> Destroying natural habitats (terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the nonliving environment.) <u>Physical Cultural Resources (PCRs)</u> Presence of PCRs at the project sites <u>Air Quality</u> i) Fugitive emission of dust (SPM, PM_{10}, $PM_{2.5}$) from excavation and vehicular movement ii) Stack emissions from generators iii) Vehicular emission iv) emission from welding activities <u>Wastewater</u> i) Generation of sanitary wastewater from construction camps <u>Solid Waste</u> i) Generation of domestic solid waste from construction camps	**Construction Phase** <u>Vegetation</u> Loss of top soil, air pollution, soil erosion, loss of aesthetic of the area <u>Natural Habitats</u> Loss of natural habitats and biodiversity <u>Physical Cultural Resources (PCRs)</u> Loss of PCRs at the project sites <u>Air</u> air pollution resulting in poor visibility, loss of vegetation, property damages, acid rain, soil contamination and health implications on workers and nearby community <u>Wastewater</u> soil and water contamination, odor, health implications (due to breeding of mosquitos and flies), and nuisance due to improper treatment and disposal of sanitary wastewater from construction camps <u>Solid Waste</u> i) nuisance, health implications on workers and community (due to breeding of mosquitos and flies) (if not disposed/treated properly)

#	Project	Activities	Environmental Aspects	Potential Environmental Impacts
			ii) Generation of empty chemical, paint, lubrication/grease, and fuel containers iii) dismantled pipelines iv) Generation of excavation material, debris etc. <u>Soil</u> i) Spillage and leakage of chemicals, fuel, lubricant on soil ii) storage of oily parts and rags on unpaved floors <u>Noise</u> Noise from construction machinery, generators, construction activities and vehicular movement <u>Safety</u> i) Safety concerns of workers ii) Safety concerns for the nearby community/passersby **Operation Phase** i) leakages in the sewers ii) damaging of sewers iii) clogging of sewers iv) Overflowing sewage due to malfunctioning of disposal pumps v) Release of aerosols and odors (H2S, NH3, amino acid and mercaptan) from	ii) soil contamination due to improper disposal of hazardous solid waste <u>Soil</u> soil contamination <u>Noise</u> Nuisance, health implications on workers and nearby community, loss of biodiversity <u>Safety</u> Safety hazards for workers and community <u>Traffic Congestion and access restrictions at or around construction sites due to construction activities</u> **Operation Phase** i) soil and water contamination due to leakages in the sewers ii) odor and outbreak of diseases due to leakages, and damaging of sewers and malfunctioning of disposal pumps iii) The gases from manholes and interceptors can affect the workers, who dredge manholes without preventive measures

#	Project	Activities	Environmental Aspects	Potential Environmental Impacts
			manholes and the interceptor line when the dredging and repair are carried out	
2	Water supply improvement Priority water network rehabilitation	i) Laying new pipelines a) Clearing of the area (cutting of tress, bushes, crops etc.) b) Excavation c) Bedding d) Laying the pipelines d) Joining/welding e) Backfilling ii) Repair and maintenance of old pipelines a) Excavation b) Removal of pipelines c) Laying the pipelines d) Joining/welding e) Backfilling	**Construction Phase** As above **Operation Phase** i) improper functioning of water treatment facilities (chlorination, filtration etc.) ii) leakages in water supply pipelines iii) Damages in water supply pipelines iv) Improper functioning of water pumps v) Energy inefficient operation of water supply pumps	**Construction Phase** As above **Operation Phase** i) water borne diseases (if no proper treatment) ii) shortage of water supply iii) water contamination due to damaging pipelines
3	Malir basin wastewater interceptors	a) Clearing of the area (cutting of tress, bushes, crops etc.) b) Excavation c) Bedding d) Laying the pipelines d) Joining/welding e) Backfilling	As above for sewerage system rehabilitation projects including operation of disposal pumps (energy consumption)	As above for sewerage system rehabilitation including resource depletion (energy) and air emissions

#	Project	Activities	Environmental Aspects	Potential Environmental Impacts
4	Desalination plant	a) Construction of desalination plant (Reverse Osmosis-RO based) b) Operation of RO plant	**Construction Phase** As above **Operation Phase** i) noise ii) seawater intake iii) water pretreatment iv) chemical dosing for cleaning v) production of brine (concentrate) vi) leakages in the underground pipelines vii) generation of sludge from pretreatment viii) spillage and leakage of chemicals ix) energy consumption	**Construction Phase** As above **Operation Phase** i) health implications on workers and nearby community and loss of biodiversity due to noise ii) fish damage from seawater intake iii) seawater contamination due to discharge of brine, chemical cleaning solutions and sludge from water pretreatment, containing chemicals and salts iv) contamination of aquifer iv) soil contamination due to chemicals spillage and leakages v) Resource depletion (energy)/air emissions
5	Wastewater treatment Wastewater treatment for reuse S IV wastewater collection and treatment	a) Construction of wastewater treatment plant b) Operation of treatment plant	**Construction Phase** As above **Operation Phase** i) noise (machinery and vehicular) ii) odor iii) air emissions/aerosols from aeration/biological tanks	**Construction Phase** As above **Operation Phase** i) health implications and loss of biodiversity due to noise ii) Health implications for workers and nearby community due to air

#	Project	Activities	Environmental Aspects	Potential Environmental Impacts
			iv) generation of sludge v) breeding of mosquitos/flies vi) Spillage and leakage of chemicals, lubricants on soil viii) malfunctioning of the plant (due to equipment failure or improper process control) ix) health and safety concerns of the workers x) energy consumption	emissions, odor and breeding of mosquitos/flies iii) surface water (receiving bodies) contamination due to improper functioning of the plant iv) soil contamination due to storage of oily parts and rags on unpaved floors, spillage and leakage of chemicals/lubricants/fuel on soil and improper disposal of sludge v) nuisance at the areas due to sitting of the plant vi) resource depletion (energy)/air emissions **Positive Impacts** i) Overall improvement of water quality of creeks, Malir and Lyari rivers ii) Improvement of sea water quality iii) Better health situation iv) Availability of water (reuse of wastewater)

5.3 Mitigation Measures

Following section describes detail of the mitigation measures for the above identified potential environmental impacts in Table 5 for the construction and operation phases of the project activities.

5.3.1 Construction Phase Mitigation Measures

Following are the construction phase mitigation measures for all the project activities.

- Campsite management
- Avoidance of clearing vegetation and restoration of the site by planting trees/crops
- Protection of natural habitats
- Protection of Physical Cultural Resources (PCRs)
- Suppression of dust emission
- Control of stack and vehicular emissions
- Safe disposal of sanitary wastewater
- Safe disposal of domestic solid waste
- Safe disposal of hazardous and construction waste
- Soil pollution control
- Noise abatement
- Protection of workers from health and safety hazards
- Protection of community from accidents
- Traffic management
- Restoration of campsites

The main responsibilities for implementing mitigation measures during the construction phase rest with the contractors appointed to carry out the projects related to water supply, sewerage and drainage, and water and wastewater treatment. The KWSB will, however, be responsible for monitoring the implementation of mitigation measures by the contractors; therefore, KWSB will implement a system of internal checks to ensure that these actions are carried out to a satisfactory standard. In exceptional circumstances, if the contractors refuse to adhere to the requirements of the mitigation plan contained in the contract documents, then the KWSB may need to use their authority to call a halt to a particular construction activity.

To avoid any misunderstandings regarding who is responsible for any particular mitigation activities recommended for the construction phase, the Construction Phase Environmental Mitigation Plan (CPEMP) will be appended to the Bidding documents. This will ensure that contractors include in their bids the cost of any mitigation actions and also a reliable mechanism for enforcement. In fact, most of the recommended actions involve little or no capital investment, but they also depend on whether the contractor's management adopts a responsible attitude toward environmental protection, thereby ensuring that the construction activity is properly planned and that mitigation measures are properly implemented. The recommended mitigation actions for the construction phase are given under:

a) Campsite Management:

The location and development of the Contractor's facilities (this applies to all types of facilities, storage areas, workshops, and labor camps) will be approved by KWSB. Locations will be selected so that it does not interfere with the environment and social well-being of the surrounding communities in respect to noise, dust, vibration and other physical impacts. The construction labor camps shall be located at least 500 m away from the nearest habitation

The size of contractor‘s facilities are limited to absolute minimum to reduce unnecessary clearing of vegetation.

b) Avoidance of Clearing Vegetation and Restoration of the Site by Planting Trees/Crops

Where grading or excavation occurs within farmland, topsoil shall be separated and stockpiled during the construction period. The topsoil stockpile shall be secured with plastic. Following construction, the topsoil shall be applied evenly to the site during the restoration process. The topsoil shall be properly compacted and stabilized to prevent erosion and sediment transport.

During the design stage of the project and finalizing the project location and alignment for the pipe laying, it should be the priority to avoid those areas where there are chances of cutting of significant trees and clearing of vegetation/crops. In case if it is not possible to avoid, then the project site would be restored to its original as much as possible by planting trees, vegetation and crops at the cleared land. All works shall be carried out in a fashion that ensures minimum damage or disruption to the flora. The contractor shall be responsible for the restoration of the site and KWSB will ensure restoration as per the requirements.

c) Protection of Natural habitats:

During site selection and finalization of pipelines and sewers alignment, the protection of the natural habitats shall be the high priority area. The natural habitats are defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the nonliving environment. Alternatives will be considered for site selection and pipelines and sewer alignments, in case of presence of natural habitats at the project areas to protect them at best.

During environmental assessment, surveys will be conducted for rare plants and priority or endemic wildlife species prior to civil work activities at all the sites. If any rare plants or sensitive wildlife species occur at the construction sites, the sensitive resource shall be fenced, and no activities will be allowed within 15 meters (50 feet) of the resource.

Prior to construction activities during the nesting season, a qualified biologist will survey potentially suitable nesting habitat for priority species birds. If active nests are identified, a qualified biologist will monitor the nesting birds’ responses to the loudest level of construction noise for an appropriate duration. If the nesting birds show signs of disturbance that could result in nest failure, all work activities that disturb the birds shall be temporarily halted and visual and acoustic barriers will be erected between the nesting location and work areas. Installation of any visual and acoustic barriers shall be overseen and approved by the qualified biologist.

d) Protection of Physical Cultural Resources (PCRs):

All necessary and adequate care shall be taken to minimize impact on cultural properties which include cultural sites and remains, places of worship including mosques, churches, etc., graveyards, monuments and any other important structures as identified during design and all properties / sites / remains notified. No work shall spill over to these properties, premises and precincts. The design options for cultural property relocation and enhancement need to be prepared. All conservation and protection measures will be taken up as per design.

During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archaeological significance, the same shall be intimated to the KWSB. Work will suspend until further orders from the KWSB. The Archaeological Department will be intimated

of the chance find and the KWSB will carry out a join inspection with the department. Actions as appropriate will be intimated to the Contractor along with the probable date for resuming the work. The contractor workers will be sensitized and fully informed about the importance of PCRs before the commencement of the work as their negligence during excavation and construction activities could damage these resources. All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest discovered on the site will be the property of the Government, and will be dealt with as per provisions of the relevant legislation.

e) Suppression of Dust Emission:

Regular water sprinkling will be the responsibility of the contractor at the dust generation points, during construction activities. The water will be also sprinkled at vehicular and machinery movement routes to avoid dust spreading to the nearby community. In addition, the provision of dust masks and ensuring their use by the workers will also be the responsibility of the contractor under CPEMP.

f) Control of Stack and Vehicular Emissions:

The stack emissions from generators, if used as standby source of power supply and vehicular/machinery movement at the site can affect the ambient air quality at project site. It will be the responsibility of the contractor to use well maintained generators and vehicles/machines to keep ambient air quality within the desired level. The contractor shall be obliged to provide fitness certificate/maintenance records of the generators, vehicles and machines before deploying them at the construction sites.

g) Safe Disposal of Sanitary Wastewater:

Generally proper disposal of sanitary wastewater is not practiced during construction at construction camps. It will be the responsibility of the contractor to dispose sanitary wastewater in a nearby drain after passing it through septic tanks. The contractor can also plan to include temporary septic tanks for the construction crew.

h) Safe Disposal of Domestic Solid Waste:

Improper disposal of domestic solid waste from construction camps leads to air, water and soil pollution in case if it is burnt, thrown in the surface water drains or on open land. The solid waste dumping site becomes breeding place for mosquitos and flies which could be the source of outbreak of diseases. The construction contractors will implement a Waste Management Plan (mentioned in CPEMP). At a minimum, the plan will address the sources of waste; waste minimization, reuse, and recycling opportunities; and waste collection, storage, and disposal procedures. The Waste Management Plan would distinguish between solid and liquid waste, as applicable, and include procedures for addressing waste that may be hazardous to health and the environment. In addition, the Waste Management Plan will address the following:

- All food waste will be contained in covered bins and disposed of on a frequent basis to avoid attracting wildlife.
- Trash bins will be accessible at all locations where waste is generated.
- The project area will be kept clean and free of litter and no litter will be allowed to disperse to the surrounding area.
- Solid waste will be removed from the site and transported to a municipal landfill or disposal site.
- Waste will not be dumped or buried in unauthorized areas or burned.
- Human waste associated with the worker camp and latrines will be properly contained and disposed of.

The construction contractors will ensure all workers receive training on proper disposal of all waste prior to working on the project site.

i) Safe Disposal of Hazardous and Construction Waste

During construction activities different types of hazardous solid waste including empty containers of paint, lubricants, grease, fuel etc. oil filters, oily rags and construction waste are generated. The hazardous waste will be properly collected and stored at impervious surface under shade. This waste will be handed over to the authorized waste collectors so that these could be disposed of properly. The construction contractors will implement the Hazardous Solid Waste Management Plan (mentioned in CPEMP). The Hazardous Solid Waste Management will identify proper management procedures for all hazardous materials and wastes that may be encountered during construction, including handling, labeling, transporting, and storing procedures. In addition, the plan will address the following:

- Non-toxic and biodegradable produces will be used whenever possible.
- Hazardous materials will be transported and stored in appropriate containers with clearly visible labels. Hazardous materials will be stored at least 100 feet from any down gradient drainage or within secondary containment capable of containing its entire volume.
- Storm water flows will be directed away from hazardous material storage areas.
- Equipment and work areas will be regularly inspected for signs of leaks and spills. Spill containment and cleanup kits will be available wherever hazardous materials are being used or stored. Any incidental spills or leaks will be contained and cleaned up as soon as it is safe to do so. Any contaminated soil will be collected and disposed of in an appropriate land fill.
- Equipment refueling and maintenance will be limited to designated areas at least 30 meters (100 feet) from any down gradient drainage.

All workers will receive training on proper handling and storage of hazardous materials, as well as spill response and cleanup procedures, prior to working on the project site.

The debris produced during construction would preferably be dumped at nearby depressions rather than being thrown away and left unattended. Leftover material would not be dumped into storm water drains or watercourses, because such practices can clog these man-made and natural drainage systems and cause many other problems for the residents.

j) Soil Pollution Control

Soil pollution can be controlled by taking following measures:

- Storage of fuel, paint, and oil containers, oil filters, oily parts and oily rags on impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 6 inch thick, done on brick edge flooring lined with polyethylene sheet
- Placement of fuel containers under containment and proper decantation arrangement to avoid its spillage and leakage on floor
- Presence of spill kit to remove spills from the floor
- Avoid washing the contaminated floors rather dry cleaning the spills from the floor with saw dust and rags
- Location of fuel storage and refilling areas at least 500 m from all cross drainage structures and important water bodies

k) Noise Abatement

To minimize noise impacts on workers and nearby communities, the following measures will be taken:

- Carry out regular inspection and maintenance of the construction vehicles and equipment
- Replace worn and noise producing parts of construction machinery in a timely manner
- In case of severe noise, use sound barriers to avoid the dispersion of sound waves into the nearby community
- Workers should use noise protection equipment when working in a noisy area.
- The noise level of 85 dBA for 8 hour working for the workers is considered safe. The contractors should ensure keeping noise levels within safe limits. In case of higher noise levels (more than 85 dBA), the workers should be rotated. The workers at higher noise level areas should not be allowed to work for more than two to three hours and shifted to calm places for rest of the hours
- Vehicular and machineries are not allowed to operate at project site at night
- Noisy machines and vehicles are not allowed to be used at the project site (noise level should not be more than 85 dBA at 7.5 m distance)

l) Protection of Workers from Health and Safety Hazards

The contractor is required to comply with all the precautions as required for the safety of the workforce as per the national/provincial and World Bank requirements. Contractor has to ensure that all operators of heavy or dangerous machinery are properly trained/certified, and also insured. The contractor shall supply all necessary safety appliances such as safety goggles, helmets, masks, safety shoes etc., to the workers and staff. The contractor has to comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. Medical facilities shall be provided to the labor at the construction camp. Suitable transport will be provided to take injured or ill person(s) to the nearest approachable hospital. First Aid Box will be provided at every construction campsite and under the charge of a responsible person who shall always be readily available during working hours. The contractor shall be responsible for providing safe drinking water and for implementing appropriate sanitation conditions, and for supplying hygienic food and a sewerage system for the construction team at the site.

The risk of fires shall be evaluated for each project site based on the activities that would occur, environmental conditions, and presence of ignitable or combustible materials in the area. If the activities pose a risk of igniting a wildfire, appropriate fire prevention and response equipment shall be available at each active site such as shovels, axes, fire extinguishers, and dedicated water tanks. All workers shall be trained on proper fire prevention and response procedures prior to working on the site. Any smoking on site shall be restricted to barren areas away from ignitable or combustible material. Smoking waste shall be fully extinguished and disposed of appropriately.

m) Protection of Community from Accidents

The construction activities, particularly the excavation, should not be carried out during rainy season to avoid any accident. The excavated areas should be properly cordoned off, and warning and safety signs should be posted at accident prone areas to warn the passersby the potential danger at the construction site. The traffic shall be diverted well before the construction area as per the traffic management plan. The construction contractors shall install temporary signs and fences around all unsafe areas to prevent members of the public

from entering the areas. If installing fences is not feasible, the area shall be clearly identified as unsafe with signs and flagging.

n) Traffic Management

At all times, the Contractor shall provide safe and convenient passage for vehicles, pedestrians and livestock. The contractor shall comply the Traffic Management Plans (TMP) as provided in CPEMP. The traffic control plans shall contain details of temporary diversions at different locations. Temporary diversion for road traffic will be constructed with the approval of the KWSB.

Special consideration shall be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night. The temporary traffic detours in settlement areas shall be kept free of dust by frequent application of water. The contractor shall take all necessary measures for the safety of traffic during construction work and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required for the information and protection of traffic approaching or passing through the construction site. All signs, barricades, pavement markings shall be as per road specification.

Informational signs shall be posted where lane and road closures could substantially disrupt traffic circulation at least 7 days prior to the closure. Proper traffic controls shall be in place during closures to minimize impacts on traffic circulation and for traffic safety. Appropriate safety precautions shall be taken when transporting large equipment on public roadways.

o) Restoration of Campsites

After the completion of construction activities at each site, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include:

- Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas.
- Soak pits, septic tanks shall be covered and effectively sealed off.
- Debris (rejected material) should be disposed of suitably.
- Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed.
- If the construction camp site is on an agricultural land, preserve top soil and good earth can be spread back for a minimum 30 cm for faster rejuvenation of the land.
- In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this specification. The rehabilitation is mandatory and should be include in the agreement with the landowner by the contractor. Also, the contractor would have to obtain a certificate for satisfaction from the landowner.

5.3.2 Operational Phase Mitigation Measures

Following are the operational phase mitigation measures for all the project activities.

- Maintenance of sewerage system and disposal pumps
- Ensuring proper functioning of water treatment facilities
- Maintenance of water supply pipelines and pumping facilities
- Noise abatement at project sites

- Improved design of seawater intake at desalination plant
- Disposal of brine, back washes and sludge after treatment
- Environmental monitoring of underground pipelines
- Soil pollution control
- Protection of workers from health and safety hazards
- Protection of community health
- Ensuring proper functioning of the wastewater treatment plants
- Implementation of energy efficiency measures at plants, and pumps
- Landscaping to improve aesthetic of the sites

a) Maintenance of Sewerage System and Disposal Pumps

Lack of maintenance of sewerage system causes many environmental impacts such as contamination of soil and water resources, outbreak of diseases, odor and nuisance areas where sewage spills over and remains stagnant for longer periods. The malfunctioning of disposal pumps also results in the same situation.

It will be the responsibility of KWSB staff to look after the proper functioning of the sewerage system and disposal pumps throughout the project lifecycle. For such system, KWSB will equip with proper trained workforce and requisite machinery with the support of vigilant governance system. KWSB will arrange standby disposal pumps and generator system to cope with all sort of emergency situation. Regular maintenance and upkeep of these pumps and generator system will be under strict operation and maintenance regime.

b) Ensuring Proper Functioning of Water Treatment Facilities

Lack of proper functioning of the water treatment facilities such as chlorination, filtration, flocculation and coagulation etc. shall result into water borne diseases among community.

KWSB staff will look after the proper functioning of the water treatment facilities throughout the project lifecycle. For such system, KWSB will be equipped with proper trained workforce and requisite machinery with the support of vigilant governance system. KWSB will arrange standby pumps and generator system to cope with all sort of emergency situation, for which substantial resources will remain available at the disposal of the Officer In-charge. Regular maintenance and upkeep of these treatment facilities, pumps and generator system will be under strict operation and maintenance regime.

c) Maintenance of Water Supply Pipelines and Pumping Facilities

Lack of proper maintenance of water supply pipelines may result into contamination of water supply due to the intrusion of sewage in it. The contaminated water resources can cause water borne diseases. The malfunctioning of tube wells and water pumps shall also be the cause of shortage of water supply. Under the project KWSB staff will look after the proper functioning of the water supply pipelines and pumping facilities throughout the project lifecycle. For creating this capacity, KWSB will equip itself with proper trained workforce and requisite machinery and will establish a vigilant governance system. In addition, an inventory of standby pumps and generator system to cope with all sort of emergency situation will be developed. Water supply pipelines, pumps, and generators will be regularly maintained under under strict operation and maintenance regime.

d) Noise Abatement at Project Sites:

Noise shall be generated at following project locations during operational phase:

- Water treatment facilities (filtration, coagulation and flocculation, desalination)

- Tube wells and water pumps
- Generators (water treatment, wastewater treatment, disposal station and water supply facilities)
- Compressors/blowers (wastewater treatment facilities)
- Pumping houses (desalination, wastewater treatment plants)

Most of the above-mentioned facilities shall be enclosed and their noise impact shall be restricted to the facilities only and noise shall not disturb the nearby community. However, the designing of these facilities shall take noise aspect into the consideration and built all the noise producing equipment (pumps, turbines, generators, compressors, blowers etc.) under enclosure to attenuate the noise impact to surrounding.

To minimize noise impacts on workers, working at noise prone areas, the following measures would be taken:

- Carry out regular inspection and maintenance of the equipment
- Replace worn and noise producing parts of the equipment in a timely manner
- In case of severe noise, use sound barriers to avoid the dispersion of sound waves into the nearby community
- Workers should use noise protection equipment when working in a noisy area.
- The noise level of 85 dBA for 8 hours working for the workers is considered safe. The management should ensure keeping noise levels within safe limits. In case of higher noise levels (more than 85 dBA), the workers should be rotated. The workers at higher noise level areas should not be allowed to work for more than two to three hours and shifted to calm places for rest of the hours.

e) Improved Design of Seawater Intake at Desalination Plant

Desalination: Seawater reverse osmosis desalination plants take in large volumes of seawater, pass it through fine pored membranes to separate freshwater from salt, and discharge the hyper-saline brine back into the ocean.

Seawater Intakes: Seawater intakes generally fall into two categories: direct intakes and indirect intakes. Direct intakes – also referred to as open water intakes – extract seawater directly from the ocean. These intakes may be located at the surface, in deep water, or less commonly, on a flotation plant. The vast majority of existing desalination plants use surface intakes, which typically consist of a set of intake screens to exclude marine life, trash, and debris; a conveyance pipeline; and a wet well or other mechanism for housing the pumps. These intakes generally require some sort of pre-treatment system to remove silt, algae, dissolved organic carbon, and other organic material that may clog the membranes. A small but growing number of desalination plants use indirect intakes, also referred to as subsurface intakes. While not suitable in all locations, they have the advantage of virtually eliminating marine life impacts associated with the intakes and reducing pretreatment requirements. Subsurface intakes extract seawater from beneath the seafloor or a beach and may be located on- or off-shore. They typically consist of buried pipes and/or wells and do not generally require a pre-treatment system because sand acts as a natural filter.

Seawater Intake Impacts: The intake of seawater from the ocean results in the impingement and entrainment of marine organisms. Impingement occurs when fish and other large organisms are trapped on the intake screen, resulting in their injury or death. Entrainment occurs when organisms small enough to pass through the intake screens, such as plankton, fish eggs, and larvae, are killed during processing of the salt water. Entrained organisms are killed by pressure and velocity changes caused by circulating pumps in the plant, chlorine and other chemicals used to prevent corrosion and fouling, and predation by filter feeders like

mussels and barnacles that line the intake pipes and themselves are considered a fouling nuisance. The impingement and entrainment impacts equal the loss of biological productivity of thousands of acres of habitat.

Mitigation Measures: Mitigation measures include i) improving the recovery rate of a desalination facility can also reduce impingement and entrainment. Typically seawater desalination plants are designed to recover (turn into freshwater) 45 to 55% of the seawater collected by the intake. Designing the plant to operate closer to the upper limits of recovery (i.e., 50 to 55%) would require withdrawing less water and as a result, would reduce both impingement and entrainment, ii) installing low-velocity intakes that allow some organisms to swim out of the current or temporarily reducing pumping or intake velocity during critical periods for marine organisms, such as during spawning or important larval stages, iii) physical barriers installation are intended to block fish passage into the desalination plant and, depending on their design, can reduce both impingement and entrainment. These barriers include metal bars, or trash racks, primary coarse screens (which have openings of 20 mm to 150 mm, and smaller, secondary screens with openings of 1 mm to 10 mm).

The design of the RO plant seawater intake should include all the above-mentioned considerations to reduce impact on marine ecosystem.

f) Disposal of Brine, Chemical Cleaning and Sludge after Treatment

The disposal of brine along with cleaning chemicals and sludge from pretreatment, into the sea may cause problems for the marine habitats and receiving water environments. This is mainly due to the higher density of concentrate discharge compared to seawater that generally sinks to the bottom layers. The tendency of the concentrate to sink when interacting with the receiving water introduces problems for the marine environment in that the discharge may be hypoxic or contain traces of damaging chemicals.

Mitigation Measures:

a. The desalination plants should dilute the concentrate to reduce density before release. Blending is a process that mixes the concentrate with cooling water, feed water, wastewater treatment plant effluent or other low TDS waters before disposal.
b. The brine should be pretreated prior to disposal into sea. Pre-treatment consists of aeration, i.e., adding oxygen to the concentrate, and degasification to remove hydrogen sulfide from the concentrate. It is also recommended to use non-toxic additives and de-chlorination techniques to limit the toxic chemical concentrations that enter the environment. The need for these techniques is site specific. Also the pretreating the source water with membrane technologies, such as microfiltration or ultrafiltration, can reduce the use of chemicals throughout the desalination process.
c. The brine should be dispersed properly into the seawater. There are several proven methods to disperse concentrated brine. For example, multi-port diffusers can be placed on the discharge pipe to promote mixing.

The design of the RO plant should include all the above mentioned considerations to reduce impact on marine ecosystem due to discharge of brine and chemicals.

g) Environmental Monitoring of Underground Pipelines

Desalination plants require water intake structures and pipelines that can carry feed water and discharge concentrate to and from sea respectively. The pipelines may be built 50 m below ground level and material may leak through to the aquifer. As such, the coastal groundwater aquifers may be contaminated through leakage in the long inlet/outlet pipes. The outlet pipes

contain discharge sludge that is usually highly concentrated brine but may also contain low concentrations of chemicals sometimes at elevated temperatures. Therefore, careful monitoring of the piping as well as flow processes is needed. Appropriate monitoring devices may be attached to fixed structures to ensure failsafe subsurface flow processes and thus should be considered before construction is completed.

h) Soil Pollution Control

The improper handling and storage of chemicals, fuel, lubricant, oily solid waste etc. at water and wastewater treatment facilities, and desalination plant can lead to soil pollution. Soil pollution can be controlled by taking following measures:

- Storage of fuel, paint, and oil containers, oil filters, oily parts and oily rags on impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 6-inch-thick, done on brick edge flooring lined with polyethylene sheet
- Placement of fuel containers and liquid chemicals under containment and proper decantation arrangement to avoid its spillage and leakage on floor
- Presence of spill kit to remove spills from the floor
- Avoid washing the contaminated floors rather dry cleaning the spills from the floor with saw dust and rags
- Location of fuel storage and refilling areas at least 500 m from all cross-drainage structures and important water bodies

i) Protection of Workers from Health and Safety Hazards

The management of the projects (wastewater treatment plants, water treatment plants, disposal stations, desalination plant) is required to comply with all the precautions as required for the safety of the workforce as per the national and World Bank requirements.

The Plant Manager/Engineer has to ensure that all operators of heavy or dangerous machinery are properly trained/certified, and also insured. The Plant Manager/Engineer shall supply all necessary safety appliances such as safety goggles, helmets, masks, safety shoes etc., to the workers and staff. Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. Maintenance activities shall be carried out by taking strict safety measures. The hazardous material and chemicals shall be handed as per the instruction of the specific Safety Data Sheet (SDS).

Medical facilities shall be provided to all the workers at the working locations. Suitable transport will be provided to take injured or ill person(s) to the nearest approachable hospital. The first aid box will be provided at every facility and under the charge of a responsible person who shall always be readily available during working hours. The workers working at aeration/biological tanks should be instructed to use facemasks to avoid inhalation of aerosol from the tanks.

j) Protection of Community Health

Community health can be affected due to noise and odor from the facilities, and improper disposal of solid waste and sludge. Noise control measures have already been mentioned above. The trees shall be planted at the periphery of the plant sites, particularly, the wastewater treatment plants, wastewater disposal stations and interceptors so that odor and noise could be attenuated due to the tree cover. The waste sludge from the wastewater treatment plant and other solid waste shall be properly collected, stored and disposed at designated places. The transportation vehicles shall be covered from the top to avoid any nuisance while passing through the residential areas.

Mosquito larvae generally live in small, shallow water bodies, where disturbance of the surface layer is uncommon. In the aerated lagoon treatment process, vigorous mixing occurs in the complete-mix lagoon and also in the partial-mix lagoon, although to a lesser degree in the latter. These lagoons would not be suitable habitat for mosquito larvae. The polishing pond, however, may provide suitable habitat for mosquito breeding. There is also the potential for fly, mosquito or insect breeding at the sludge-drying site. However, once the sludge is dry, it is relatively inert and odorless. There will be regular anti-mosquito and insecticide spray at the plant facility to address the mosquito and insect problem. Fly and mosquito breeding in the polishing pond and sludge-drying beds can be controlled by the addition of chemicals (for example, calcium hypochlorite or chlorine).

k) Ensuring Proper Functioning of Wastewater Treatment Plants

Improper functioning of the wastewater treatment plants shall result into insufficient treatment and contamination of water and soil. Plant operation requires strict operational control and regular monitoring. There shall be a standby arrangement for all the critical equipment of the plant so that plant could remain in operation even in case of failure of any equipment. The preventive maintenance shall be the priority of the plant management for ensure its perfect operation throughout the year.

In the case of a power failure or shut-down, standby generators will be provided so that the plant can operate as long as possible. In the case of plant failure, chlorination of the effluent could also be increased to reduce the incidence of pathogenic bacteria.

l) Implementation of Energy Efficiency Measures at Plants and Pumps

Energy inefficient operation of wastewater treatment plants, desalination plant, water pumps and disposal pumps shall be another environmental concern which could have environmental impacts in terms of resource depletion and consequent air emission issues. The energy audits shall be compulsory during operational phases and implementation of the energy efficiency measures shall be the responsibility of the project management.

m) Landscaping to Improve Aesthetic of the Sites

The aesthetic of the sites such as wastewater treatment plants, disposal stations and wastewater interceptors shall be improved by landscaping. The green spaces shall be developed at these sites to create their positive image among nearby community.

6.0 STAKEHOLDER CONSULTATION

This chapter describes the objective, process, and outcome of the stakeholder consultations carried out before or during the preparation of Environmental Management Framework (EMF).

6.1 Requirement of Stakeholder Consultation

KWSB recognizes the importance of early and continuing engagement and meaningful consultation with stakeholders. KWSB will engage the stakeholders, including communities, groups, or individuals affected by proposed projects, and with other interested parties, through information disclosure, consultation, and informed participation in a manner proportionate to the risks to and impacts on affected communities. The Bank will have the right to participate in consultation activities to understand the concerns of affected people, and how such concerns will be addressed by the KWSB in project design and mitigation measures. The Bank will monitor, as part of its due diligence, the implementation of consultation and stakeholder engagement by the KWSB.

It is important to consult stakeholder before and during the preparation of Environmental Management Framework (EMF) and document stakeholders' consultation in the EMF. This consultation is considered very important to validate the potential risks and impacts identified in the EMF.

6.2 Process of Stakeholder Consultation

KWSB will undertake a process of meaningful consultation in a manner that provides stakeholders with opportunities to express their views on project risks, impacts, and mitigation measures, and allows the KWSB to consider and respond to them. Meaningful consultation will be carried out on an ongoing basis as the nature of issues, impacts and opportunities evolves. Meaningful consultation is a two-way process, that:

a) Begins early in the project planning process to gather initial views on the project proposal and inform project design;

b) Encourages stakeholder feedback, particularly as a way of informing project design and engagement by stakeholders in the identification and mitigation of environmental and social risks and impacts; Continues on an ongoing basis, as risks and impacts arise;

c) Is based on the prior disclosure and dissemination of relevant, transparent, objective, meaningful and easily accessible information in a timeframe that enables meaningful consultations with stakeholders in a culturally appropriate format, in relevant local language(s) and is understandable to stakeholders;

d) Considers and responds to feedback;

e) Supports active and inclusive engagement with project-affected parties;

f) Is free of external manipulation, interference, coercion, discrimination, and intimidation; and

g) Is documented and disclosed by KWSB

6.3 Identification of Stakeholders

Stakeholder" refers to individuals or groups who:

- are affected or likely to be affected by the project (*project-affected parties*); and

- may have an interest in the project (*other interested parties*)

For KWSSIP, the relevant stakeholders include affected communities (which are directly or indirectly affected by the project activities, KWSB staff, the representatives of Karachi Metropolitan Corporation, six District Municipal Corporations, NGOs, Community Based Organizations (CBOs), civil society, Local Government Departments, Sindh Environmental Protection Agency (SEPA) staff.

6.4 Environmental Management Framework (EMF) Consultation and Disclosure

The consultation is required with the stakeholders regarding the potential environmental risks and impacts of the proposed project/subprojects as part of the EMF document before or during its preparation. At this point in time, the detail about the project/subprojects and their exact locations are not known, therefore, it is not possible to engage community and carry out the consultation for those projects which are unknown. However, KWSB will organize consultation workshop with the stakeholder institutions to share the draft EMF and finalize the EMF in the lights of the recommendations made by the participants. Major participants of the workshop will be representatives of Karachi Metropolitan Corporation, six District Municipal Corporations, NGOs, Community Based Organizations (CBOs) etc. after the completion of draft version of the EMF. After the project locations are identified and details are available for each component of the project, Focused Group Discussions (FGDs) will be carried out by KWSB with the directly affected stakeholders.

After the project locations are identified and details are available for each component of the project, Focused Group Discussions (FGDs) shall be carried out with the directly affected stakeholders. These FGDs shall provide complete detail of the project activities to the concerned stakeholder and get their relevant feedback, concerns and suggestions to be considered in the planning for offsetting environmental risks and impacts in the EMF. The EMF shall be finalized in the light of these stakeholder consultations.

6.5 Proceedings of the Stakeholder Consultations

Preliminary stakeholder consultations were carried out during field visits prior to the preparation of EMF. The summary of the consultations is as under:

A daylong meeting was held with KWSB management. KWSB prepares IEEs/EIAs for all the new projects as per the requirements of SEPA 2014. IEEs/EIAs were prepared by outsourced consultants. KWSB successfully secured no-objection certificates of all the project implemented by KWSB in the recent past and are under implementation at present. It was stated that IEEs/EIAs were of satisfactory quality. IEE/EIA for the rehabilitation projects were not required by SEPA. KWSB management is committed to continue the practice of outsourcing IEEs/EIAs of the proposed projects and sub-projects under KWSSIP to the third parties. Further to this, capacity of KWSB for conducting environmental assessment and monitoring is not enough. KWSB will establish an Environmental Cell within Project Implementation Unit (PIU) of KWSSIP.

Preliminary consultations were conducted with Districts managements and a few community representatives. Districts management informed that they were involved mostly in rehabilitation of infrastructure activities, IEEs/EIAs for such activities were not required by SEPA. Accordingly, no environmental assessment exercises were conducted in the past. Environmental assessment and monitoring capacities are non-existent at the districts management level.

Community representatives reported that communities were facing dilapidated environmental conditions with very low level of water supply and sanitation services. Communities living along the main drains and rivers are facing serious environmental issues and generally public health is at low level. Most of the representatives of the communities reported that water supply was intermittent, erratic, and contaminated. During rainy reasons, most of the area was flooded by rain and sewerage water that led to serious health issues and inconvenience to the communities.

7.0 ENVIRONMENTAL MANAGEMENT FRAMEWORK

This chapter describes institutional arrangements for environmental management, screening methodology for the projects, generic mitigation plan, monitoring framework, and capacity building of stakeholders involved in environmental assessment, monitoring and management. The guidelines for environmental compliance and occupational health and safety requirements will also be described.

7.1 Institutional Arrangement

The institutional arrangement for the environmental and social assessment of KWSSIP project is presented in Figure 5.

KWSB shall be responsible for the compliance of environmental safeguard requirements of the KWSSIP project components. The PC-1 of the project components, including environmental compliance requirements, shall be prepared by KWSB and submitted to Sindh Planning and Development Board (SPDB) for approval and subsequent stages of the project. The Environmental and Climate Section of SPDB shall review and approve the environmental requirements of the PC-1.

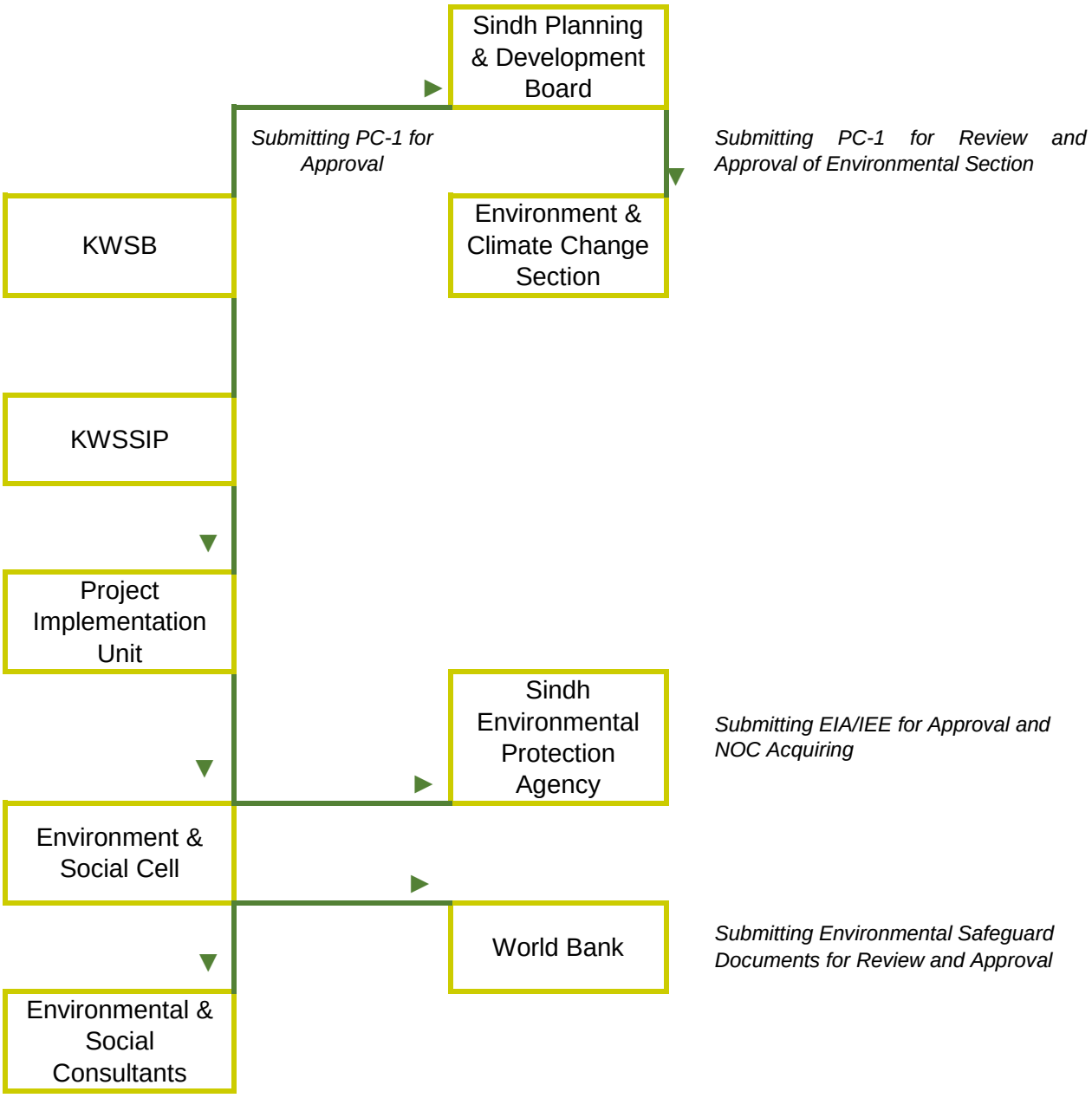
The project activities at KWSB shall be monitored and managed by the Project Implementation Unit (PIU), to be established specifically for KWSSIP. The Environmental and Social Cell (ESC) shall operate under PIU which shall take care of the environmental and social safeguard requirements of the project components. The ESC shall have the liberty to outsource environmental and social compliance requirements to different consultants and specialists. The consultants shall facilitate ESC in preparing environmental assessment, monitoring and compliance documents.

The ESC shall be responsible for preparing two types of environmental and social documents. One of these documents shall be prepared for the compliance of provincial environmental requirements and submitted to Sindh Environmental Protection Agency (SEPA) for acquiring No Objection Certificate (NOC) and other types of documents shall be prepared for the compliance of safeguard requirements of World Bank and submitted to World Bank Safeguard Staff for review, approval and for further action.

7.2 World Bank Environmental Review Project Cycle

Environmental review begins with screening at the time of project identification. Scoping and preparation of the Environmental Assessment (EA) occur in tandem with or as integral parts of the prefeasibility and feasibility studies. The final EA is sent to the Bank by KWSB prior to appraisal. If the EA is satisfactory to both KWSB and the Bank, it forms the basis for the decision of Regional Environmental Division (RED) on environmental clearance and the environmental condition to be negotiated with KWSB, some or all of which are incorporated into the loan agreement. The EA may be adequate for the purposes of appraisal, but the Bank review may reveal needs for additional analyses before clearance can be given and negotiations undertaken. Supervision includes monitoring the project's environmental performance and compliance with relevant conditions agreed on between the Bank and KWSB. After implementation is complete, the Project Completion Report (PCR) includes evaluation of both the impacts that actually occurred and the effectiveness of mitigation measures. The Operations Evaluation Department (OED) again audits selected projects possibly some years after the PCR.

Figure 5: Institutional Arrangement for Environmental Assessment of KWSSIP



7.3 Environmental Screening

Under World Bank's Operational Policy 4.01 (Environmental Assessment), the bank requires Environmental Assessment (EA) of projects proposed for Bank financing to help ensure that these are environmentally sound and sustainable, and thus to improve decision making. First step of the environmental assessment is the screening.

Environmental screening is the responsibility of the World Bank Task Manager (TM), with advice and assistance from the Regional Environmental Division (RED). An essential part of screening is to identify which aspects of a project are not environmentally significant and which therefore

can prudently be dropped from further consideration. Its purpose is to ensure that the appropriate amount of attention is devoted to the environmental aspects of the proposed project from the very outset of the project cycle, to identify as much as possible the key environmental issues, and to determine the type of environmental analysis which is needed so that those issues, and others which may arise, can be addressed effectively in project planning, design, and appraisal.

Screening is carried out at the time of identification. The environmental screening of each proposed project shall be carried out to determine the appropriate extent and type of EA required. The Bank classifies the proposed project into following one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts, and so designated in the Initial Executive Project Summary (IEPS).

Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the borrower is responsible for preparing a report, normally an EIA (or a suitably comprehensive regional or sectoral EA).

Category B: A proposed project is classified as Category B, if its potential adverse environmental impacts, on human populations or environmentally important areas, including wetlands, forests, grasslands, and other natural habitats, are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A EA. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. The findings and results of Category B EA are described in the project documentation (Project Appraisal Document and Project Information Document).

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

Bank and international experience shows that projects in certain sectors or of certain types are normally best classified as illustrated below in Box-A. These examples are only illustrative; they are by no means exhaustive.

BOX-A

Illustrative List

Category A Projects	Category B Projects	Category C Projects
a) Dams and reservoirs;	(a) Agro-industries (small-scale);	(a) Education;
(b) Forestry production projects;	(b) Electrical transmission;	(b) Family planning;
(c) Industrial plants (large-scale) and industrial estates;	(c) Aquaculture and mariculture;	(c) Health;
(d) Irrigation, drainage, and flood control (large-scale);	(d) Irrigation and drainage (small-scale);	(d) Nutrition;
(e) Land clearance and leveling;	(e) Renewable energy;	(e) Institutional development;
(f) Mineral development (including oil and gas);	(f) Rural electrification;	(f) Technical assistance; and
(g) Port and harbor development;	(g) Tourism;	(g) Most human resource projects.
(h) Reclamation and new land development;	(h) Rural water supply and sanitation;	
(i) Resettlement and all projects with potentially major impacts on people;	(i) Watershed projects (management or rehabilitation); and	
(j) River basin development;	(j) Rehabilitation, maintenance, and upgrading projects (small-scale).	
(k) Thermal and hydropower development; and		
(l) Manufacture, transportation, and use of pesticides or other hazardous and/or toxic materials.		

Source: World Bank Environmental Source Book 1999

7.4 Environmental Assessment (EA)

After the screening process and classification of the category of the project, the type and extent of the EA required is decided and executed. It is the KWSB's responsibility to prepare Terms of References (TORs) for the EA or other analysis and to obtain the necessary experts to carry it out. The Bank is available to assist KWSB as necessary. The task of determining the scope of the EA is critical, and is therefore one in which the Bank normally participates. It is important not only to cover the environmental issues known at the inception of the study, but also to allow breadth and flexibility so that new issues can be identified and, if significant, addressed. However, it is also important to frame the investigation so that time and resources are concentrated in the areas where potential impacts are likely to be found.

After the completion of the EA report, KWSB shall review it to ensure that the consultants or agency staff followed the TORs and met both Bank and country requirements. The task manager (TM), assisted by RED staff, shall also review the adequacy of the EA report.

Bank staff after reviewing in detail the EA findings and recommendations and include in the Final Executive Project Summary (FEPS), a summary of the EA status, the major environmental issues, and how those issues have been or will be addressed. It notes any proposed environmental conditionality.

The appraisal mission shall review the EA with KWSB, resolves any remaining environmental questions, assesses the capacity of country institutions to implement EA recommendations, determines whether the EA findings have been properly addressed during project preparation, and discusses environmental conditionality to the loan agreements. The Staff Appraisal Report (SAR) and President's Report (PR) shall contain summaries of the EA and its main findings.

Based on the information presented in the SAR and the EA, the RED chief issues formal environmental clearance for the project. Clearance is a necessary prerequisite to the Regional Vice President's authorization to begin negotiations. In the negotiations themselves, the issues and actions critical to environmental soundness and sustainability in the project are discussed, and appropriate covenants are incorporated into loan or credit documents.

Implementation and Supervision: EA recommendations provide the basis for supervising the environmental aspects of project implementation. KWSB is obliged to implement measures to mitigate anticipated environmental impacts, to monitor programs, to correct unanticipated impacts, and to comply with any environmental conditionality. Procedures for startup and continuing operation of the project will normally specify these agreements, as well as measures to protect the health and safety of project staff. Proper staffing, staff training, and procurement of spare parts and equipment to support preventive, predictive and corrective maintenance are also necessary elements of implementation.

Supervision is an essential aspect of the Bank's environmental review, since the environmental clearance decision is based in part on the assumption that mitigating measures and other provisions will be fully implemented and will be effective in avoiding or controlling adverse impacts that might otherwise have made the project unacceptable for Bank support. Supervision is carried out through a combination of the i) reports required from KWSB on compliance with environmental conditionality, ii) status of mitigating measures, results of monitoring programs and other environmental aspects of the project etc.. Bank supervision missions shall also review implementation of environmental provisions, corrective actions taken to respond to impacts, and compliance with environmental conditionality, including institutional strengthening components; and site visits by Bank environmental specialists or consultants as required to supervise complex environmental components or respond to environmental problems.

7.5 Environmental Assessment Requirement of Sindh Environmental Protection Agency (SEPA)

The Sindh Environmental Protection Agency Review of the IEE and EIA Regulations, 2014 categorizes development projects into three schedules, according to their anticipated potential environmental impact. The proponents of the projects with the potential for more adverse environmental impacts (see Schedule II) are required to submit an Environmental Impact Assessment (EIA). While, for the proponents of projects with the potential for less environmental impact (see Schedule I), must submit an Initial Environmental Examination (IEE) with the

respective environmental protection agency (EPA). The proponent of the projects falling under Schedule III shall conduct screening and file environmental checklist. Box-B presents Schedule I, II and III.

The Regulations also provide the necessary details on the preparation, submission, and review of IEEs and EIAs. The following is a brief step-by-step description of the approval process:

1. To determine whether a sub-project is categorized as requiring an IEE, EIA or screening, as per the three schedules attached to the Regulations.
2. An EIA, IEE or screening is conducted as per the requirements outlined in the SEPA Guidelines.

BOX-B

SEPA's Environmental Assessment Schedules

Schedule I (IEE)

A. Agriculture, Livestock and Fisheries

1. Poultry, livestock, stud and fish farms
2. Projects involving packaging, formulation, cold storage and warehouse of agricultural products.

B. Energy

1. Hydroelectric power generation less than 50 MW
2. Thermal power generation less than 100MW
3. Coal fired power plants with capacity less than 50 MW
4. Transmission lines less than 11 KV, and grid station
5. Waste-to-energy generation projects including bio-mass less than 25 MW
6. Solar project
7. Wind project

Schedule II (EIA)

B. Oil and Gas Projects

1. Petroleum refineries.
2. LPG and LNG Projects(including LNG Terminals, re-gasification units) except LPG filling stations
3. Oil and gas transmission systems
4. Oil and gas gathering system, separation and storage.

C. Manufacturing and Processing

1. Cement plants
2. Chemical manufacturing industries
3. Fertilizer plants
4. Steel Mills
5. Sugar Mills and Distilleries
6. Food processing industries including beverages, dairy milk and products, slaughter houses and related activities with total cost more than Rs. 200 Million
7. Industrial estates (including export processing zones)
8. Man-made fibers and resin projects with total cost of Rs 200 M and above
9. Pesticides (manufacture or formulation)
10. Petrochemicals complex

Schedule III (Checklist)

a. Construction of, offices and small commercial buildings (1-6 story),home industrial units, ware houses, marriage / banquet facilities, large scale motor vehicles workshops, restaurants / food outlets ,large baking unit subject to the compliance with existing zoning laws.

b. Reconstruction / rehabilitation of roads (small roads in urban area and farm to market roads more than 2 km).

c. On-farm dams and fish farms.

d. Pulses mills.

e. Flour Mills

f. Projects promoting energy efficiency (small scale).

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

h. Canal cleaning

i. Forest harvesting operations

j. Rain harvesting projects

C. Oil and Gas Projects

1. Oil and gas 2D/3D Seismic survey and drilling activities
2. Oil and gas extraction projects including exploration and production located outside the environmentally sensitive areas
3. Construction of LPG storage facilities
4. Construction of LPG,CNG filling station and petrol pumps

D. Manufacturing and Processing

1. Ceramics and glass units less than 500 million
2. Food processing industries with total cost less than Rs. 200 millions

Schedule II (EIA)

A. Energy

1. Hydroelectric power generation over 50 MW
2. Thermal power generation over 100 MW
3. Coal power projects above 50 MW
4. Transmission lines (11 KV and above) and distribution projects.
5. Nuclear power plants
6. Wind energy projects if falls under any sensitive, protected area.
11. Synthetic resins, plastics and man-made fibers, paper and paperboard, paper pulping, plastic products, textiles (except apparel),printing and publishing, paints and dyes, oils and fats and vegetable ghee projects, with total cost more than Rs. 10 million
12. Tanning and leather finishing projects
13. Battery manufacturing plant

D. Mining and Mineral Processing

1. Mining and processing of coal, gold, copper, sulfur and precious stones
2. Mining and processing of major non-ferrous metals, iron and steel rolling
3. Smelting plants (total cost of Rs. 100 M and above)

E. Transport

1. Airports
2. Federal or Provincial highways or major roads (including rehabilitation or rebuilding or reconstruction of existing roads)
3. Ports and harbor development
4. Railway works
5. Flyovers, underpasses and bridges having total length of more than 500 m

F. Water Management, Dams, Irrigation and Flood Protection

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

G. Water Supply and Filtration

Large Water supply schemes and filtration plants.

k. Rural schools (Secondary and Higher Secondary) and rural and basic health units having at least ten beds capacity.

l. BTS Towers

m. Lime Kilns

n. Ice factories and cold storage.

o. Cotton oil mill

p. Warehouses for pesticides and pharmaceuticals

Source: SEPA Review of IEE & EIA Regulations, 2014

3. The Fee (depending on the cost of the sub-project and type of report) is submitted along with the EIA or IEE document.

4. The IEE/EIA is also accompanied by an application in the format prescribed in Schedule V of the Regulations.
5. The EPA conducts a preliminary review of the report and replies within 15 days of the submission. It either a) confirms completeness, or b) asks for additional information, if needed, or c) returns the report and asks for additional studies, if necessary.
6. The Agency shall make every effort to carry out its review of the environmental checklist within thirty days, IEE within sixty days, and of the EIA within four months of issue of confirmation of completeness under regulation 9.
7. The EPA accords their approval, subject to certain conditions:
    a. Before commencing construction of the sub-project, the proponent is required to submit an undertaking accepting the conditions.
    b. Before commencing operation of the sub-project, the proponent is required to obtain from the SEPA a written confirmation of compliance with the approval conditions and requirements of the IEE.
8. An Environmental Management Plan (EMP) is to be submitted with a request for obtaining confirmation of compliance.
9. The SEPA is required to issue confirmation of compliance within 20 days of receipt of the request and complete documentation.
10. The IEE/EIA approval is valid for three years from the date of operational phase NOC.
11. After completion of construction, a monitoring report is to be submitted to the SEPA, followed by annual monitoring reports, during operations.

7.6 Categorization of KWSSIP Subprojects

On the basis of above-mentioned guidelines of World Bank and Sindh Environmental Protection Agency (SEPA), the preliminary assessment of the categorization of the KWSSIP subprojects and environmental assessment requirements are given in Table-11.

For sewerage system and water supply rehabilitation and water supply improvement projects, SEPA does not require any environmental assessment whereas these are supposed to be under category B subprojects which would require limited EIA in the form of IEE, Environmental Management Plan (EMP) etc.

The Malir basin interceptor, wastewater treatment plants and desalination plants are under category A and schedule II for World Bank and SEPA respectively, which would require detailed EIA.

Table 11: Preliminary Categorization and EA Requirements of KWSSIP Subprojects

KWSIIP Subprojects	Categories & Requirements			
	World Bank		SEPA	
	Category	EA Required	Schedule	EA Required
i) Sewerage system rehabilitation ii) Priority sewer network rehabilitation	i) B ii) B	i) Limited EIA ii) Limited EIA	i) Nil ii) Nil	i) Not Required ii) Not Required
i) Water supply improvement	i) B	i) Limited EIA	i) Nil	i) Not Required

ii) Priority water network rehabilitation	ii) B	ii) Limited EIA	ii) Nil	ii) Not Required
Malir basin wastewater interceptors	A	Detailed EIA	Schedule II	EIA
Desalination plant	A	Detailed EIA	Schedule II	EIA
i) Wastewater treatment ii) Wastewater treatment for reuse iii) S IV wastewater collection and treatment	i) A ii) A iii) A	i) Detailed EIA ii) Detailed EIA iii) Detailed EIA	i) Schedule II ii) Schedule II iii) Schedule II	i) EIA ii) EIA iii) EIA

7.7 Generic Mitigation Plan

Table 12 presents generic mitigation plan for the avoiding or mitigating the potential environmental impacts identified above.

Table 12: Generic Mitigation Plan

Subproject (s):

Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
	Construction Phase		
Vegetation Loss of top soil, air pollution, soil erosion and loss of aesthetic of the area due to clearing of land for camp sites, laying pipelines and building infrastructure	**Restoration of the Construction Sites** Where grading or excavation occurs within farmland, topsoil shall be separated and stockpiled during the construction period. The topsoil stockpile shall be secured with plastic. Following construction, the topsoil shall be applied evenly to the site during the restoration process. The topsoil shall be properly compacted and stabilized to prevent erosion and sediment transport.	Contractor	Start and end of construction
	During the design stage of the project and finalizing the project location and alignment for the pipe laying, it should be the priority to avoid those areas where there are chances of cutting of significant trees and clearing of vegetation/crops.	Designer	Design
	Tree Plantation In case if it is not possible to avoid, then the project site would be restored to its original as much as possible by planting trees, vegetation and crops at the cleared land. All works shall be carried out in a fashion that ensures minimum damage or disruption to the flora.	Contractor	End of construction
Natural Habitats Loss of natural habitats and biodiversity during construction activities	**Protection of Natural Habitats** During site selection and finalization of pipelines and sewers alignment, the protection of the natural habitats shall be the high priority area. Alternatives will be considered for site selection and pipelines and sewer alignments, in	Designer	Design

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	case of presence of natural habitats at the project areas to protect them at best.		
	During environmental assessment, surveys shall be conducted for rare plants and priority or endemic wildlife species prior to civil work activities at all the sites. If any rare plants or sensitive wildlife species occur at the construction sites, the sensitive resource shall be fenced, and no activities will be allowed within 15 meters (50 feet) of the resource.	Contractor	During construction
	Construction activities shall be scheduled outside of the prime bird nesting season to the extent feasible. If construction activities occur during the prime nesting bird season, these should be conducted at least 75 meters (250 feet) from the forested areas where suitable nesting habitat for priority bird species may be located.	Contractor	During construction
	Prior to construction activities during the nesting season, a qualified biologist shall survey potentially suitable nesting habitat for priority species birds. If active nests are identified, a qualified biologist shall monitor the nesting birds' responses to the loudest level of construction noise for an appropriate duration. If the nesting birds show signs of disturbance that could result in nest failure, all work activities that disturb the birds shall be temporarily halted and visual and acoustic barriers shall be erected between the nesting location and work areas. Installation of any visual and acoustic barriers shall be overseen and approved by the qualified biologist.	Biologist	During environmental assessment
Physical Cultural Resources (PCRs)	**Protection of Physical Cultural Resources (PCRs)**		
Loss of PCRs at the project sites during construction activities		Environmentalist	During environmental assessment

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	During environmental assessment, surveys shall be conducted for archeological and cultural resources prior to civil work activities at all the sites.		Design
	All necessary and adequate care shall be taken to minimize impact on cultural properties which includes cultural sites and remains, places of worship including mosques, churches, etc., graveyards, monuments and any other important structures as identified during design and all properties / sites / remains notified. The design options for cultural property relocation and enhancement need to be prepared.	Designer	
	No work shall spill over to these properties, premises and precincts. All conservation and protection measures will be taken up as per design. During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archaeological significance, the same shall be intimated to the KWSB. Work shall be suspended until further orders from the KWSB. The Archaeological Department shall be intimated of the chance find and the KWSB shall carry out a join inspection with the department. Actions as appropriate shall be intimated to the Contractor along with the probable date for resuming the work. The contractor workers shall be sensitized and fully informed about the importance of PCRs before the commencement of the work as their negligence during excavation and construction activities could damage these resources. All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation.	Contractor	During construction
Air Quality	**Suppression of Dust Emission**		
Air pollution resulting in poor visibility, loss of vegetation, property damages, acid rain, soil	Regular water sprinkling shall be the responsibility of the contractor at the dust generation points, during construction activities. The water will be also	Contractor	During construction

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
contamination and health implications on workers and nearby community due to fugitive emissions of dust (SPM, PM_{10}, $PM_{2.5}$), stack and vehicular emissions during construction activities	sprinkled at vehicular and machinery movement routes to avoid dust spreading to the nearby community. In addition, the provision of dust masks and ensuring their use by the workers will also be the responsibility of the contractor under Construction Phase Environmental Mitigation Plan (CPEMP). Free distribution of disposable gas masks at the construction site by the contractor. **Control of Stack and Vehicular Emissions** The stack emissions from generators, if used as standby source of power supply and vehicular/machinery movement at the site can affect the ambient air quality at project site. It will be the responsibility of the contractor to use well maintained generators and vehicles/machines to keep ambient air quality within the desired level. The contractor shall be obliged to provide fitness certificate/maintenance records of the generators, vehicles and machines before deploying them at the construction sites.	Contractor	During construction
Wastewater soil and water contamination, odor, health implications on workers and community (due to breeding of mosquitos and flies), and nuisance due to improper treatment and disposal of sanitary wastewater from construction camps	**Wastewater Treatment** It shall be the responsibility of the contractor to dispose of sanitary wastewater in a nearby drain after passing it through septic tanks. The contractor can also plan to include temporary septic tanks for the construction crew.	Contractor	During construction
Solid Waste nuisance, health implications on workers and community (due to breeding of mosquitos and flies), surface water and soil contamination due to improper disposal of domestic and hazardous solid waste from construction camps and construction waste	**Solid Waste Management** The construction contractors shall implement a Waste Management Plan (mentioned in CPEMP). At a minimum, the plan shall address the sources of waste; waste minimization, reuse, and recycling opportunities; and waste collection, storage, and disposal procedures. The Waste Management Plan should distinguish between solid and liquid waste, as applicable, and include procedures for addressing waste that may be	Contractor	During construction

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	hazardous to health and the environment. In addition, the Waste Management Plan shall address the following: • All food waste shall be contained in covered bins and disposed of on a frequent basis to avoid attracting wildlife. • Trash bins shall be accessible at all locations where waste is generated. • The project area shall be kept clean and free of litter and no litter shall be allowed to disperse to the surrounding area. • Solid waste shall be removed from the site and transported to a municipal landfill or disposal site. • Waste shall not be dumped or buried in unauthorized areas or burned. • Human waste associated with the worker camp and latrines shall be properly contained and disposed of. The construction contractors shall ensure all workers receive training on proper disposal of all waste prior to working on the project site. The debris produced during construction should preferably be dumped at nearby depressions rather than being thrown away and left unattended. Leftover material should not be dumped into storm water drains or watercourses, because such practices can clog these man-made and natural drainage systems and cause many other problems for the residents. **Hazardous Solid Waste Management** The construction contractors shall implement the Hazardous Solid Waste Management Plan (mentioned in CPEMP). The Hazardous Solid Waste Management shall identify proper management procedures for all hazardous materials and wastes that may be encountered during construction, including handling, labeling, transporting, and storing procedures. In addition, the plan shall address the following: • Non-toxic and biodegradable produces will be used whenever possible.		

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	• Hazardous materials shall be transported and stored in appropriate containers with clearly visible labels. Hazardous materials shall be stored at least 100 feet from any down gradient drainage or within secondary containment capable of containing its entire volume. • Storm water flows shall be directed away from hazardous material storage areas. • Equipment and work areas shall be regularly inspected for signs of leaks and spills. Spill containment and cleanup kits shall be available wherever hazardous materials are being used or stored. Any incidental spills or leaks shall be contained and cleaned up as soon as it is safe to do so. Any contaminated soil shall be collected and disposed of in an appropriate land fill. • Equipment refueling and maintenance shall be limited to designated areas at least 30 meters (100 feet) from any down gradient drainage. All workers shall receive training on proper handling and storage of hazardous materials, as well as spill response and cleanup procedures, prior to working on the project site.		
Soil Soil contamination due to storage of oily parts and oily rags on unpaved floors, spillage and leakage of chemicals, fuel, and lubricants on soil (construction camps/sites)	**Soil Pollution Control** Soil pollution can be controlled by taking following measures: • Storage of fuel, paint, and oil containers, oil filters, oily parts and oily rags on impervious floor under shade or storing of fuel and lubricants on a sand flooring of at least 6 inch thick, done on brick edge flooring lined with polyethylene sheet • Placement of fuel containers under containment and proper decantation arrangement to avoid its spillage and leakage on floor • Presence of spill kit to remove spills from the floor • Avoid washing the contaminated floors rather dry cleaning the spills from the floor with saw dust and rags • Location of fuel storage and refilling areas at least 500 m from all cross drainage structures and important water bodies	Contractor	During construction

Subproject (s):

Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment

Potential Environmental Impacts	Mitigation Measure	Responsibility	Implementation Stage
Noise	**Noise Abatement**		
Nuisance, health implications of workers and nearby community, loss of biodiversity due to noise from construction machineries, generators, construction activities and vehicular movement	Construction noise and the associated effects shall be reduced or minimized, to the extent possible, by implementing the following procedures: • Select quieter equipment and construction activities, whenever feasible; • Carry out regular inspection and maintenance of the construction vehicles and equipment; • Replace worn and noise producing parts of construction machinery in a timely manner; • Ensure motorized vehicles and equipment are equipped with the greatest possible noise reduction parts, such as mufflers, silencers, insulators, and enclosures; • Workers should use noise protection equipment when working in a noisy area; • Locate noise generating equipment as far from sensitive receptors as feasible; • Limit civil work activities to daytime hours (8:00 to 18:00), to the extent feasible; • Notify and coordinate with residents adjacent to project areas prior to construction to inform them of the possibility of temporary noise disruption, and how to report noise complaints; • Install acoustic barriers between stationary equipment and sensitive receptors located within 300 meters (1,000 feet); • Implement a Noise Complaint Program to record and respond to noise complaints during construction	Contractor	During construction
Health and Safety	**Occupational Health and Safety Management**		
Safety hazards for workers and community due to construction activities/sites	The construction contractors shall implement a Health and Safety Plan (mentioned in CPEMP) that addresses the applicable risks and prevention procedures applicable to each contractor's work. At a minimum, the Health and Safety Plan shall address hazards that may be encountered during construction, including prevention and response procedures, for the following topics: • General occupational hazards that may be encountered (e.g., moving machinery and motorized equipment, working at heights or in confined	Contractor	During construction

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	spaces, repetitive motions, falling objects, exposure to heat, loud noises, and hazardous materials, protective clothing). The risk of fires shall be evaluated for each project site based on the activities that would occur, environmental conditions, and presence of ignitable or combustible materials in the area. If the activities pose a risk of igniting a wildfire, appropriate fire prevention and response equipment shall be available at each active site such as shovels, axes, fire extinguishers, and dedicated water tanks. All workers shall be trained on proper fire prevention and response procedures prior to working on the site. Any smoking on site shall be restricted to barren areas away from ignitable or combustible material. Smoking waste shall be fully extinguished and disposed of appropriately. The construction contractors shall supply all workers with personal protective equipment (PPE), and ensure workers use the proper PPE during all work activities. At a minimum, PPE for workers shall include: • Safety headgear • Steel toed boots • Safety glasses or impact-resistant eye protection • Ear protective devices • Harnesses for workers operating at heights • Respirators • Gloves • High visibility clothing or vests • Other specialized protective equipment for the drilling, welding, etc. All PPE shall be properly fitted for each worker, including body size and gender, and workers shall be trained in the proper use of PPE, prior to working on the project site.		

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	Medical facilities shall be provided to the labor at the construction camp. Suitable transport will be provided to take injured or ill person(s) to the nearest approachable hospital. First Aid Box will be provided at every construction campsite and under the charge of a responsible person who shall always be readily available during working hours. The contractor shall be responsible for providing safe drinking water and for implementing appropriate sanitation conditions, and for supplying hygienic food and a sewerage system for the construction team at the site. The construction activities, particularly the excavation, should not be carried out during rainy season to avoid any accident. The excavated areas should be properly cordoned off, and warning and safety signs should be posted at accident prone areas to warn the passersby the potential danger at the construction site. The traffic shall be diverted well before the construction area as per the traffic management plan. The construction contractors shall install temporary signs and fences around all unsafe areas to prevent members of the public from entering the areas. If installing fences is not feasible, the area shall be clearly identified as unsafe with signs and flagging.		
Traffic Traffic congestion at or around construction sites due to construction activities	**Traffic Management** At all times, the Contractor shall provide safe and convenient passage for vehicles, pedestrians and livestock. The contractor shall comply the Traffic Management Plan (TMP) as provided in CPEMP. The traffic control plans shall contain details of temporary diversions at different locations. Temporary diversion for road traffic will be constructed with the approval of the KWSB. Special consideration shall be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night. The temporary traffic detours in settlement areas shall be kept free of dust by frequent application of water. The contractor shall take all necessary measures for the safety of traffic during construction work and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required for the information and protection of traffic	Contractor	During construction

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	approaching or passing through the construction site. All signs, barricades, pavement markings shall be as per road specification Informational signs shall be posted where lane and road closures could substantially disrupt traffic circulation at least 7 days prior to the closure. Proper traffic controls shall be in place during closures to minimize impacts on traffic circulation and for traffic safety. Appropriate safety precautions shall be taken when transporting large equipment on public roadways.		
Campsite	**Campsites Restoration**		
Damaging of aesthetic and landscaping of the campsites	After the completion of construction activities at each site, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include: • Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas. • Soak pits, septic tanks shall be covered and effectively sealed off. • Debris (rejected material) should be disposed of suitably. • Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed. • If the construction camp site is on an agricultural land, preserve top soil and good earth can be spread back for a minimum 30 cm for faster rejuvenation of the land. • In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this specification. The rehabilitation is mandatory and should be include in the agreement with the landowner by the contractor. Also, he would have to obtain a certificate for satisfaction from the landowner.	Contractor	After the completion of construction activities
Operational Phase Sewerage System Rehabilitation Priority Sewer Network Rehabilitation			

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
Malir Basin Interceptors			
Soil and water contamination, odor and outbreak of diseases due to leakages and damaging of sewers and malfunctioning of disposal pumps	**Maintenance of Sewerage System and Disposal Pumps** It is required to look after the proper functioning of the sewerage system and disposal pumps throughout the project lifecycle. For such system, KWSB should have to be equipped with proper trained workforce and requisite machinery with the support of vigilant governance system. There shall be the need to equip standby disposal pumps and generator system to cope with all sort of emergency situation. Regular maintenance and upkeep of these pumps and generator system shall be under strict operation and maintenance regime.	Chief Engineer (KWSB)	Operational
Energy inefficiency of disposal pumps	**Implementation of Energy Efficiency Measures** It is required to conduct frequent energy audits of the disposal pumps and implement energy efficiency measures to reduce energy consumption and consequent environmental problems.	Chief Engineer (KWSB)	Operational
Water Supply Improvement Priority Water Network Rehabilitation			
Water borne diseases, shortage of water supply, water contamination due to damaging pipelines, improper water treatment (chlorination, filtration etc.) and malfunctioning of water supply system (water pumps)	**Ensuring Proper Functioning of Water Supply and Treatment System** It is required to look after the proper functioning of the water supply pipelines, pumping facilities and water treatment facilities (filtration, chlorination etc.) throughout the project lifecycle. For such system, KWSB		Operational

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	should have to be equipped with proper trained workforce and requisite machinery with the support of vigilant governance system. There shall be the need to equip standby pumps and generator system to cope with all sort of emergency situation. Regular maintenance and upkeep of these water supply pipelines, pumps, generators and water treatment facilities shall be under strict operation and maintenance regime.	Chief Engineer (KWSB)	
Energy inefficiency of water pumps and water treatment plants	**Implementation of Energy Efficiency Measures** It is required to conduct frequent energy audits of the water pumps and water treatment plants and implement energy efficiency measures to reduce energy consumption and consequent environmental problems.	Chief Engineer/Plant Manager (KWSB)	Operational
Desalination Plant			
Health implications on workers and nearby community and loss of biodiversity due to noise	**Noise Abatement at Project Sites** *(Common to Desalination, Wastewater Treatment Plants, Water Treatment, Water Pumps, Disposal Pumps)* Noise shall be generated at following project locations during operational phase:	Chief Engineer (KWSB)	Operational

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	• Water treatment facilities (filtration, coagulation and flocculation, desalination) • Tube wells and water pumps • Generators (water treatment, wastewater treatment, disposal station and water supply facilities) • Compressors/blowers (wastewater treatment facilities) • Pumping houses (desalination, wastewater treatment plants) Most of the above mentioned facilities shall be enclosed and their noise impact shall be restricted to the facilities only and noise shall not disturb the nearby community. However, the designing of these facilities shall take noise aspect into the consideration and built all the noise producing equipment (pumps, turbines, generators, compressors, blowers etc.) under enclosure to attenuate the noise impact to surrounding. To minimize noise impacts on workers, working at noise prone areas, the following measures should be taken: • Carry out regular inspection and maintenance of the equipment • Replace worn and noise producing parts of the equipment in a timely manner • In case of severe noise, use sound barriers to avoid the dispersion of sound waves into the nearby community • Workers should use noise protection equipment when working in a noisy area. • The noise level of 85 dBA for 8 hour working for the workers is considered safe. The management should ensure keeping noise levels within safe limits. In case of higher noise levels (more than 85 dBA), the workers should be rotated. The workers at higher noise level areas should not be allowed to work for more than two to three hours and shifted to calm places for rest of the hours.		
Fish damage from seawater intake	**Improved Design of Seawater Intake at Desalination Plant** Mitigation measures include i) improving the recovery rate of a desalination facility can also reduce impingement and entrainment. Typically, seawater	Designer	Design

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	desalination plants are designed to recover (turn into freshwater) 45 to 55% of the seawater collected by the intake. Designing the plant to operate closer to the upper limits of recovery (i.e., 50 to 55%) would require withdrawing less water and as a result, would reduce both impingement and entrainment, ii) installing low-velocity intakes that allow some organisms to swim out of the current or temporarily reducing pumping or intake velocity during critical periods for marine organisms, such as during spawning or important larval stages, iii) physical barriers installation are intended to block fish passage into the desalination plant and, depending on their design, can reduce both impingement and entrainment. These barriers include metal bars, or trash racks, primary coarse screens (which have openings of 20 mm to 150 mm, and smaller, secondary screens with openings of 1 mm to 10 mm). The design of the RO plant seawater intake should include all the above mentioned considerations to reduce impact on marine ecosystem.		
Seawater contamination due to discharge of brine, chemical cleaning solutions and sludge from water pretreatment, containing chemicals and salts	**Improved Disposal of Brine and Other Waste Streams into Sea** i) The desalination plants should dilute the concentrate to reduce density before release. Blending is a process that mixes the concentrate with cooling water, feed water, wastewater treatment plant effluent or other low TDS waters before disposal.	Designer	Design
	ii) The brine should be pretreated prior to disposal into sea. Pre-treatment consists of aeration, i.e., adding oxygen to the concentrate, and degasification to remove hydrogen sulfide from the concentrate. It is also recommended to use non-toxic additives and de-chlorination techniques to limit the toxic chemical concentrations that enter the environment. The need for these techniques is site specific. Also the pretreating the source water with membrane technologies, such as microfiltration or ultrafiltration, can reduce the use of chemicals throughout the desalination process.	Plant Manager	Operational

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	iii) The brine should be dispersed properly into the seawater. There are several proven methods to disperse concentrated brine. For example, multi-port diffusers can be placed on the discharge pipe to promote mixing. The design of the RO plant should include all the above mentioned considerations to reduce impact on marine ecosystem due to discharge of brine and chemicals.		
Contamination of aquifer	**Environmental Monitoring of Underground Pipelines** Desalination plants require water intake structures and pipelines that can carry feed water and discharge concentrate to and from sea respectively. The pipelines may be built 50 m below ground level and material may leak through to the aquifer. As such, the coastal groundwater aquifers may be contaminated through leakage in the long inlet/outlet pipes. The outlet pipes contain discharge sludge that is usually highly concentrated brine but may also contain low concentrations of chemicals sometimes at elevated temperatures. Therefore, careful monitoring of the piping as well as flow processes is needed. Appropriate monitoring devices may be attached to fixed structures to ensure failsafe subsurface flow processes and thus should be considered before construction is completed.	Designer Plant Manager	Design Operational
Soil contamination due to chemicals spillage and leakages	**Soil Pollution Control** *(Common to Desalination, Wastewater Treatment Plants, Water Treatment)* The improper handling and storage of chemicals, fuel, lubricant, oily solid waste etc. at water and wastewater treatment facilities, and desalination plant can lead to soil pollution. Soil pollution can be controlled by taking following measures: • Storage of fuel, paint, and oil containers, oil filters, oily parts and oily rags on impervious floor under shade or storing of fuel and lubricants	Chief Engineer (KWSB) Plant Manager (Desalination)	Operational

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	on a sand flooring of at least 6 inch thick, done on brick edge flooring lined with polyethylene sheet • Placement of fuel containers and liquid chemicals under containment and proper decantation arrangement to avoid its spillage and leakage on floor • Presence of spill kit to remove spills from the floor • Avoid washing the contaminated floors rather dry cleaning the spills from the floor with saw dust and rags • Location of fuel storage and refilling areas at least 500 m from all cross drainage structures and important water bodies		
Wastewater Treatment Wastewater Treatment for Reuse S IV Wastewater Collection and Treatment			
Health implications and loss of biodiversity due to noise	**Noise Abatement** As above	Chief Engineer (KWSB)	Operational
Health implications for workers and nearby community due to air emissions, odor and breeding of mosquitos/flies	**Protection of Workers from Health and Safety Hazards** The management of the projects (wastewater treatment plants, water treatment plants, disposal stations, desalination plant) is required to comply with all the precautions as required for the safety of the workmen as per the national and World Bank requirements. The Plant Manager/Engineer has to ensure that all operators of heavy or dangerous machinery are properly trained/certified, and also insured. The Plant Manager/Engineer shall supply all necessary safety appliances such as safety goggles, helmets, masks, safety shoes etc., to the workers and staff. Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. Maintenance activities shall be carried out by taking strict safety measures. The hazardous material and chemicals shall be handed as per the instruction of the specific Safety Data Sheet (SDS).	Chief Engineer (KWSB) Plant Manager (Desalination)	Operational

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	Medical facilities shall be provided to all the workers at the working locations. Suitable transport will be provided to take injured or ill person(s) to the nearest approachable hospital. The first aid box will be provided at every facility and under the charge of a responsible person who shall always be readily available during working hours. The workers working at aeration/biological tanks should be instructed to use facemasks to avoid inhalation of aerosol from the tanks. **Protection of Community Health** Community health can be affected due to noise and odor from the facilities, and improper disposal of solid waste and sludge. Noise control measures have already been mentioned above. The trees shall be planted at the periphery of the plant sites, particularly, the wastewater treatment plants, wastewater disposal stations and interceptors so that odor and noise could be attenuated due to the tree cover. The waste sludge from the wastewater treatment plant and other solid waste shall be properly collected, stored and disposed at designated places. The transportation vehicles shall be covered from the top to avoid any nuisance while passing through the residential areas. Mosquito larvae generally live in small, shallow water bodies, where disturbance of the surface layer is uncommon. In the aerated lagoon treatment process, vigorous mixing occurs in the complete-mix lagoon and also in the partial-mix lagoon, although to a lesser degree in the latter. These lagoons would not be suitable habitat for mosquito larvae. The polishing pond, however, may provide suitable habitat for mosquito breeding. There is also the potential for fly, mosquito or insect breeding at the sludge-drying site. However, once the sludge is dry, it is relatively inert and odorless. There will be regular anti-mosquito and insecticide spray at the plant facility to address the mosquito and insect problem. Fly and mosquito breeding in the polishing pond and sludge-drying beds can be controlled by the addition of chemicals (for example, calcium hypochlorite or chlorine).	Landscape Specialist	After completion of construction activities

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
		Chief Engineer (KWSB)	Operational
		Chief Engineer (KWSB)	Operational
Surface water (receiving bodies) contamination due to improper functioning of the plant	**Ensure Proper Functioning of Wastewater Treatment Plants** Improper functioning of the wastewater treatment plants shall result into insufficient treatment and contamination of surface water (receiving bodies) and soil. Plant operation requires strict operational control and regular monitoring. There shall be a standby arrangement for all the critical equipment of the plant so that plant could remain in operation even in case of failure of any equipment. The preventive maintenance shall be the priority of the plant management for ensure its perfect operation throughout the year. In the case of a power failure or shut-down, standby generators will be provided so that the plant can operate as long as possible. In the case of	Chief Engineer (KWSB)	Operational

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Potential Environmental Impacts	**Mitigation Measure**	**Responsibility**	**Implementation Stage**
	plant failure, chlorination of the effluent could also be increased to reduce the incidence of pathogenic bacteria.		
Soil contamination due to storage of oily parts and rags on unpaved floors, spillage and leakage of chemicals/lubricants/fuel on soil and improper disposal of sludge	**Soil Pollution Control** As above	Chief Engineer (KWSB)	Operational
Nuisance at the areas due to sitting of the plant	**Landscaping to Improve Aesthetic of the Sites** *(Common to Wastewater Treatment Plants, Disposal Stations, Wastewater Interceptors)* The aesthetic of the sites such as wastewater treatment plants, disposal stations and wastewater interceptors shall be improved by landscaping. The green spaces shall be developed at these sites to create their positive image among nearby community.	Landscape Specialist	After construction activities

7.8 Monitoring Framework

Monitoring of the Mitigation Plan (MP) is required at construction and operational phases of the project components. The monitoring is the requisite for World Bank and Sindh Environmental Protection Agency (SEPA). The monitoring framework is illustrated in Figure 6.

7.8.1 Construction Phase Monitoring

Construction phase monitoring of the project components shall be required for the compliance of MP and Environmental Management Plan (EMP) mentioned in the Environmental Assessment (EA) for World Bank and SEPA respectively.

a) Project Implementation Unit

The overall responsibility of compliance of MP and compliance reporting to World Bank and SEPA is with KWSB. The Project Implementation Unit (PIU), established under KWSB for the management of KWSIIP project activities, shall overall supervise the monitoring and compliance of MP.

b) Environmental and Social Cell (ESC)

The Environment and Social Cell (ESC) under PIU shall overall take care of environmental and social aspects of the project activities. ESC shall arrange environmental monitoring and prepare compliance reports and submit to PIU for further submitting to the World Bank, to fulfill its monitoring, reporting and compliance requirement of environmental safeguard.

The Construction Phase Environmental Management Plan (CPEMP) shall be prepared and appended with the tender document for the contractors. It will be a standard document. The contractors should be required to prepare their own site specific EMPs. These EMPs shall contain following plans to eliminate, offset or reduce environmental, health and safety impacts during construction phase:

- Sanitation plan
- Soil pollution control plan
- Dust control plan
- Waste management plan
- Health and safety plan
- Noise abatement plan
- Traffic management plan
- Campsite restoration plan
- Tree plantation plan

The compliance of CPEMP shall be the responsibility of the contractor and compliance cost shall be added in the bidding documents. The ESC shall have the responsibility to ensure compliance of CPEMP during construction phase through contractors. The compliance would require measurements of environmental parameters and observations at the construction sites to evaluate compliance. The ESC shall hire the services of independent environmental consultancy firm as Third Party for Third Party Validation (TPV).

c) Third Party Validation

The Third-Party Validation shall be carried out through independent environmental consultancy firm. The consultant firm shall monitor the environmental parameters and conduct field surveys at the construction sites to evaluate compliance level by the contractors. The

consultant firm shall prepare monthly monitoring and evaluation report for each site and submit to ESC. The ESC shall review the report, discuss with the consultant firm and finalize the findings. In case of noncompliance from the contractors, the ESC shall have the authority to halt the construction activities or impose penalties as per the contract conditions. The ESC shall submit the final version of monitoring and evaluation reports to PIU. PIU shall submit these reports to World Bank for their review and further action. Also these reports shall be submitted to SEPA as per the frequency to be mentioned in the construction phase 'No Objection Certificate (NOC)' requirements (Quarterly and yearly).

7.8.2 Operational Phase Monitoring

The overall responsibility of compliance of operational phase MP is with KWSB.

a) KWSB

In the organizational hierarchy of KWSB, Deputy Managing Director Technical Services (DMDTS), is overall responsible for the operation and maintenance of water supply and sewerage infrastructure. The Chief Engineer of each district is the sole responsible for the utility services in his respective district. The operation of utilities (water supply and treatment, sewerage and disposal pumps) and plants (wastewater treatment, desalination, water treatment) are under direct jurisdiction of Engineers and Plant Managers respectively.

The monitoring and compliance of operational phase MP shall be under the responsibilities of Engineers and Plant Managers for respective utility and plant. These personnel shall report to the DMDTS) for the compliance and monitoring of MP.

b) Environmental Laboratory

The KWSB Engineers and Plant Managers shall have the leverage to hire the services of competent environmental laboratory to monitor environmental parameters at utilities and plant sites. The compliance reports shall be submitted by the respective Engineers and Plant Managers to Deputy Managing Director at set frequency (fortnightly). The laboratory reports shall be the part of these compliance reports.

The respective Engineers and Plant Managers shall take corrective actions and preventive measures in case of any nonconformity against the MP. These corrective and preventive measures and rectification shall also be the part of the compliance reports.

The DMDTS shall submit the operational phase MP compliance reports to PIU for further submission to World Bank.

The monitoring plan is presented in Table 13.

Figure 6: Monitoring Framework

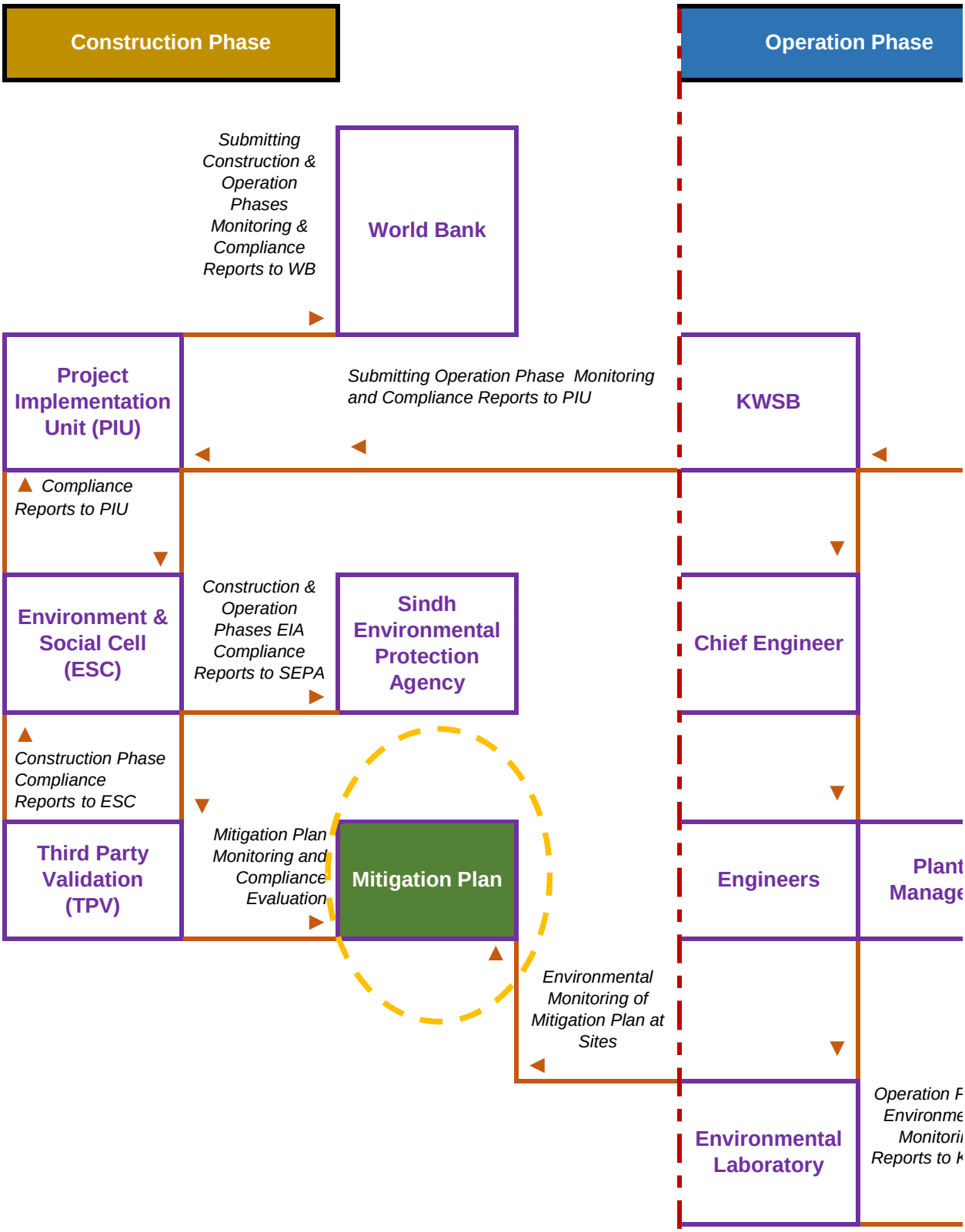


Table 13: Mitigation and Monitoring Plan

Subproject (s):*Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Construction Phase			
Restoration of the Construction Sites Tree Plantation	Environmental Consultancy Firm	***Evaluation for*** i) Proper stockpiling of topsoil ii) proper application of topsoil iii) tree plantation as per Tree Plantation Plan	Fortnightly at each site
Protection of Natural Habitats	Environmental Consultancy Firm	***Evaluation for*** i) Fencing of the sensitive resources ii) construction activities restricted to about 15 m of the resources iii) construction activities whether occurring during prime nesting season or not iv) if construction is carried out, it should be at about 75 m from the forested area to avoid disturbing nesting habitats v) the placement of visual and acoustic barriers at the vicinity of nesting habitats	-do-
Protection of Physical Cultural Resources (PCRs) .	Environmental Consultancy Firm	***Evaluation for*** i) the care taken by the contractor for the protection of PCRs (identification, protection measures taken, reporting etc.)	-do-
Suppression of Dust Emission Control of Stack and Vehicular Emissions	Environmental Consultancy Firm	***Evaluation for*** i) regular water sprinkling at dust generation points at construction sites and vehicular and machineries routes ii) use of dust masks by the workers iii) fitness certificates/maintenance records of vehicles/machines ***Monitoring for*** i) TSPM, PM_{10}, $PM_{2.5}$ at construction sites, vehicular routes, nearby community ii) stack monitoring of generators (CO, NOx, SOx iii) vehicular emissions (CO, NOx, SOx, Lead)	Weekly at each site
Wastewater Treatment	Environmental Consultancy Firm	***Evaluation for*** i) proper treatment and disposal of sanitary wastewater from campsites i.e. construction of septic tanks and disposal in the nearby drain through sewers	Weekly at each site

Subproject (s):*Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Mitigation Measure	**Monitoring Responsibility**	**Monitoring Parameters**	**Frequency**
		Monitoring for i) wastewater characteristics i.e. pH, BOD_5, COD, TSS, TDS)	
Solid Waste Management Hazardous Solid Waste Management	Environmental Consultancy Firm	***Evaluation for*** i) compliance of waste management plan ii) compliance of hazardous solid waste management plan iii) training of the workers iv) use of PPE during handling of hazardous solid waste	Weekly at each site
Soil Pollution Control	Environmental Consultancy Firm	***Evaluation for*** i) compliance of soil pollution control plan ii) availability of spill kit iii) spill response procedures iv) training of the workers	Weekly at each site
Noise Abatement	Environmental Consultancy Firm	***Evaluation for*** i) compliance of noise abatement plan ii) use of ear plugs/ear muffs by the workers iii) enclosures for the noisy equipment iv) erection of noise barriers at appropriate places v) equipment are fitted for silencers/mufflers v) fitness certificates/maintenance records of vehicles/machines vi) noise complaints records ***Monitoring for*** i) Noise levels (dBA) at construction sites ii) vehicular noise at about 7.5 m distance iii) noise levels at nearby community/forests	Weekly at each site Noise monitoring after every two hours at each location (8:00 am to 6:00 pm)
Occupational Health and Safety Management	Environmental Consultancy Firm	***Evaluation for*** i) compliance of health and safety plan ii) availability and use of PPE by the workers iii) accident records iv) availability of First Aid Boxes and trained staff for first aid v) medical facilities vi) safety measures at sites taken while working and operating machines vii) availability and use of fire control equipment viii) training of the staff ix) maintenance of hygiene conditions x) availability of safe drinking water ***Monitoring for*** i) drinking water quality	Weekly at each site
Traffic Management	Environmental Consultancy Firm	Evaluation for i) compliance of traffic management plan during construction	Weekly at each site
Campsites Restoration	Environmental Consultancy Firm	Evaluation for i) compliance of campsite restoration plan ii) pre and post scenario of the campsites	Pre and post construction

Mitigation Measure	Monitoring Responsibility	Monitoring Parameters	Frequency
Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
			activities at each site
Subproject(s): Sewerage System Rehabilitation, Priority Sewer Network Rehabilitation, Malir Basin Interceptors			
Operational Phase			
Maintenance of Sewerage System and Disposal Pumps	Chief Engineer (KWSB)/ Engineers	***Evaluation for*** i) compliance of Standard Operating Procedures (SOPs) ii) compliance of preventive maintenance schedule iii) records of complaints and their rectification iv) maintenance activities v) availability and condition of equipment for sewerage system upkeep vi) conditions of the equipment vii) training of the staff ***Evaluation for*** conduction of energy audit and implementation of energy efficiency measures	Daily
Implementation of Energy Efficiency Measures	Chief Engineer (KWSB)/ Engineers		Annual
Water Supply Improvement Priority Water Network Rehabilitation			
Operational Phase			
Ensuring Proper Functioning of Water Supply and Treatment System	Chief Engineer (KWSB)/Engineers	***Evaluation for*** i) compliance of Standard Operating Procedures (SOPs) ii) compliance of preventive maintenance schedule iii) records of complaints and their rectification iv) maintenance activities v) availability and condition of equipment for water supply system upkeep vi) conditions of the equipment vii) effectiveness of the treatment facilities viii) training of the staff ***Monitoring for*** i) treated water quality	Daily/ Water sampling and analysis (one sample daily from each site)

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Mitigation Measure	**Monitoring Responsibility**	**Monitoring Parameters**	**Frequency**
		Evaluation for conduction of energy audit and implementation of energy efficiency measures	Annual
Implementation of Energy Efficiency Measures	Chief Engineer/Engineers/Plant Manager (KWSB)		
Desalination Plant			
Noise Abatement at Project Sites *(Common to Desalination, Wastewater Treatment Plants, Water Treatment, Water Pumps, Disposal Pumps)*	Chief Engineer (KWSB)/Engineers/Plant Managers	***Evaluation for*** i) compliance of SOPs ii) use of ear plugs/ear muffs by the workers iii) enclosures for the noisy equipment iv) erection of noise barriers at appropriate places v) equipment are fitted for silencers/mufflers vi) compliance of preventive maintenance procedures/schedule ***Monitoring for*** i) Noise levels (dBA) at noisy areas of the site/plant	Daily/ Noise level monitoring once a day
Improved Disposal of Brine and Other Waste Streams into Sea	Plant Manager	***Evaluation for*** i) proper disposal of brine and other waste streams as per design ***Monitoring for*** i) brine characteristics i.e. pH, BOD_5, COD, TDS	Daily/Brine sampling and analysis once a day
Environmental Monitoring of Underground Pipelines	Plant Manager	***Monitoring for*** i) leak detection devices attached with underground pipelines infrastructure	Daily
Soil Pollution Control *(Common to Desalination, Wastewater Treatment Plants, Water Treatment)*	Chief Engineer (KWSB)/Engineers Plant Manager	***Monitoring for*** i) compliance of soil pollution control SOPs	Daily

Subproject (s): *Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Mitigation Measure	**Monitoring Responsibility**	**Monitoring Parameters**	**Frequency**
Implementation of Energy Efficiency Measures	Plant Manager (KWSB)	***Evaluation for*** conduction of energy audit and implementation of energy efficiency measures	Annual
Wastewater Treatment Wastewater Treatment for Reuse S IV Wastewater Collection and Treatment			
Operational Phase			
Protection of Workers from Health and Safety Hazards Protection of Community Health	Chief Engineer (KWSB)/Engineers Plant Manager	***Evaluation for*** i) compliance of health and safety SOPs ii) availability and use of PPE by the workers iii) training of the workers iv) maintenance activities as per safety standards v) handling and storage of hazardous material as per safety standards and SDS requirements vi) availability of medical facilities i.e. first aid, first aid boxes, transportation, hospitalization etc. vii) proper disposal of sludge and other waste material viii) plantation of trees ix) implementation of insect, mosquitos and flies control methods	Daily
Ensure Proper Functioning of Wastewater Treatment Plants	Chief Engineer (KWSB)/Plant Manager	**Evaluation for** i) compliance of SOPs ii) compliance of preventive maintenance plan/schedule iii) Operational ***Monitoring for*** i) influent and effluent characteristics i.e. pH, BOD_5, COD, TSS, TDS, O&G ii) DO in aeration tanks	Daily/Influent and effluent analysis once a day/DO analysis three times a day Annual

Subproject (s):*Sewerage system rehabilitation, Priority sewer network rehabilitation, Water supply improvement, Priority water network rehabilitation, Malir basin wastewater interceptors, Desalination plant, Wastewater treatment, Wastewater treatment for reuse, S IV wastewater collection and treatment*			
Mitigation Measure	**Monitoring Responsibility**	**Monitoring Parameters**	**Frequency**
Implementation of Energy Efficiency Measures	Plant Manager (KWSB)	***Evaluation for*** conduction of energy audit and implementation of energy efficiency measures	
Landscaping to Improve Aesthetic of the Sites *(Common to Wastewater Treatment Plants, Disposal Stations, Wastewater Interceptors)*	Chief Engineer (KWSB)/Engineers/Plant Managers	***Evaluation for*** i) maintenance of landscaping as per requirements	Daily

7.9 Capacity Building

Capacity building shall be required for the stakeholders involved for the implementation, supervision, monitoring, evaluation, and reporting of the mitigation measures during construction and operational phases of the project components. This section describes the capacity building requirements for the stakeholders involved.

Following are the key stakeholders involved for the accomplishment of the environmental safeguard requirements of the KWSSIP project:

- KWSB Technical Services Staff (KWSBTS)
- Environment and Social Cell (ESC)
- Environmental Consultancy Firm (ECF)
- Environmental Laboratory (EL)
- Contractors (CONTs)

Table-14 presents detail of trainings required for the capacity building of above mentioned key stakeholders on environmental safeguard requirements.

Table 14: Training Requirements

#	Trainings *(Resource Person)*	Key Stakeholders *(Frequency)*				
		KWSBTS	**ESC**	**ECF**	**EL**	**CONTs**
1	Overview of Project and Subprojects and their Environmental Impacts and Mitigation Measures	■	■	■		■
	(Environmentalist)	*Once at the start*				*Once for Every Contractor*
2	Construction Phase Environmental Management Plan (CPEMP)	■	■	■		■
	(Environmentalist)	*Once at the start*				*Once for Every Contractor*
3	Environmental Monitoring and Evaluation Requirements during Construction and Operational Phases	■	■	■	■	
	(Environmentalist)	*Once at the start*				
4	Environmental Assessment of the Projects		■			
	Environmentalist/EIA Expert		Once at start			
5	Environmental Monitoring, Evaluation and Compliance Reporting Requirements	■	■	■		
	(Environmental Safeguard Specialist)	*Once at the start*				

6	Public Consultation, Disclosure and Grievance Redress Mechanism Requirements *(Environmental Safeguard Specialist)*	■	■			
		Once at the start				

8.0 GRIEVANCE REDRESS MECHANISM

This chapter describes the Grievance Redress Mechanism to be adopted by the KWSB to facilitate resolution of any community complaints and grievances about the project's environmental performance, in line with the requirements of World Bank.

8.1 Requirements of Grievance Redress Mechanism (GRM)

KWSB will respond to concerns and grievances of project affected parties related to the environmental and social performance of the project in a timely manner. For this purpose, KWSB will propose and implement a grievance redress mechanism (GRM) to receive and facilitate resolution of such concerns and grievances. The GRM will be proportionate to the potential risks and impacts of the project and will be accessible and inclusive. Where feasible and suitable for the project, the GRM will utilize existing formal or informal GRM, supplemented as needed with project specific arrangements.

(a) The GRM is expected to address concerns promptly and effectively, in a transparent manner that is culturally appropriate and readily accessible to all project-affected parties, at no cost and without retribution. The mechanism, process or procedure will not prevent access to judicial or administrative remedies. KWSB will inform the project-affected parties about the grievance process in the course of its community engagement activities, and will make publicly available a record documenting the responses to all grievances received; and

(b) Handling of grievances will be done in a culturally appropriate manner and be discreet, objective, sensitive and responsive to the needs and concerns of the project-affected parties. The mechanism will also allow for anonymous complaints to be raised and addressed.

8.2 Grievance Redress Mechanism for KWSSIP

The KWSB will establish a Grievance Redress Mechanism (GRM) to facilitate the resolution of community complaints and grievances about the project's environmental and social performance. This shall be in line with the requirements of the World Bank. Under this mechanism, a Grievance Redress Cell (GRC) will be established in the Project Implementation Unit. At least there will be one focal person for GRM at each construction sites during construction phase. This person shall be directly accessible to the community for the registration of complaints and their resolution.

The established GRM will be communicated to the public and particularly the affected community through print and electronic media and during public consultations and community engagement events.

This cell shall maintain a Community Complaints Management Register (CCMR), at the site, for registering complaints and grievances. All written and oral grievances will be recorded in the Register. The information will include the date and the particulars of the complainant; a description of the grievance; the follow-up action required; the person responsible for implementing the action; and a target date for its completion. Each complaint shall be recorded in the register with a complaint number and provided to the affected person for follow up purpose. GRC member shall take necessary actions as per the nature, scale and type of the grievance registered. He or she can halt the construction activities in case the contractors do not comply with the CPEMP and causing grievances to the nearby community.

For operational phase GRM, the respective Engineers and Plant Managers of the utilities and plants respectively shall be responsible for maintaining community complaints in the CCMR and their resolution. They can also get the assistance of other team members of KWSB and PIU for the resolution of the complaints.

Android based GRM Application (GRM App) shall also be established, launched and publicized to make GRM effective, easy and accessible to everybody. This App shall be designed in a very user friendly simple format to lodge a complaint. After receiving the complaint, complaint number shall be sent to the applicant immediately. He or she will be contacted, if required. He or she will be informed as soon as his complaint is resolved or time to time updated for the progress of the complaint. This App shall be maintained by GRC. All the records of GRM shall be accessible to the public and World Bank. A monthly Grievance Redress Report (GRR) shall be prepared and be part of the compliance reports.

9.0 PUBLIC CONSULTATION FRAMEWORK

This chapter describes the requirement of the World Bank and the Sindh Environmental Protection Agency for the public consultation during different stages of the projects.

9.1 Requirement of World Bank for Public Consultation

KWSB recognizes the importance of early and continuing engagement and meaningful consultation with the public. KWSB will engage the public affected by proposed projects, through information disclosure, consultation, and informed participation in a manner proportionate to the risks to and impacts on affected communities. The Bank will have the right to participate in consultation activities to understand the concerns of affected people, and how such concerns will be addressed by KWSB in project design and mitigation measures. The Bank will monitor, as part of its due diligence, the implementation of consultation and public engagement by KWSB.

For all Category A and B projects proposed for International Bank for Reconstruction and Development (IBRD) or International Development Association (IDA) financing, during the environmental assessment (EA) process, KWSB will consult project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and takes their views into account. KWSB will initiate such consultations as early as possible. For Category A projects, KWSB will consult these groups at least twice: (a) shortly after environmental screening and before the terms of reference for the EA are finalized; and (b) once a draft EA report is prepared. In addition, KWSB will consult with such groups throughout project implementation as necessary to address EA-related issues that affect them.

9.2 Requirements of Public Consultation by Sindh Environmental Protection Agency

The public consultation or public hearing is also one of the requirements of the Sindh Environmental Protection Agency (SEPA) to consult public to get their views on the submitted Environmental Impact Assessment (EIA) report to the SEPA before final approval and award of construction phase NOC from SEPA. Prior to public hearing, advertisement is required to be given in any English or Urdu national newspaper and in a local newspaper of general circulation in the area affected by the project.

The Agency shall also ensure the circulation of the EIA report to the concerned Government Agencies and solicit their comments. All comments received by the Agency from the public or any Government Agency shall be collated, tabulated and duly considered by it before decision on the EIA. The Agency may issue guidelines indicating the basic techniques and measures to be adopted to ensure effective public consultation, involvement and participation in EIA assessment.

9.3 Disclosure

For meaningful consultations between KWSB and project affected groups and local NGOs on all Category A and B projects proposed for IBRD or IDA financing, KWSB will provide relevant material in a timely manner prior to consultation and in a form and language that are understandable and accessible to the groups being consulted.

For a Category A project, KWSB will provide for the initial consultation a summary of the proposed project's objectives, description, and potential impacts; for consultation after the draft EA report is prepared, KWSB will provide a summary of the EA's conclusions. In addition, for a Category A

project, KWSB will make the draft EA report available at a public place accessible to project-affected groups and local NGOs.

Any separate Category B report for a project proposed for IDA financing is made available to project affected groups and local NGOs. Public availability in the borrowing country and official receipt by the Bank of Category A reports for projects proposed for IBRD or IDA financing, and of any Category B EA report for projects proposed for IDA funding, are prerequisites to Bank appraisal of these projects.

Once KWSB officially transmits the Category A EA report to the Bank, the Bank distributes the summary (in English) to the executive directors (EDs) and makes the report available through its InfoShop. Once KWSB officially transmits any separate Category B EA report to the Bank, the Bank makes it available through its InfoShop.

10 BUDGET

This chapter describes the tentative budget for the environmental assessment and compliance of mitigation plan during construction and operational phases of the project and subprojects.

10.1 Tentative Budget

The yearly tentative budget under different cost head is mentioned in Table 15. Total tentative budget for the compliance of environmental safeguard requirements is about Rs.181.6 million.

Table 15: Tentative Yearly Budget for Environmental Assessment and Compliance

All Costs are in Pak Rupee (PKR)

#	Cost Head	Unit Cost	No. of Units	Total Amount
	A- Environmental Assessment (Lump Unit Cost)			
1	Sewerage system rehabilitation	500,000	1	500,000
2	Priority sewer network rehabilitation	500,000	1	500,000
3	Water supply improvement	500,000	1	500,000
4	Priority water network rehabilitation	500,000	1	500,000
5	Malir basin interceptor	1,000,000	1	1,000,000
6	Desalination plant	1,000,000	1	1,000,000
7	Wastewater treatment	1,000,000	1	1,000,000
8	Wastewater for reuse	1,000,000	1	1,000,000
9	SIV Wastewater collection and treatment	1,000,000	1	1,000,000
	Total-A			***7,000,000***
	B- Construction Phase CPEMP Implementation			
11	Fixed cost per project (fire safety equipment, septic tanks, installation of noise barriers, and environmental monitoring equipment) Estimated 20 sub-projects, and lump sum each project cost	1,000,000	20	20,000,000
12	Monthly operational cost (PPE, first aid, solid waste management, water sprinkling, traffic management, Restoration of camp sites etc.) for 12X20=240 months	300,000	240	72,000,000
	Total-B			***92,000,000***
	C-Operational Phase MP Implementation			
13	Fixed cost per project (as above)	500,000	20	10,000,000
14	Monthly operational cost (For One Year)	2,000,000	12	24,000,000
	Total-C			***34,000,000***
	D-Training			
15	Training cost (EMF) for 6 trainings	500,000	6	3,000,000
	Total-D			***3,000,000***

	E- Third Party Validation Cost			
16	Third party validation cost (For One Year)	2,000,000	12	24,000,000
	Total-E			***24,000,000***
	F- Operation of Environment & Social Cell			
17	Environment and Social Cell Cost (For One Year) (Salary of Environmental Engineer, Junior Environmental Scientist at PIU, and one environmental Scientist at each district and Operational expenses of the cell)	1,800,000	12	21,600,000
	Total-F			***21,600,000***
	Grand Total			**181,600,000**

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