ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

FOR

CONSTRUCTION OF SURFACE WATER TREATMENT PLANT (PACKAGE 03)

TRANSMISSION MAIN, FEEDING MAIN AND DISTRIBUTION NETWORK

(PACKAGE 04)

Lahore Water and Wastewater Management Project

DRAFT ESIA REPORT

11 October 2019

ABBREVIATIONS

AIIB	Asian Infrastructure Investment Bank
AIDS	Acquired Immune Deficiency Syndrome
Al	Aluminium
AP	Affected People
APHA	American Public Health Association
As	Arsenic
B	Boron
Ba	Barium
BCP	Building Code of Pakistan
BDL	Below Detection Limit
BOD	Biological Oxygen Demand
BOQ	Bill of Quantities
BRBD	Bambanwala Ravi Bedian Depalpur
CAPEX	Capital Expenditure
CBD	Convention on Biological Diversity
CBOs	Community Based Organizations
CCMR	Community Complaints Management Register
Cd	Cadmium
CDA	Capital Development Authority
CDIAC	Carbon Dioxide Information Analysis Centre
CFCs	Chlorofluorocarbons
CIA	Cumulative Impact Assessment
Cl	Chlorine
CMR	Complaint Management Register
CN	Cyanide
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
CoI	Corridor of Impact
Cr	Chromium
Cu	Copper
dB	Decibel
DBO	Design, Built and Operate
DCO	District Coordinating Office

DDO	Deputy District Officer
DI	Ductile Iron
DMAs	District Metered Areas
DMZs	District Metered Zones
DOTS	Directly Observed Treatment Short
E&S	Environmental and Social
EA	Executing Agency
EC	Electrical Conductivity
EDO	Executive District Officers
EHS	Environment, Health & Safety
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMP	Environment Management Plan
EPA	Environmental Protection Agency
EPC	Engineering Procurement and Construction
EPO	Environmental Protection Ordinance
ES	Environment and Social
ESHS	Environment, Social, Health and Safety
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESP	Environmental and Social Policy
ESSs	Environmental and Social Standards
ESS	Environment and Social Staff
F	Fluorine
GC/MS	Gas Chromatography–Mass Spectrometry
GIIP	Good International Industry Practice
GoP	Government of Pakistan
GoPb	Government of Punjab
GPCD	Gallons Per Capita Per Day
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GRS	Grievance Redress System
HC	Hydrocarbons
HIV	Human Immunodeficiency Virus

HUD and PHED	Housing Urban Development and Public Health Engineering Department
IEE	Initial Environmental Examination
IPCC	Intergovernmental Panel on Climate Change
IPPF	Indigenous Peoples Planning Framework
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
KIS	Key Informants Survey
KWSB	Karachi Water and Sewerage Board
LAA	Land Acquisition Act
LBC	Lahore Branch Canal
LCC	Lower Chenab Canal
LDA	Lahore Development Authority
LESCO	Lahore Electric Supply Company
LWASA	Lahore Water and Sanitation Agency
MCL	Metropolitan City of Lahore
MCM/year	Million Cubic Meters per year
MDGs	Millennium Development Goals
MGD	Million Gallon Per Day
Mn	Manganese
MS	Mild Steel
MSDS	Material Safety Data Sheet
MW	Mega Watt
NCS	National Conservation Strategy
NEAP	National Environmental Action Plan
NGO	Non-Government Organization
NGVS	No Guideline Value Set
Ni	Nickel
NO	Nitrogen Monoxide
NO_2	Nitrogen Dioxide
NO_{3-}	Nitrate
NOC	No Objection Certificate
NO_x	Nitrogen Oxides
NRW	Non-Revenue Water
NS	No Standard

NSDWQ	National Standards for Drinking Water Quality
NTU	Nephelometric Turbidity Unit
O&M	Operational and Maintenance
O_3	Ozone
ODP	Ozone Depletion Potential
OHS	Occupational Health and Safety
OPEX	Operational Expenditure
P&D	Planning and Development
PAH	Polynuclear Aromatic Hydrocarbons
Pak-EPA	Pakistan – Environmental Protection Agency
PAPs	Project Affected Persons
PAS	Pakistan Administrative Service
Pb	Lead
PCRWR	Pakistan Council of Research in Water Resources
PD	Project Director
PEPA	Pakistan Environmental Protection Act
PEPC	Pakistan Environmental Protection Council
PEPO	Pakistan Environmental Protection Ordinance
PEQS	Punjab Environmental Quality Standards
PHA	Punjab Horticulture Authority
PHED	Public Health Engineering Department
PM_{10}	Particulate Matter of 10 micrometres size or less
$PM_{2.5}$	Particulate Matter of size 2.5 micrometres or less
PMC	Project Management Consultants
PMU	Project Management Unit
PNCS	Pakistan National Conservation Strategy
PPE	Personal Protective Equipment
PPP	Purchasing Power Parity
PRV	Pressure Reducing Valve
PSC	Project Steering Committee
PSES	Perseverance Social & Environmental Safeguards
PVC	Polyvinyl Chloride
RD	Reduced Distance
RoW	Right of Way
RP	Resettlement Plan

RPF	Resettlement Planning Framework
Sb	Antimony
SDGs	Sustainable Development Goals
SDR	Solar Dominance Ratio
Se	Selenium
SESMP	Site-specific Environmental and Social Management Plan
SF_6	Sulphur Hexafluoride
SIA	Social Impact Assessment
SO_2	Sulphur Dioxide
SO_x	Sulphur Oxides
SSI	Semi-structured Interview
STI	Sexually Transmitted Infections
SWTP	Surface Water Treatment Plant
TCU	True Colour Unit
TDS	Total Dissolved Solids
TMA	Tehsil Municipal Administration
TOC	Total Organic Carbon
TSS	Total Suspended Solid
UAN	Universal Access Number
UGT	Underground Tank
VECs	Valued Environmental Components
WAPDA	Water and Power Development Authority
WHO	World Health Organization
WSS	Water Supply and Sanitation
WTS	Water Treatment Sludge
Zn	Zinc

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EXECUTIVE SUMMARY

Government of Punjab, through the Lahore Water and Sanitation Agency (LWASA), is planning to implement the Lahore Water and Wastewater Management Project (LWWMP) through financing from the Asian Infrastructure Investment Bank (AIIB). It will comprise construction of water supply and wastewater infrastructure. To address the environmental and social impacts of the LWWMP and to comply with the national regulatory as well as AIIB Environmental and Social Policy requirements, the present Environmental and Social Impact Assessment (ESIA) has been prepared for the water supply component (the proposed project) comprising packages 3 and 4.

Project Background

Pakistan is in the group of countries that are now moving from the state of water stressed to water scarce countries. High population growth, increasing urbanization, inefficient irrigation practices, un-sustainable water use, and fragmented management are placing enormous pressure on surface and ground water resources. Lahore depends entirely on groundwater to meet the water demand of its 11.1 million population. Water is abstracted through 585 tube-wells installed in the city and then is pumped into the main distribution system. The current state of the water extraction is fast depleting the groundwater. Lahore also lacks bulk conveyance and treatment systems for the domestic and industrial wastewater that it produces. Resultantly, most of the wastewater is disposed into the nearby storm water drains, which eventually discharge into Ravi River untreated. This has serious health and hygiene implications for the residents and major environmental implications for the city's water bodies and Ravi River.

In order to address the above issues, the LWASA has proposed the LWWMP to improve reliability of water supply and wastewater services in the metropolitan city of Lahore and improve operational performance of the LWASA.

Project Description

Category of the proposed project

The Punjab Environmental Protection Act categorizes the proposed project as Schedule-II (F). In accordance with the AIIB's Environmental and Social Policy (ESP), the proposed project has been assigned Category 'A'.

Components of the proposed project

To augment existing groundwater supplies with the surface water resource, the Water Supply Infrastructure component of the LWWMP includes the following:

a) Package-03: Diversion of 100 cusec (245,000 m3/day) of water from Bambanwala-Ravi-Bedian-Depalpur (BRBD) canal to the proposed surface water treatment plant by constructing the required water intake infrastructure and channel; and construction of a new Surface Water Treatment Plant (SWTP) with a capacity of 54MGD (245,000 m3/day) and supplying it to the most affected areas of the city.

b) Package-04: Construction of 3.5km-long transmission main pipeline for water supply from the SWTP to feeding mains pipeline; 55 feeding mains pipeline (28 km long) connecting to the existing distribution network of four selected serving areas, and rehabilitation of existing distribution pipes (81km), covering four district metering zones (DMZs) named Shadipura, Baghbanpura, Fatehgarh and Mustafabad of district Lahore.

Location of the proposed project

The proposed project site is located in the South-East of Lahore near the Indian border, BRBD canal and Bhaini road. The proposed SWTP (Package 03) is located in two villages (i) 90% part is located in village Ganja Sindhu; (ii) and 10% part in village Natt while 3 km long Intake Channel pass through three village (i) Ganja Sindhu (0.7km); (ii) Jandiala (1 km); and (iii) Bhaseen (1.2 km) of Union Council 176 Awan Dhaewala Tehsil Shalimar, District Lahore and of Punjab province of Pakistan. The proposed electricity transmission line will be installed from nearest existing Momin Pura grid station located 5.7 km away.

The water transmission main, feeding main and distribution pipeline (Package 04) will be laid down along the Bhaini road near Moaza Lakhodair and will connect to Shadi Pura distribution network of LWASA. The treated water will be distributed to four (04) serving areas including Shadipura, Baghbanpura, Fatehgarh and Mustafabad of district Lahore.

Implementation schedule of the proposed project (Packages 03 and 04)

The implementation of the project is divided into two parts[1]. The first part will be the preconstruction phase of six (06) months and the second part will be the construction stage of 36 months. The operation and maintenance (O&M) of the proposed project will be carried out by Engineering Procurement and Construction (EPC) Contractor for almost 2 years.

Assessment of Alternatives

Several alternatives were considered and investigated for the proposed project to reduce possible environmental, social and resettlement impacts.

Three (03) site options were considered for SWTP (Package 03):

[1] (Annexure-10, PC-1 of LWWMP-Construction of SWTP at BRBD Canal-June, 2019)

- **Option-1:** The SWTP is proposed next to BRBD canal along Bhaini Road. The total land required will be about 300 Acres. Land in excess to 300 Acres required for SWTP is available at this location.
- **Option-2:** The SWTP is proposed at a distance of 4.5 km from BRBD canal towards Ring Road along Bhaini Road. Land in excess to 302 Acres required for SWTP is available at this location.
- **Option-3:** The SWTP is proposed to be located near Natt kalah village

After assessing merits and demerits of all three options, option-2 was found more feasible due to its cost effectiveness, less travel time and no requirement of additional land for UGTs and OHRs, there it is proposed to be selected for the SWTP.

Three (03) site options were considered for the laying of transmission main (Package 04):

- **Option-1:** Parallel to Bhaini Road towards Hando Mohallah. The total length of this proposed option is 3.1 km length up to the terminal point near Meya Town.
- **Option-2:** Along Bhaini Road having a total length of 3.4 km length up to the terminal point at serving area of Fateh Garh.
- **Option-3:** Parallel to Bhaini Road towards Zahra Peer.

After considering all three options, option-2 was found more feasible due to its financial viability, and no requirement of addition land as the pipe will be laid along the Bhaini Road. Therefore, it will have least environmental and social impacts and is proposed to be selected for the laying of transmission main. Two (02) options were considered for water treatment process (technological alternatives):

- **Option-1:** ultra-filtration (membrane technology)
- **Option-2:** conventional treatment (rapid sand filter)

After assessing merit and demerits of both options, option-2 was found more feasible as it is cost-effective, easy to operate and can remove heavy metals and total organic carbon (TOC) that may present in raw water. Therefore, the option-2 is proposed to be selected for water treatment process.

Policy, Legal and Administrative Framework

According to Punjab Environmental Protection Act, 2012, an environmental and social assessment study is required prior to commencement of any development project. The present document complies with this requirement.

The AIIB Environmental and Social Policy is also applicable for this proposed project. According to this Policy, the proposed project falls under Category A that requires ESIA study (where the project is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented). The proposed project will require application of Environmental and Social Standard (ESS) 1 – Environmental and Social

Assessment and Management and ESS 2 – Involuntary Resettlement (which includes land acquisition).

Environmental and Social Baseline of the proposed project area

The Proposed Project site is located at the South-East of Lahore near the BRBD canal and Bhaini Road. The proposed project area is less developed than the other parts of Lahore.

The direct area of influence consists of (i) Ganj Sindhu village and some parts of Moazza Naatt for the construction of SWTP. (ii) The area of about 3.5 km for the proposed Transmission Main starting from SWTP at Ganj Sindhu to a point near Shadi Pura along Bhaini road to four (04) serving areas i.e. Shadipura, Baghbanpura, Fatehgarh and Mustafabad of district Lahore (Package 04).

In Lahore, there are two sources of clean water, one is surface water which is no more available while the second is ground water which is being extracted through 585 tube wells amounting to the volume of 2.45 million m3/day (540 MGD). The total surface water diverted to Lahore is 6.02 million cubic metre per day (MCM/day) and is mainly used for agricultural purposes. The Bambawala-Ravi-Badian-Deplapur (BRBD) Canal mainly feeds the command area of Upper Bari Doab Canal on the Pakistan side of the Pak-India border. The Upper Bari Doab Canal irrigates command areas of Lahore Branch, Khaira distributary, Butcher Khana distributary, Main Branch Lower and other smaller channels. The remaining flow of the BRBD Canal supplements Depalpur Canal. The main sources of surface water that can be used, as alternative to groundwater in Lahore are Ravi River, Lahore Branch Canal, Khaira Distributary and the BRBD canal. To reduce the stress on groundwater of Lahore, water from one of these four sources needs to be collected and treated for domestic, commercial and industrial use.

There are a number of sensitive receptors along the project routes (within 3-4 km) that may be adversely affected by the project activities including religious institutions, schools, administrative institutions, health facilities, graveyard, and fishery farm.

Baseline of air quality, water quality (both surface and groundwater) and noise levels were monitored and the parameters were found to be within the limits. However, the bacterial contamination was evident in most of the surface water and groundwater samples, apparently due to the contamination from sewage water.

In general, various kinds of common trees and shrubs were found haphazardly planted in the project area. Local bird species were observed flying in the area, on the trees, bushes and on electricity lines. Large mammals were not seen in the area but small mammals such as bats, squirrels, domestic cat, jackals etc., were observed. Farm Animal such as cow, buffalo, goat etc. were observed in the area. Fish species in BRBD canal include Mali Fish, Rahu Fish and Thela Fish. All floral and faunal species are not listed in the “Red List” according to the

International Union of Conservation of Nature (IUCN). No endemic species was recorded from the study area.

The major local communities nearby the proposed project area are Ganj e Sindhwan, Natt Kalan, Taj Garh, Momin Pura and its Grid Station, Baghban Pura, Sukh Nehar, Mughal Pura, Dharam Pura, Fateh Garh, Karool Ghatti, Itehad Park (Cantt,) Lakhodair and Harbanspura etc. The proposed sites for the SWTP and the water intake channel are covered with cultivated land and vegetables, wheat and grains are the common crops. Local people get water from hand pumps, motor operated pumps and some of the tube wells installed by WASA for drinking purpose. Health and sanitation situation is not satisfactory. Also, there is no proper sewage system in the proposed area.

The result analysis of socio-economic survey of the proposed project area indicates that majority of the people belong to low socioeconomic group. Majority of the people are living in joint family system (63%) and in cemented houses (98.5%). Majority of the community members (98%) are Muslims and almost 63% are literate (can read or write). However, a large proportion (27%) of people are illiterate mainly because of low socio-economic status. Approximately 2000 different industries were identified in the area including steel processing, wood, pharmaceutical, plastic bag manufacturing industries and flour mills. Important historical sites found in the project area include Shalimar Garden, Tomb of Takiya Yateem Shah and Tomb of Dai Anga/Gulabi Bagh.

Stakeholder consultation

A steady consultation process has been maintained with all relevant stakeholders including general public, civil society organisations, responsible authorities, environmental experts and government officials and some secondary stakeholders, e.g. private industrial sectors. The responses from the stakeholders were gathered through focus group discussion, interviews, meetings and stakeholder questionnaire and all the points discussed were recorded. Written feedbacks and pictorial profile of all stakeholders being consulted are provided as report annexures.

The local community members were apprehensive about the water quality, price of metered water and billing system and demanded a subsidized water supply in near future. Majority of them stated that the proposed project will not generate any adverse environmental impacts and will provide them with an easy access to clean drinking water supply which is presently their basic need.

The local government officials expressed their concerns such as expected risk of dengue, excessive land requirement and purchasing, expected life risk to the locals and clearing of agricultural land. They recommended that the ESIA of the proposed project should be shared with their respective departments for feedback. Similarly, the proposed ESMP and other

project related documents (except confidential information) should be available in public domain to examine the project and its suitability.

Furthermore, the environmental experts suggested that project alternatives should be considered in detail in the proposed ESIA report and most feasible options should be selected in order to minimize all the possible environmental, socio-economic and biological impacts. They further suggested the use of latest technology and processes for water treatment and overall project activities. Other environmental experts stated that no hunting policy and wildlife protection mechanism should be adopted throughout the project. Also, advanced waste management practices should be adopted.

Anticipated Environmental and Social Impacts (Package 03 and 04)

The proposed project of LWASA is expected to have both positive and negative impacts on the physical, biological and socio-economic environment of the project area.

The anticipated positive impacts of both Package 03 and 04 include:

The project will provide sustainable and clean water source in serving areas. Access to clean water will improve the general health status of the area and reduce exposure to waterborne diseases. The proposed project will sensitize all consumers to use less water as LWASA will charge them according to their consumption. There will be need of large quantities of materials required for construction and operation of the project, the majority of which will be sourced locally and from surrounding areas. This will eventually offer a ready market for suppliers in and outside the project area. The project will provide relief, social burdens imposed on women as they are the caretakers of their sick children and elderly groups. The proposed project will have also a positive impact on climate as presently there are 60 tube wells contributing 6.28tCO2eq per hour in the atmosphere through usage of approximately 13.75MW of electricity, however, the proposed SWTP will only require 4 MW to operate hence contributing 1.828tCO2eq per hour in the atmosphere. Moreover, the most significant impact of the project would be, the reduced dependency on the groundwater reserve resulting in an increased useable lifetime of the aquifer, as well as employment opportunities in its' both phases i.e. construction and operation.

Significant negative environmental impacts during construction of Package 03 may include:

The construction activities such as site preparation, grading, excavations/earthworks, spoil and stockpiling of materials, construction machinery (such as asphalt and batching plant) and vehicular movement have a potential to generate substantial amount of dust at the site. Other source of dust emission could be the material transporting vehicles on unpaved road, which is going towards proposed site of SWTP i.e. Bhaini and Ganj-e-Sidhwan Road. Major sources

of exhaust emissions may include non-road diesel equipment, construction machinery (such as asphalt and batching plant) and earth moving equipment (fork lifters, excavators and bulldozers etc.) and the vehicles which will be used to transport construction material. Emission from these sources will contribute to increase in concentration of sulphur dioxide, nitrogen dioxide, carbon monoxide and particulate matter in the project area, and may increase the global warming potential of the project. Currently, water is not scarce in the project area. Whereas, the construction of the proposed project would require approximately 80 m3/day amount of water, which will be fulfilled by groundwater resource. The extraction of 80 m3/day of water will cause additional but minor burden on groundwater resouce which is currently being used by the residents to meet their domestic water demands. However, no major impact is anticipated on irrigational land. Improper management of solid, liquid, and hazardous substances may pollute existing soil, surface and ground water quality of project area. Furthermore, poor construction management practices can cause disturbance to aquatic life of BRBD Canal. The establishment of permanent facilities such as the tanks, treatment works and access roads will result in the permanent loss of topsoils from these sites. Whereas, noise and vibrations are also expected to generate during construction activities using heavy machinery and transportation vehicles. These noise sources will most likely to affect the sensitive receptors present within the proximity of construction works. Various types of waste will be expected to generate in the course of construction which includes; spoil (from excavation), shrubs, stumps and felled trees, packaging wastes (cement bags, plastics, excess rejected material), and liquid waste (washout and washroom waste). Improper management of such waste at construction sites and camps will impact the health and safety of the workers, local residents and aesthetics of the area.

The flora and crop cover of the area will be greatly affected by the construction of proposed SWTP, as it involves clearing/removal of 324 acres (131 hectare) of agricultural land as well as uprooting of several trees and cutting of approximately 343 fruit trees of Guava. However, no major tree/plant cutting and vegetation removal is involved during laying of power transmission lines, as the transmission route is covered with a very thin layer of vegetation, which is not of any significant importance. During the construction activities at SWTP, farm animals like cattle and sheep, habituating the adjacent agricultural fields may get displaced and affected by the project activities. Furthermore, the power transmission lines will pose electrocution threats to bats and birds of the area when they are travelling in group. Improper handling and storage of hazardous substances and empty cement bags at construction site can lead to fire and explosion that may in turn cause injury and possible death of a worker. Lack of provision of personal protective equipment (PPE) and training can cause serious health and safety hazards at site.

Mitigation Measures

The surplus water from the construction activities should be used in spraying and sprinkling of the area to reduce the dust emissions, All roads within the plant site will be paved as early as possible after completion of construction work. Batching plants and all the associated machinery should be installed with suitable pollution abatement technology such as scrubbers. A containerized sewage treatment plant (STP) can be installed for the duration of construction period which may treat water and make it reusable for green areas. The contractor should ensure efficient use of water at site by sensitizing construction staff to prevent irresponsible water usage to reduce pressure on existing local water source. To prevent surface/ground water contamination, spillage prevention and control measures should be instituted where hazardous materials are stored in pallets and where possible under cover in secondary containment. Minimize shoreline disturbance e. g limiting access of construction activities and workers to vulnerable areas that could contribute to sediment loading. Establish a buffer strips of natural vegetation along the shore to stabilize shorelines. Conduct regular monitoring of canal for turbidity and total suspended Solids

The risks of soil erosion and degradation can also be significantly reduced by adoption of good construction site management practices, such as establishment of vegetative buffer zones, slope stabilization, protection of soil storage areas and use of sediment traps. All noisy equipment should be installed and operated as far away from the sensitive receptors as practicably possible. The contractor should ensure that, the high noisy activities should be carried out after the school timings. All machinery and vehicles to be used at site should be in good working condition and properly lubricated. The waste that is recyclable or reusable (aluminium or iron bars) should be sold to waste vendors and those that cannot be sold out (broken brick pieces) should be used as a filling material for levelling the depressions, subject to technical feasibility. All non-recyclable waste generated at the site should be sold to EPA certified waste vendor such as Global Waste Management, Lahore. Cash compensation should be given to the titleholders of the affected agricultural land. LWASA has allocated approximately 10 Million Rupees for compensatory plantation purposes, which is capable of planting approximately 10,000 to 15,000 trees of about 5-6 feet height. Use signage and speed humps in the areas where farm animals crossing is possible. Ensure to maintain safe distance between two phases and phase and ground, so that the group of bats and birds may not get entangled in them. Provide and appropriate PPEs to site workers and train them in handling of emergency situations.

Significant negative environmental impacts at various stages of project implementation of Package 04 may include:

As the laying of water transmission mains and distribution network will be carried out on main roads, narrow streets and close to sensitive receptors, therefore dust and exhaust emissions generated from construction activities can cause nuisance and severe health effects on workers and sensitive receptors present at site. Presently, all serving areas are using groundwater to meet their daily water demands and use of same resource of water during construction will cause additional burden on this resource. The works at construction site including removal of topsoil and digging, as well as presence of machinery and workers at site will have minor negative impacts on soil quality. Improper management of the construction debris may cause the existing drainage system to fail or get clogged, hence, causing localized flooding of the properties adjacent to these structures. This flooding may negatively impact the people, sensitive receptors present in low lying area such as Fateh Garh and Shadipura. During construction, the noise levels of the area might enhance as there are many already small-scale industries (such as wood, steel and cold storage) and commercial areas present within the RoW of water transmission mains and distribution network. The main waste during laying of water distribution network includes; excavated soil, old and worn-out pipes, spoils, kitchen and chemical waste as well as maintenance wastewater (generated while maintenance and cleaning of machinery, equipment and vehicles).

During the construction phase of the project, approximately 250 trees will be removed, majority of which are located along the route Lahore Branch canal. As the project activities will be carried out in residential communities therefore, no endangered animal species exists in the area. Only the domestic and stray animals like cats and dogs can be seen wondering in the area which can be affected by hitting and striking with moving machinery.

Mitigation Measures

Avoid and or control blowing of dust from potential sources by shielding them off from the exterior. For example, using tarpaulin or plastic sheets or by sprinkling with water. Carryout regular monitoring at the site or near the sensitive receptors in order to ensure that ambient air quality remains within the standards limits set by PEQS. All construction machinery should be properly tuned and maintained in good working condition in order to minimize emission of pollutants. The contractor should ensure efficient use of water at site by sensitizing construction staff to prevent irresponsible water usage to reduce burden on existing local water source. Remove and store topsoil in separate piles and reinstate after refilling of trenches. The contractor should be responsible for ensuring that no construction material or waste debris shall block the existing drainage channel in the areas of distributions mains. All machinery and

vehicles to be used as site should be in good working condition and properly lubricated and maintained to keep noise levels within the acceptable range of PEQS. The soil excavated should be used as backfill and thereby reducing the generation of spoil material and related waste pollution concern. Old and broken pipes should be sold to the local vendor. LWASA has allocated approximately 10 Million Rupees for compensatory plantation, which is capable of planting approximately 10,000 to 15,000 trees of about 5-6 feet height. Train drivers to maintain speed limits in the congested area or where there is possibility of encountering the stray and domestic animals.

Significant negative social impacts at various stages of project implementation may include (Package 03 and 04)

Social impacts such as: traffic congestion, which will be moderately increased in both areas of Package 03 and 04, resulting in an increase in dust and noise pollution in the subsequent project areas. Whereas, during Construction phases, influx of immigrant workers at site may expose to many communicable diseases. Gender inequality might arise during construction through discrimination made against women by unequal work distribution and unequal pay structure among others. Sexual harassment against women might occur as a consequence of mixing of men and women at the construction site. The influx of labors, typically young guys seeking construction jobs can be associated with a series of social challenges such as crime, illegal drug abuse and prostitution. Villainy such as drug abuse and prostitution would affect social harmony and security in project area and ruining the image and intent of an otherwise a good project. According to the baseline data, several graveyards present in the areas of Package 04 are coming under the corridor of the impact. Other important sites coming under corridor of impact include: a Shrine of Madho Lal Hussain, Shah Gor Pir and Takia Shah as well as historical places such as Shalimar Garden and tomb of Dai Anga.

Mitigation Measures

Resettlement plan is being developed in agreement with Project Affected Persons (PAPs). Compensation to project affected people should be paid in cash and should be according to the current market value. Establish a proper traffic management plan in consultation with traffic police department. Regular water sprinkling should be done on all construction active areas present close to sensitive receptors in order to reduce dust exposure. Limit the construction activities to day time to avoid disturbance to nearby communities. Sensitize workers and surrounding communities on awareness and prevention of communicable diseases through training, awareness campaigns and workshops during community meetings. The Contractor should make sure that no discrimination is made on the basis of gender while hiring of workers. A Gender Action Plan (GAP) is being developed which will include at minimum, conformance

with relevant laws, equal opportunity employment and gender sensitization. Establish and strictly enforce a No Sexual Harassment Policy in accordance with provincial law. Develop and enforce a strict code of conduct for workers to regulate behaviour in the local communities. Eliminate an employee who continues misconduct or lack of care, carries out duties amateurishly or inattentively, fails to conform to provisions of the contract, or persists in any conduct which is harmful to safety, health, or the protection of the environment. Alternate route should be assigned for the people going towards historical/cultural places. before start of construction at cultural historical places, necessary approvals from Punjab Archaeological Department.

Anticipated Environmental Impacts During Operational Phase (Package 03)

Improperly maintained generators can discharge hot gases / smoke into the air and pollute the existing air quality of the project area. SF6 is a gas with excellent insulation performance and used in many tubular poles of power transmission. This is a potent greenhouse gas with a significantly higher global warming potential than carbon dioxide. The leakage of this gas from poles can cause adverse impacts on local air quality. The water treatment process will generate waste from coagulation/flocculation, sedimentation and filtration processes. The sludge generated, if not properly disposed, has potential to pollute the underlying soil, surface and ground water resources. Approximately, 0.06 m3/day of domestic waste (such as kitchen, paper and plastic waste) and 15 m3/day sewerage is expected to generate from the construction site. During project operational phase, noise and vibration level at SWTP site might increase considerably during working of pumps, blowers, motors and generators. The proposed project of SWTP will cause additional burden of 100 cusec on BRBD canal, which is expected to increase to 1000 cusec in future. Thus, the agricultural fields already being irrigated by BRBD will face water shortages in near future leading to loss of agriculture and livelihood of the many titleholders. Whereas, poorly designed chlorine storage tanks and constructed electric installations can lead to fire and explosion that may in turn cause injury and possible death of the workers. Improper handling and storage of hazardous substances and lack of training and avoidance of the use of PPE by workers can cause serious health hazards leading to injuries and possible death.

Mitigation Measures

The generator to be installed at site should be equipped with chimney having proper height to discharge the hot gases/smoke. LESCO should prefer CF3I insulating gas as alternative to SF6. Recycling of filter backwash water should be done (expected to be 5% of the volume abstracted) and the coagulant sludge, which is considered to be toxic, can be dumped in Lakhodair landfill site present at a distance of approximately 3 km from the proposed site of

SWTP or sold to the EPA certified waste vendor such Global Waste Management for incineration. Integrated waste management system should be developed for the site to manage domestic waste of the site. All noisy equipment and machinery such as generators and blowers should be housed in closed rooms or buildings, and the workers should be provided with necessary PPEs i.e. ear plugs and muffs etc. while working near the noisy machinery. Ensure water abstraction does not exceed quantities agreed with irrigation department. Appropriate fire safety equipment should be installed at convenient locations within the plant. Proper training should be given to site workers on health and safety measures, to save them from possible occupational hazards. Hazardous materials should be well labelled and stored in their original containers, and the workers should be provided with necessary PPEs while dealing with hazardous material.

Anticipated Environmental Impacts During Operational Phase (Package 04)

The water leaks may occur due to water overflow or when the pipe becomes old and ruptures due to natural incidents such as earthquake. Leaking water pipes can allow potentially harmful contaminants to enter into existing drinking water system thus deteriorating the water quality. In addition, the BRBD Canal runs throughout 11 months of a year. Under the annual canal closure plan, Indus River System Authority (IRSA), BRBD canal remain close for 20-25 days. In this period of time, the surface water will not be available in these areas. The consumers of the selected areas, after completion of the SWTP project, will be affected. So, there is a need of proper approach and plan for these particular 20-25 days. Pipe repair and fitting work may generate noise at site. This impact can be anticipated as minor and insignificant as this will remain only for very short period of time. Solid waste generated during maintenance work will consist of excess soil, broken concrete, pipe and fitting material. This impact can be anticipated minor as a very little amount of waste is expected to generate. However, there would be no additional wastewater generation is anticipated in the operational phase of the project as LWASA will charge the consumers of the serving areas according to the amount of water consumed by them. The new water metering system will induce efficient water consumption by the households of the serving areas of the project.

Mitigation Measures

Establish a leakage management plan for all District Metered Zones (DMZ) and District Metered Areas (DMAs). LWASA has planned to make the 28 tube wells remain operational to meet their water demand during canal closure period. As for the noisy maintenance activity at site, the immediate residents should be informed prior to work, ensuring to carry out the activity only in day time. After the repair and maintenance activity the disturbed area shall be backfilled

immediately. The solid waste should be managed through a detailed Integrated Waste Management Plan prepared by the contractor.

Environmental and Social Management Plan (ESMP)

The Project Management Unit (PMU) for the Project will be LWASA. The PMU will be supported by a team of consultants, the Project Management Consultants (PMC) in implementation of the project. The dedicated team of Environment and Social Specialists of PMC will support PMU in ESMP implementation, reviewing and approving site specific environmental and social management plan (SSESMP) submitted by the contractors, supervising and reporting contractors' environmental and social performance, assessing the contractor compliance with the submitted SSESMP and contractor's code of conduct, as well as fulfilling requirements of AIIB and other stakeholders.

The construction contractors will be responsible for implementation and adherence to all the mitigation measures and monitoring arrangements outlined in the ESMP associated with their respective activities. The contractors will be hired through proper bidding procedure. The contractors must have qualified environmental and social experts on full time basis to interpret and implement the ESMP.

The ESMP provides a mitigation plan, a monitoring plan and a training program with responsible parties and budget. The ESMP shall become the part of construction contract agreement and shall be strictly enforced during the implementation of the proposed project.

Grievance Redress Mechanism (GRM)

The GRM has been developed for the LWWMP and the same would be followed for the proposed project. It comprises three-tier system to provide a time-bound, early, transparent and fair resolution for project-affected people (PAPs) and other stakeholders' grievances. The Environmental and Social (ES) staff of Project Management Unit (PMU) will undertake public awareness campaigns on the GRM with the assistance of ES staff of PMC and contractors. All complaints received verbally or in writing will be properly documented and recorded in the Complaint Management Register(s). In addition, an easy-to-access web-based GRM will be implemented.

ESMP Budget

The total estimated cost for environmental mitigation measures and environment quality monitoring for construction and operational phase is PKR 262m ($1.7m), which include PKR 229m/$1.5m for construction phase environmental mitigation measures and environment quality monitoring; and PKR 33m/0.2m for operational phase environment management cost and environmental monitoring.

CHAPTER 01

1 PROJECT INTRODUCTION

1. Government of Punjab, through the Lahore Water and Sanitation Agency (LWASA), is planning to implement the Lahore Water and Wastewater Management Project (LWWMP) through financing from the Asian Infrastructure Investment Bank (AIIB). It will comprise construction of water supply and wastewater infrastructure. To address the environmental and social impacts of the LWWMP and to comply with the national regulatory as well as AIIB Environmental and Social Policy requirements, the present Environmental and Social Impact Assessment (ESIA) has been prepared for the water supply component (the proposed project) comprising packages 3 and 4.

1.1 PROJECT BACKGROUND

2. Pakistan is in the group of countries that are now moving from the state of water stressed to water scarce countries. High population growth, increasing urbanization, inefficient irrigation practices, un-sustainable water use, and fragmented management are placing enormous pressure on surface and ground water resources. Lahore depends entirely on groundwater to meet the water demand of its 11.1 million population. Water is abstracted through 585 tube-wells installed in the city and then is pumped into the main distribution system. The current state of the water extraction is fast depleting the groundwater. Lahore also lacks bulk conveyance and treatment systems for the domestic and industrial wastewater that it produces. Resultantly, most of the wastewater is disposed into the nearby storm water drains, which eventually discharge into Ravi River untreated. This has serious health and hygiene implications for the residents and major environmental implications for the city's water bodies and Ravi River.

3. In order to address the above issues in Lahore, Water and Sanitation Agency (WASA) Lahore has proposed the Lahore Water and Wastewater Management Project (LWWMP). The LWWMP is being considered for funding by the Asian Infrastructure Investment Bank (AIIB). The overall objectives of the LWWMP are to improve reliability of water supply and wastewater services in the metropolitan city of Lahore and improve operational performance of the LWASA. The LWWMP project will diversify Lahore water supply to a surface water source by diverting water from Banbawala Ravi Bedian Depalpur irrigation canal. More sustainable, reliable and predictable water will be provided to the residents of Lahore by constructing water treatment, transmission and distribution infrastructure under the project. Introduction of consumer metering and replacement of old network will significantly reduce the non-revenue water which is currently estimated at 45 percent of total supplied water.

4. As part of wastewater management in Lahore, the LWWMP project will assist LWASA in construction of a modern conveyance system by constructing the proposed trunk sewers through underground tunnelling (a trenchless technique which minimizes excavation). The proposed project will also rehabilitate the storm water infrastructure.

5. In accordance with AIIB's Environmental and Social Policy (ESP), a study of environmental and social impact assessment (ESIA) has been carried out. Two ESIA reports have been prepared for the two components of the project, as listed below.

- ESIA for Trunk Sewer from Larech colony to Gulshan-e-Ravi (the present document)
- ESIA for Water Supply Infrastructure (presented under separate cover).

This report presents the ESIA for Water Supply Infrastructure, and consists of the following parts:

i. Water intake structure and channel, and Surface Water Treatment Plant (SWTP) (Package 03)
ii. Water Supply Pipeline of transmission main, feeding main and rehabilitation of existing distribution network of four (04) serving areas in Lahore (Package 04)

1.2 Objectives of the ESIA

6. The overall purpose of carrying out this ESIA is to ensure compliance with applicable regulations, policies and guidelines of Government of Punjab (GoPb) and AIIB's Environment and Social Policy (ESP) and Standards. The specific objectives of the proposed ESIA are as follows:

- Identification of the project activities
- Establishment of Environmental and Social baseline conditions of the project area by employing various methodologies and identifying sensitive components of the existing environment within the project area and area of potential project influence.
- Ensure that potential significant positive and adverse environmental and social impacts associated with the project activities are identified.
- Recommend mitigation and monitoring measures during construction, commissioning and operation phases that can be incorporated into the design of the proposed activities to minimize any damaging effects or any lasting negative consequences.
- Prepare an Environmental and Social Management Plan (ESMP) to be implemented during the development of the proposed project and detailed mitigation measures as well as institutional roles and responsibilities for the operationalization of the ESMP.
- Assess the proposed activities and determine whether they comply with the relevant environmental regulations of Government of Punjab and Government of Pakistan and requirements of the project lenders, the AIIB.

- Prepare an ESIA report for submission to the Asian Infrastructure Investment Bank (AIIB) and Environmental Protection Agency (EPA), Punjab.

1.3 Project Overview

7. Currently, the groundwater abstraction by Lahore WASA is 2,454,888 m3/day (540 MGD)[2], or equivalent to 2.45 million cubic meters per day. In addition to this, a significant quantity of water is also abstracted by Private Housing Societies, Cantonment Boards, Railway Colonies and areas under the jurisdiction of local government. Consequently, the groundwater table continues to deplete rapidly. The current decline rate is observed to be more than one meter per annum. With the ongoing declining of groundwater level, several existing tube wells are becoming un-operational and the city has started to face severe water shortages. Thus, the groundwater source alone does not seem to be a dependable source for the future[3].

8. To augment existing groundwater supplies with the surface water resource, the Water Supply Infrastructure component of the LWWMP includes the following three partss:

c) Diversion of 100 cusec (245,000 m3/day) of water from Bambanwala-Ravi-Bedian-Depalpur (BRBD) canal to the proposed surface water treatment plant by constructing the required water intake infrastructure and channel; and construction of a new Surface Water Treatment Plant (SWTP) with a capacity of 54MGD (245,000 m3/day) and supplying it to the most affected areas of the city.

d) Construction of 3.5km-long transmission main pipeline for water supply from the SWTP to feeing mains pipeline; 55 feeding mains pipeline (28 km long) connecting to the existing distribution network of four selected serving areas, and rehabilitation of existing distribution pipes (81km), covering four district metering zones (DMZs) named Shadipura, Baghbanpura, Fatehgarh and Mustafabad of district Lahore.

e) Construction of a new Ravi syphon of BRBD canal.

9. The ESIA report pertains to the first two parts (a and b). A supplementary ESIA will be carried out when the design of the Ravi syphon is being prepared. An addendum ESIA report for this part will be prepared to this ESIA report.

1.3.1 Proposed Project Area and Location

10. The location of the proposed water intake structure, channel and SWTP (Package 03) is at Moza (revenue boundary and also called village) Ganj Sindhu (most part) and moza Natt (some part) while the Intake Channel will pass through three villages named moza Ganja Sindhu, moza Bhaseen and moza Jandiala from intake at RD-315+040 of BRBD Canal of

[2] 1 MGD (UK) = 4,546 m^3/d
[3] (Appendix II: TOR of the ESIA consultancy, ESIA for LWWMP-Inception Report (Final) Jan-2019).

Union Council 176 Awan Dhaewala, tehsil Shalimar, district Lahore, Punjab province of Pakistan with an access form Bhaini Road. The location can be accessed through Ring Road and G.T Road and down the Bhaini Road while the surface water source (BRBD Canal) is located in the East of SWTP site. The water transmission main, feeding main and distribution network and the distribution pipeline (Package 04) will be laid down along the Bhaini road near Moaza Lakhodair (Bhaini Road connects BRBD Canal West Bank road to the Ring road), and will connect to Shadi Pura Distribution Network of LWASA.

11. A parcel of an estimated land of 324 acres (131 hectare) will be acquired for the construction of SWTP and water intake channel (a linear strip of land (17 acres): 3km long and 21 meters wide) from four moazas/villages namely Ganj Sindhu, and some parts of Moaza Natt, Jandiala and Bhaseen (Package 03) respectively.

12. The area for the proposed Transmission Main pipeline for water supply will be about 3.5 km starting from SWTP at Ganj Sindhwan to a point near Shadi Pura along Bhaini road. The treated water will be distributed to a total area of 30.56 km^2 divided in four (04) serving areas (Package 04). Further details of the project location and area along-with location map is given in Chapter 2.

1.4 Project Beneficiaries

13. The proposed project will provide employment opportunities to the local communities during both the construction and operation phases. More importantly, the project will provide Water Supply Infrastructure from proposed SWTP by pumping through different feeding mains to the existing distribution network of LWASA to approximately over one (01) million population of four areas of Lahore district covering Shadipura, Baghbanpura, Fatehgarh and Mustafabad. Degradation of water quality is a very severe issue and causing numerous health problems. The current total water demand in these four areas is 44 Million gallons per day (MGD) at the rate of 40 gallons per capita per day (180 litres per capita per day). The total population of these areas is projected to be 1,389,800 up to year 2030[4]. Consequently, the total water demand for year 2030 is projected to be 55.60 MGD, while the capacity of proposed SWTP for inflow of 100 cusecs is 54MGD (245,000 m3/day). Main beneficiary areas are as follows:

- Shadipura distribution network, with a total area of 11.45 km^2, will serve a total population of 228,768. The total length of distribution network will be approximately 178 km.
- Baghbanpura distribution network, with a total area of 5.42 km^2, will serve a total population of 366,499. The total length of distribution network will be approximately 169 km.

4 Annexure-01, PC-1 of Lahore Water and Wastewater Management Project (LWWMP)-Construction of SWTP at BRBD Canal-May, 2019

- Fatehgarh distribution network, with a total area of 10.41 km^2, will serve a total population of 397,778. The total length of distribution network will be approximately 237 km.
- Mustafabad distribution network, with a total area of 3.28 km^2, will serve a total population of 102,611. The total length of distribution network will be approximately 127 km[5].
- People from adjoining areas, who may receive water from the mentioned areas
- LWASA will run the operations of the first surface water treatment plant in the Lahore District

1.5 Approach and Methodology of ESIA

14. The systematic investigative and reporting methodology for conducting this ESIA study was adopted from provincial rules and regulations framed under Punjab Environment Protection Act (PEPA-1997 amended in 2012) and AIIB Environmental and Social Policy and Environment and Social Standards (ESSs). Following key activities were performed for conducting this study:

i. Desk review was carried out and information/documentation was collected for:
- Relevant environmental and social laws
- Water environmental quality and discharge standards, including environmental quality report and environmental monitoring data
- Previous studies for key environmental and social issues
- Surface and groundwater monitoring data and related information

ii. Baseline environmental profile of the study area has been primarily collected through field visits to the proposed sites, comprehensive literature survey, field studies and investigations and discussion with stakeholder and various agencies.

iii. The ESIA team made reconnaissance field visits between June 2019 and July 2019 to collect information, carry out discussions and conduct field studies to collect primary data in the key areas of terrestrial and aquatic ecology, hydrology, industries and socioeconomics of the local community, physical and biological environment. The ESIA team also consulted various line agency personnel, local communities and environmental groups. Available reports and literature relevant to the project were reviewed and socio-economic and environmental data available from local authorities were collected.

iv. Various government departments were visited for collection of data including:
- Punjab Forest Department, District Lahore
- Punjab Fisheries Department, District Lahore
- Punjab Wildlife and Parks Department, District Lahore

[5] Final Feasibility Study Report of Lahore Water and Wastewater Management Project (LWWMP)-Feb. 2019

- Punjab Irrigation Department, District Lahore
- Punjab Industries Department, District Lahore
- Pakistan Meteorological Department, District Lahore
- Punjab Archaeological Department, District Lahore
- Pakistan Council of Research in Water Resources (PCRWR), District Lahore

15. A few departments such as Rapid Soil Fertility Research Institute Lahore and Mines and Mineral Department of Punjab, Lahore were contacted telephonically to obtain information required for establishing baseline study of the project area.

i. An industrial survey of more than 500 industries was carried out to collect information such as; wastewater discharge from industries, number of wastewater discharge outlets along River Ravi, current water usage downstream of River Ravi, and hydrological and hydraulic data of River Ravi, etc. The report also highlighted the details of the drainage system used in Lahore.

ii. Site environmental monitoring was conducted for water, groundwater, air, noise, and other parameters as needed, in order to collect the data of the environmental baseline of the project area.

iii. Multiple samples were collected from the project area (Package 03 and 04) for ambient air quality assessment with the help of equipment such as Respirable Dust Sampler, HAZ Scanner (Model HIM-6000), Digital Dust Monitor (Model-3443), Sound Level Meter (SL-5868P), Garmin etrex 20, Kanomax Ambient Air Gadgets, Carbon Monoxide Meter and Carbon Dioxide meter.

iv. Multiple water (surface, ground and wastewater) samples were collected by using water sampling device (WinLab) as per American Public Health Association-APHA Standard method and examined in EPA Certified Lab.

v. Soil samples were collected as per the standard protocol and were analysed in EPA certified lab.

vi. Ecological data including flora and fauna for Package 03 was collected employing standard techniques. Transect walks were undertaken along the eight feet wide kacha (unpaved) road constructed to demarcate the agricultural fields.

vii. Only seasonal plants were observed during the survey. However, for comparison of frequency and abundance, trisects were run by following stratified randomized method for plants. Usual field parameters like plant composition, cover and density could not be applied in this situation. However, the frequency and abundance are used to define the problems to a fair extent. Solar Dominance Ratio (SDR) could not be employed beyond a reference status as the number of plants at each point was too small to make a forest type or vegetation type. Also, the area is not being used for grazing etc., the carrying

capacity calculation in that direction would also be a futile exercise since all planting and removing is partial so no dynamics of the plant community have been taken into account. Apart from delineation of plant species by using the afore mentioned method, the species date available from each study was also subjected to statistical analysis.

viii. For fauna study, the areas to be monitored were demarcated and study points A to Z were selected and marked. The surveyors were allowed to use indirect signs in addition to direct sighting of the animals or the birds. The equipment included binocular, cameras and wherever required a GPS.

ix. General observations were recorded to assess set criteria to study socioeconomic conditions. The baseline information is based on general observations during survey of the area and data collected from secondary sources. Living conditions like appearance of houses, sanitation of the surrounding environment, mode of transportation, quality of water used, methods of getting water, availability of gas and electricity etc. were observed in order to have an idea about the socioeconomic conditions of the community inhabitants and factory employees.

x. More than 100 neighbouring community inhabitants of the project area were interviewed for the socioeconomic assessment. The questionnaires were specifically designed to address education level, occupation, family size, number of earning individuals, total income and the issues regarding housing and schools. Data was analysed for the selected parameters for the socioeconomic assessment of factory employees and community members. Mean/ averages, ranges and percentages were used to analyse the data and the results are interpreted in the form of graphs.

xi. An assessment of alternatives was carried out for the proposed project sitting/locations and adopted technologies.

xii. The project sites were reviewed and assessments of any planned land acquisition and associated displacement (physical and economic) were made for both title holders and non-title holders.

xiii. For the identification, prediction, analysis and evaluation of the potential impacts that may originate from the project, diverse study methods and tools including use of checklists, matrices, expert opinions and observations were employed.

xiv. Significance of potential environmental and socio-economic impacts was determined by considering event magnitude and receptor sensitivity of project activities. Event magnitude was determined based on parameters such as Extent/Scale, Frequency, Duration and Intensity, each was equally weighted and assigned a rating of 1, 2 or 3. Resulting individual ratings were then summed up to give the overall event magnitude ranking. Receptor sensitivity (biological/ecological, human and physical feature/receptor) was determined based on parameters such as Presence of Receptor, Resilience of

Receptor and Human Receptors, each of one were equally weighted and assigned a rating of 1, 2, or 3. Receptor sensitivity was then scored on a scale from low (score: 1) to high (score: 6) by adding the individual parameter scores.

xv. An Environmental and Social Management Plan was developed which recommends (a) measures to safeguard the environment before, during, and after implementation of the Project; (b) mitigation measures and the monitoring program, including cost implications and an institutional setup for implementing the program; and (c) responsible agency for environmental monitoring during project implementation.

xvi. A detailed Social Impact Assessment was conducted to collect gender disaggregated impact data and develop mitigation measures, particularly with reference to resettlement and information was used to prepare a Resettlement Plan (RPs) separately for SWTP (Package 3) and for the water treatment plant and transmission line and distribution system (Package 4), as needed.

xvii. Stakeholder Engagement Workshop was conducted at LWASA office in order to prepare a Stakeholder Engagement Plan (SEP) in accordance with PAK-EPA and Environmental and Social Standards of AIIB.

16. Once approved by the Lahore Water and Sanitation Agency (LWASA) and Asian Infrastructure Investment Bank (AIIB), the report will be disclosed as per the legal and AIIB requirement.

1.6 Area of Influence

17. The potential impacts of the proposed project on its surrounding physical environment include air and water quality impacts, noise generation, land transformation and changes to soil. The direct area of influence consists of (i) Ganj Sindhu village and some parts of Moazza Naatt for the construction of SWTP. (ii) The area of about 3.5 km for the proposed Transmission Main starting from SWTP at Ganj Sindhu to a point near Shadi Pura along Bhaini road to four (04) serving areas i.e. Shadipura, Baghbanpura, Fatehgarh and Mustafabad of district Lahore (Package 04).

18. The adverse impacts are expected to be more severe in areas located near to the project and will reduce as the distance increases from the project and its associated activities (broader area of impact). For this purpose, a study area of one kilometre around each of water intake structure and channel, SWTP, transmission main, feeding main and distribution network was delineated in view of potential impacts, to assess the baseline conditions in the areas likely to be affected by the project due to its proximity to the project site. This is referred to as the Area of Influence in this study (**Figure 1.1 and 1.2**).

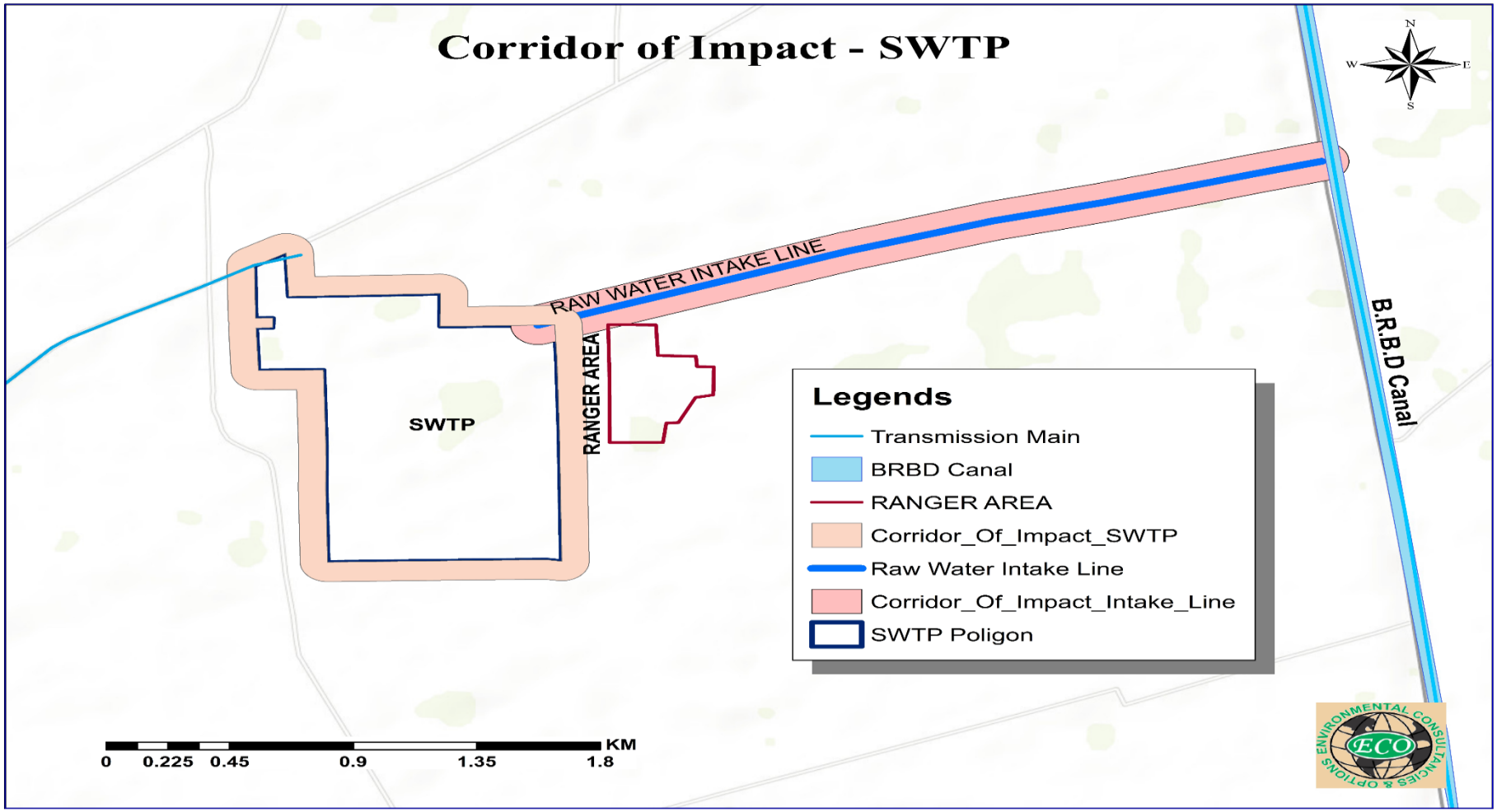


Figure 1.1 Area of Influence (Package 03)

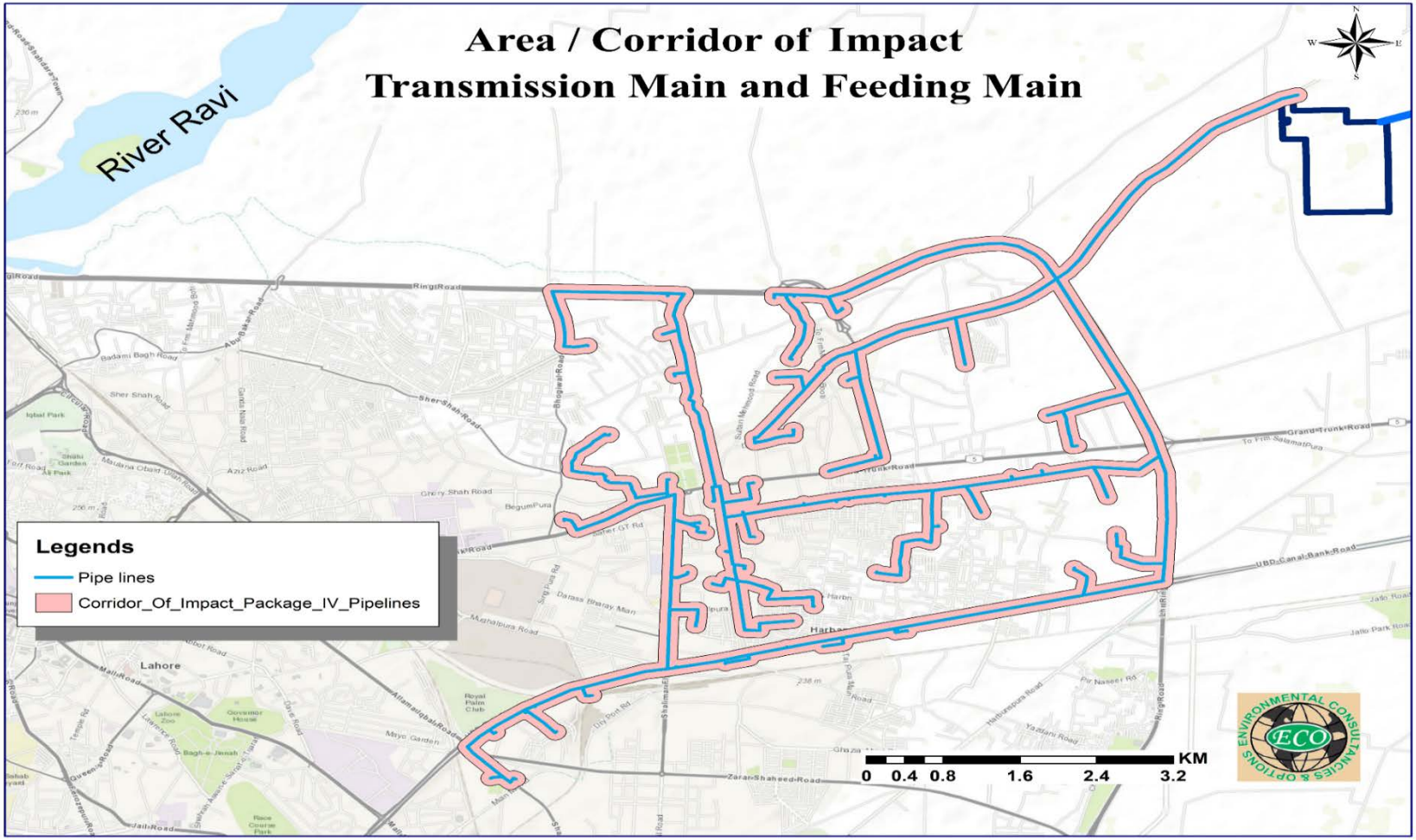


Figure 1.2 Area of Influence (Package 04)

1.7 Composition of the study team

19. The composition of the ESIA study team is provided as Annexure-CC.

1.8 Structure of the ESIA Report

20. The structure of the ESIA report is presented below in **Table 1.1**.

Table 1.1 Structure of the ESIA Report

Executive Summary	
Chapter 1 "Introduction"	**It covers briefly** Objective of ESIA, Project Overview, Project Beneficiaries, Overview of Legal and Policy Framework, Approach and Methodology of ESIA, Area/Corridor of Impact, Composition of the study team and structure of ESIA report.
Chapter 2 "Project Introduction"	**It provides information about** Project Background, Project Objectives, Project Components, Overview of Policy and Legal Framework, Project Civil Works, Description of Associated Facilities, an overview of Master Plan for Water Supply for Lahore, Need for the Project along with Associated Facilities, Project Location, Salient Features, Waste Generation and Disposal, Human Resource Requirements for the Project and Operation and Maintenance
Chapter 3 "Legal, Policy and Regulatory Framework"	**It comprises of** National Water Policy 2018, National Drinking Water Policy 2009, Punjab Drinking Water Policy 2017, National Environment Policy 2005, Adaptation of Millennium Development Goals Indicators by Pakistan, GoP/GoPb Environmental, Social and Resettlement Laws, Land Acquisition Act of Pakistan, AIIB Environmental and Social Policy, AIIB Environment and Social Standards, Good International Industry Practices, Gap Analysis and Requirements for Statutory Clearances.
Chapter 4 "Environment and Social Baseline Conditions of the Project Area"	**It gives detail about** Study area, Physical Environment, Biological environment, Social and economic environment, Land use and natural resources and Cultural aspects.
Chapter 5 "Assessment of Alternatives"	**It covers mainly** No Project Scenario, Infrastructure Siting, Construction Camp, Material Sourcing, Other Temporary and Permanent Facilities, Technology Alternatives for Drinking Water Treatment, and Operations and Management Cost,

	Water Discharge and Sludge Alternatives, Utility Network Alternatives, Alternatives from the perspective of Land Acquisition, Resettlement and other Social Factors and Summary Table of Alternatives.
Chapter 6 "Stakeholder Participation, Consultation and Information Disclosure"	**It covers in detail** Requirements for Stakeholder's Participation, Consultations and Information Disclosure, Regulatory Requirements**,** The AIIB Requirements, Consultation and Information Disclosure Process, Outcome of Consultations and Information Disclosure, Stakeholder Engagement Methodology, Identification of Stakeholders, Outcome of Stakeholders Mapping**,** Identification of Stakeholders Views and Concerns and Stakeholder Engagement Plan
Chapter 7 "Environmental and Social Impacts and Risks and Mitigation Measures"	**It discusses** Assessment of Primary and Secondary Impacts, Positive Impacts of the Project, impacts during construction phase, impacts during operational phase, impacts during the Decommissioning Phase, Mitigation Measures, Project Associated Risks-Management and Mitigation, Climate Change Considerations, Risk of Earthquakes, Action Plan for Climate Change, Chance Finding Procedures and Cumulative and Induced Impacts, and Mitigation Measures"
Chapter 8 "Environmental and Social Management Plans, and Monitoring and Evaluation"	**It includes** Environment and Social Management Procedures for the Project, Institutional Arrangement and Responsibilities, Capacity Building and Training plan for LWASA and other Stakeholders, Inclusion of ESMPs in Contract and Bidding Documents, Construction Environmental Action Plan, Environmental Code of Conduct, Mitigation Plans, Cost of Implementation of ESMPs, Environment Monitoring Plan, AIIB Monitoring and Evaluation, Compliance Monitoring and Effects Monitoring, Labour Management Plan, Documentation and Reporting and ESMPs Implementation Budget
Chapter 9 "Grievances Redress Mechanism"	**It includes** National/Provincial Regulatory and Policy Requirements on Grievances Redressal Mechanism, Assessment of Current Grievance Redressal Practices and Institutional Arrangements of LWASA, Description of Grievance

	Mechanism, Grievance Record Keeping, Monitoring and Reporting
Annexes	NOC from Irrigation Department, Construction Activities and Materials, Summary of Population projection, Punjab Environmental Quality Standards (PEQS), Gap Analysis and Requirements for Statutory Clearances, comparison between IFC/AIIB and PEQS for noise, Traffic count, Lab Reports packages-03 and 04, Pictorial evidence for Environmental Monitoring Packages-03 and 04, Pictorial Profile of Flora and Fauna Packages-03 and 04, Public consultation feedback forms, pictorial profile of consultation with Government officials and responsible authorities, Feedback forms of consultation with government officials and responsible authorities, Pictorial Profile of consultation with experts, Feedback form of consultation with Experts, Pictorial Profile of Stakeholder Engagement Workshop, Attendance sheet for Stakeholder Engagement Workshop, Calculation for Power Requirement, Labour Camp Management Plan, GHS Emission Inventory, Occupational Health and Safety Management Plan, Chance Find Procedure, Social Framework Agreement (SFA), Grievance Logging and Initial Response Form, Tools for Conduction ESIA, Composition of ESIA team, list of reference and Glossary.

CHAPTER 02

2 PROJECT DESCRIPTION

2.1 Project Background

21. Currently there are two burning issues related to water in Pakistan; one is the quantity of water and the other is the quality of the supplied or extracted water. Globally water scarcity especially with respect to water degradation is an issue in almost all the under-developed and most of the developing countries. Pakistan is no exception to this scenario and as per the climate change categorization; we are among the seventh most vulnerable countries affected by the global warming[6].

22. The Pakistan Council of Research for Water Resources (PCRWR) reported that Pakistan touched the "water stress line" in 1990 and crossed the "water scarcity line" in 2005. PCRWR also warned that the country will reach absolute water scarcity by 2025[7]. A number of factors are placing enormous pressure on surface and ground water resources such as growing population, increasing urbanization, out-dated irrigation practices and poor management of water resources. This implicates more measures to be taken to cater for future climate change challenges.

23. Punjab province accounts for 53 percent (110 million) of Pakistan's total population of about 207 million (Census-2017). Punjab is among the most urbanized regions of South Asia, experiencing a consistent and long-term demographic shift of the population to cities. The population density of the Punjab is more than 3½ times the rest of Pakistan[8]. Lahore is the capital city of Punjab and the second biggest city of Pakistan having current population of 7.07 million (as per Census-2017), spreading over an area of 350 sq. km., whereas the population of 'Lahore district' is 11.13 million (as per Census-2017) spreading over an area of 1,772 sq.km. It is situated on the flood plain of the River Ravi, with a gradual slope towards the southwest. Largely the city lies towards east and south of River Ravi. Being the most advance city, Lahore is rapidly urbanizing and transforming into regional urban hub of key economic (commercial, industrial and financial) and socio-economic activities and development.

24. The quality of water is a key component in determining the quality of life of residents of Lahore. Water and sanitation infrastructure, which is the major economic and social infrastructure that is closely related to human development and inclusive growth, has also improved since 2010[9]. However, water quality is a serious issue in Lahore and especially in suburbs; water borne, and water related diseases are on the rise due to the drinking of

[6] (Global Climate Risk Index, 2019)
[7] (National Research Agenda on Water 2016-2025 by PCRWR-2016)
[8] (Appendix II: TOR for ESIA Consultancy, Final Inception Report-Jan. 2019)
[9] (Section 1.1, Final Feasibility Study Report of LWWMP Project-Feb. 2019)

contaminated unsafe water. Degrading water quality of Lahore is mainly because of the lacking of bulk conveyance and treatment systems for the domestic and industrial wastewater that it produces. Resultantly, most of the wastewater is disposed into the nearby storm water drains which eventually discharges into Ravi River untreated. This has serious health and hygiene implications for the residents and major environmental implications for the city's water bodies and Ravi River.

25. In this context, the LWWMP has been proposed by LWASA with an aim to improve reliability of water supply and wastewater services in the metropolitan city of Lahore. The proposed project will diversify Lahore water supply to a surface water source by diverting water from the BRBD irrigation canal. More sustainable, reliable and predictable water will be provided to the residents of Lahore by constructing water treatment, transmission and distribution infrastructure under the project. Introduction of consumer metering and replacement of old network will significantly reduce the non-revenue water which is currently estimated at 45% of total supplied water.

2.1.1 An Overview of Water Supply for Lahore by WASA

26. Lahore WASA (LWASA) was established under Section-10 (2) of the Lahore Development Authority (LDA) Act-1975 to perform all functions and exercise all authorities regarding water supply, sewerage and drainage with a mandate to collect fees and charges from users for the provided services. It is the second largest water utility in Pakistan (after Karachi Water and Sewerage Board) with operating service area of more than 350 sq. km. LWASA is delivering water to its customers through 700,000 water connections, 585 tube-wells and 5,400 km of distribution networks. LWASA is catering for 90 percent of the city's population in its declared urban jurisdiction while rest of the population is served by private housing schemes and cantonment board. The 90 percent of the 700,000/ connections are covered under present sewerage system, but there is no wastewater treatment facility. Wastewater is collected through 4,000 km of sewerage networks and is directly pumped into nearby River Ravi through 16 large disposal stations and 95 lift stations without any treatment. This action is not only polluting the River Ravi but also causing other issues like groundwater contamination and water borne diseases[10].

27. LWASA's operating expenditures in 2017-18 were PKR 9,731.5 million and operating revenues were PKR 3,841 million. This shows an operating deficit of PKR 5,890.5 million, which is met by subsidy from the Government of Punjab. Tariffs are unrealistically low, not charged on actual volumetric consumption but on plot size, which were last revised in the year

[10] (Section 1: Project Description, Final Inception Report-Jan. 2019)

2004. In the absence of bulk and domestic metering, it is difficult to calculate the exact non-revenue water (NRW) but LWASA has estimated the NRW as more than 45 percent, which is extremely high[11].

28. At present groundwater is the only available source to meet the water needs of 11.1 million population of Lahore. Around 585 tube-wells comprising of variable depths (400-850 ft.) are being used for the extraction of groundwater and then, pumped into the distribution system, resulting in rapid depletion of groundwater table (about 1.0 meter per annum). Thus, the groundwater source does not seem a dependable/reliable source in future. Currently, the groundwater abstraction by LWASA is 540 million gallons per day (MGD), or equivalent to 2.45 million cubic meters per day (1,000 cusecs).

29. In view of increasing demand due to ongoing urbanization and increased commercial activities, the number of tube wells is also increasing with every passing day. With the ongoing declining of groundwater level, several existing tube wells are becoming non-functional and the city has started to face severe water shortages. LWASA would need to both seek improvements in service functions and resolve threats that emanate from:

- Exclusive reliance on groundwater that has, over the years, drastically depleted the aquifer levels i.e. on average 01 meter per annum. As there is more abstraction of ground water as compared to the recharge owing to the low discharge of Ravi river, which is almost dry in the winter and summer season except the rainy season/flooding in July- August every year[12], resulting thereby chances of further depletion of water table and failure of tube-wells;
- Tapping deep aquifer is also associated with increasing consumption of electricity. Currently, the energy expense is over 40% of the annual expenditure of LWASA as per LWASA report;
- Lack of water measurement at its production, distribution, and consumption points results in the inefficient management of the network, with apparently huge quantities of Non-Revenue Water (NRW). For this 100% water metering and Non-Revenue Water Management is to be done.

2.1.2 An Overview of Master Plan-2040 for Water Supply for Lahore

30. The proposed project is in line with the LWASA's Master Plan-2040. The future water demand of Lahore cannot be met entirely from depleting ground water resource. As sufficient

[11] (Annexure-13, PC-1 of Lahore Water and Wastewater Management Project (LWWMP)-Construction of SWTP at BRBD Canal-May, 2019)
[12] (Japan International Cooperation Agency (JICA) Study in 2010 titled "Preparatory Study on Lahore Water Supply, Sewerage and Drainage Improvement Project")

surface supplies are available so an alternate approach can be to completely shift to Surface Water for the Lahore District.

31. Due to very low water table in River Ravi it can no longer be considered as dependable surface water source. An alternate to Ravi River which can be used as a source of water is BRBD canal. Additional water which is available at the upstream of Syphon of BRBD canal can be utilized. Total water demand for whole of Lahore District is about 2522 Cusecs for year 2040. The existing capacity of Syphon shall be increased, and Irrigation Department shall provide about 1000 cusec to Lahore WASA. The BRBD canal water can be treated by using conventional method and can be supplied to different areas within Lahore District. Different packages including phase wise execution plan is given in **Table 2.2.** For all these packages 60% of system efficiency has been assumed (NRW 40%). List of Areas included in these packages and summary of their population projections up-to year 2040 is provided as **Annexure-C.**

Table 2.1 Master Plan Packages and their Phase wise Execution

Phase I	
Total Completion Time	5 Years
Projected Population (2040)	1,957,984
Package I-Projected Water Demand (2040) mgd	54
Package II-Projected Water Demand (2040) mgd	83
Phase II	
Total Completion Time	5 Years
Projected Population (2040)	1,362,560
Package I-Projected Water Demand (2040) mgd	50
Package II-Projected Water Demand (2040) mgd	45
Phase III	
Total Completion Time	5 Years
Projected Population (2040)	1,622,793
Package I-Projected Water Demand (2040) mgd	57
Package II-Projected Water Demand (2040) mgd	57
Phase IV	
Total Completion Time	5 Years
Projected Population (2040)	893,019
Projected Water Demand (2040) mgd	62
Phase V	
Total Completion Time	5 Years
Projected Population (2040)	1621982
Package I-Projected Water Demand (2040) mgd	58
Package II-Projected Water Demand (2040) mgd	58
Local Water Production Zones	
Proposed number of 4-cfs Tube wells	134
Projected Population (2040)	5,131,366
Projected Water Demand (2040) mgd	359
Rural and Non WASA Zones	
Proposed number of 4-cfs Tube wells	100
Projected Population (2040)	6,888,376
Projected Water Demand (2040) mgd	482

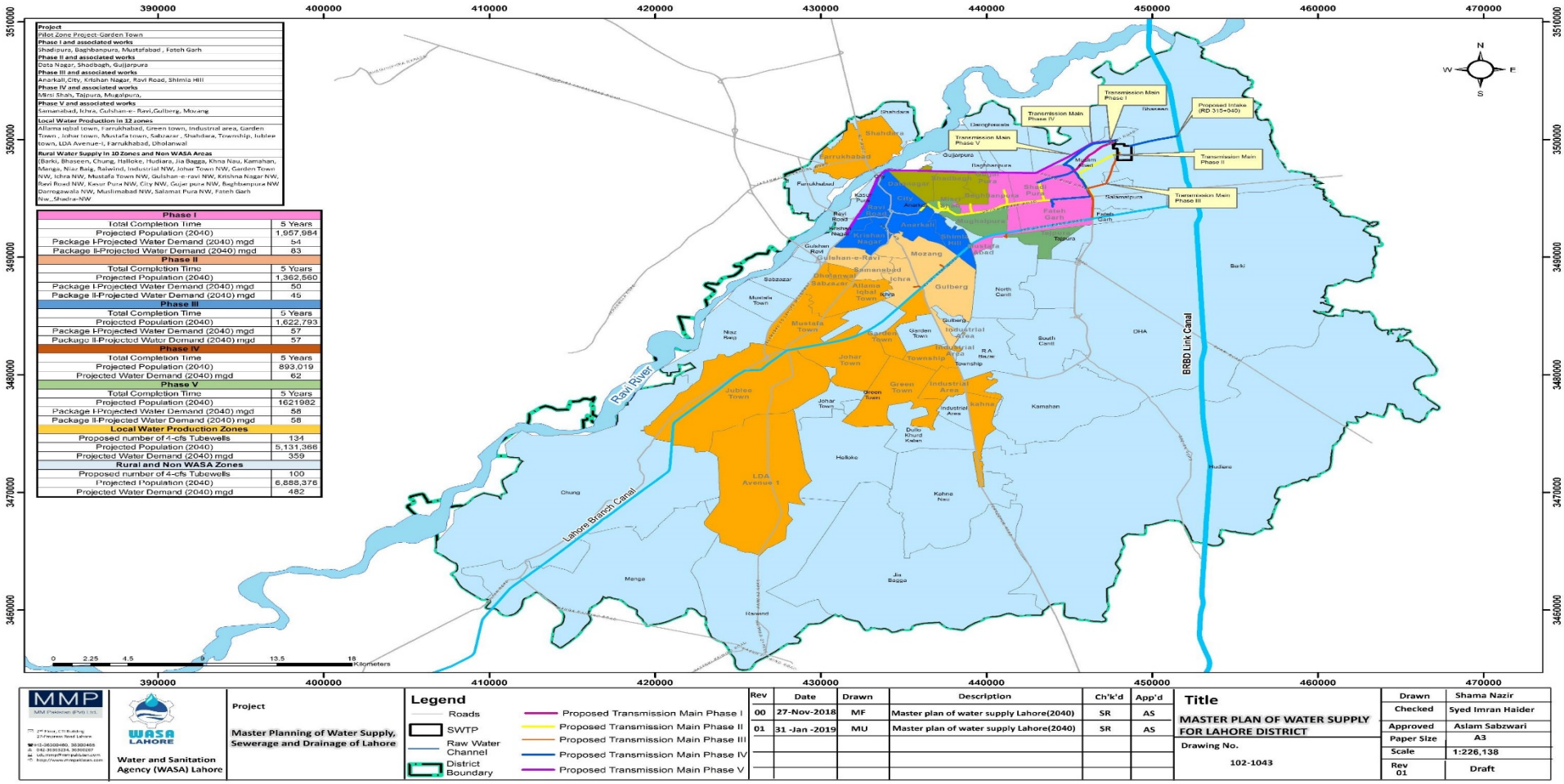


Figure 2.1 Master Plan of Water Supply for Lahore District

(Source: PC-1 of LWWMP-Construction of Surface Water Treatment Plant at BRBD-May, 2019)

2.1.3 Rationale for the project

32. In view of increasing demand due to ongoing urbanization and increased commercial activities, the number of tube-wells are also increasing with every passing day. However, Lahore receives an average annual rainfall of about 715 mm, which does not contribute much in recharging the aquifer, as groundwater abstraction is much higher than recharge. Consequently, the groundwater table continues to deplete rapidly. The current decline rate is observed to be more than 01 meter per annum[13].

33. With the ongoing declining of groundwater level, several existing tube wells are becoming non-functional and the city has started to face severe water shortages. Thus, the groundwater source alone does not seem to be a reliable source in future[14].

34. According to the "Final Master Plan Report for Lahore 2040"[15], the groundwater balance of the Lahore aquifer is facing increasingly negative trend since the 1970's due to population growth and urbanization and excessive pumping. Static water level in majority of wells has been recorded by LWASA for each year since 2000.

35. Preventive maintenance of existing water supply system is not in place owing to financial and institutional constraints. Uneven groundwater development has resulted in a big groundwater depression, with maxim.0um depth to groundwater up to 47 m in areas such as Baghbanpura, Fatehgarh, Mustafabad and Shadipura etc. which shows the current situation of water table and the cone of depression in the center of the built-up area[16].

36. To cater for the significant demand of water that is required for domestic and industrial use, alternate sources other than groundwater are needed to be used such as surface water from rivers, canals and lakes. The Master planning study carried out by Punjab Irrigation Department has also identified some short and long-term Investment plans up to a planning horizon of the year 2040[17].

37. Four (04) alternate sources[18] are considered in Final-Feasibility Study Report of the proposed project i.e. i) River Ravi, ii) Lahore Link Canal, iii) Khaira Distributary and iv) BRBD Canal. The flow of River Ravi is being controlled by our trans-boundary neighbour (India), and so it is not ideal source of water that can be used instead of ground water. While the total capacity of BRBD canal is about 7260 cusecs, at the moment only 4600 is being withdrawn. This means that water from BRBD canal is a better/dependable source as compared to River Ravi that can be used to supply water to residents of Lahore after treatment.

[13] (Section 1.1: Final Feasibility Study Report of LWWMP-Feb. 2019)
[14] (Section 1.2: Final Feasibility Study Report of LWWMP-Feb. 2019)
[15] (Executive Summary, Final Feasibility Study Report of LWWMP-Feb, 2019)
[16] (Executive Summary, Final Feasibility Study Report of LWWMP-Feb, 2019)
[17] (Annexure-1, PC-1 for LWWMP - Construction of Surface Water Treatment Plant at BRBD Canal, 2019)
[18] (Final-Feasibility Study Report of LWWMP-Feb, 2019)

38. To augment existing groundwater supplies with the surface water resource, the Government of Punjab (GoPb) seeks AIIB financing for (i) constructing infrastructure to divert water from a nearby irrigation channel - the 'Bambanwala Ravi Bedian Depalpur' (BRBD) Canal, and (ii) construction of a new state-of-the art SWTP with a capacity of 244,579 m^3/d (53.8 MGD), and supplying it to the most densely populated areas of the city i.e. Baghbanpura, Fatehgarh, Mustafabad and Shadipura.

To bring the value of NRW to 25% or less a proper leak detection program needs to be established. Reducing the NRW value is a crucial step as it has direct impact on the cost of water being supplied to the end users as well as the total number of consumers that can be supplied with fresh treated water. For this purpose, LWASA urgently needs help in strengthening its computerized billing system and monitoring the system through introducing zoning approach, which has been proven to be one of the best global practices in addressing Water Supply and Sanitation (WSS) issues, particularly in mega cities. Finally, to ensure the supply of water with the desired quality standards, some investment is required in the enhancement of existing laboratories besides strengthening the water quality monitoring systems coupled with specialized staff training.

2.2 Project Objectives

39. The overall objectives of the LWWMP are to improve reliability of water supply and wastewater services in the metropolitan city of Lahore and improve operational performance of the Lahore Water and Sanitation Services Agency.

40. Specific to the Water Supply Infrastructure component (Package 03 and Packge-04), the main objectives[19] are provided below

- Ensure sustainable supply of safe water
- Reduce deteriorating environmental impacts due to untreated sewage disposal, that may contaminate groundwater sources. Supply of piped potable water will reduce the risk of intaking contaminated water
- Strengthen institutional capacity of LWASA to deliver improved services to the people of Metropolitan City of Lahore (MCL) and become financially a strong entity
- Provide uninterrupted and continuous (24/7) supply of adequate quantity of safe drinking water to the contiguous urban core (LWASA service area) through a unified water supply network
- Rationalize and manage water demand through conservation and metering

[19] (Annexure-15, PC-1 of LWWMP-Construction of SWTP at BRBD Canal-May, 2019)

- Ensure sustainable provision of water through reliance on multiple sources such surface supplies, rainwater harvesting and even closure of some of existing wells overlying acutely low water levels
- Maximize the efficiency of the water supply system by creating self-sustaining Distribution Management Zones and Distribution Management Areas, acting as Cost Centres
- Institute a robust water measurement and monitoring system at the production, distribution and consumer end to minimize Non-Revenue Water (NRW)

2.3 Description of the Water Supply Infrastructure Component

41. Under the water supply infrastructure component, LWASA will draw water from Banbawala Ravi Bedian Depalpur (BRBD) canal which flows in the East of Lahore. The canal itself takes off from Lower Chenab Canal (LCC), which originates from Chenab River, at Bambanwala and flows in a North-South direction crossing River Ravi via a siphon, an underground hydraulic structure which carries the canal water across River Ravi. This component will include:

- Construction of a new Ravi Siphon: The BRBD Canal has a design discharge of 205,000 lps at Bambanwala headworks but the maximum flow is limited to 140,000 lps. One of the reasons for the limited flow is the limited design capacity of Ravi siphon. Irrigation department is proposing to construct a new siphon to increase the discharge capacity, thereby increasing water flow in BRBD canal. Besides providing 2,800 lps (or 54 MGD) water for potable use under the project (later to be increased to 28,000 lps in the subsequent phases), the increased flow will also cater the needs of downstream irrigation in the service area of BRBD canal.
- Construction of potable water infrastructure. The project will finance construction of infrastructure for intake of raw water and a Surface Water Treatment Plant (SWTP) (Package 03), and transmission and distribution network to provide clean water to the selected localities in Lahore (Package 04).
- Reduction of Non-Revenue Water (NRW). To address water shortage, water quality and revenue issues in a comprehensive way, the project will implement an NRW program to reduce NRW from the existing 45 percent to less than 20 percent. This will be accomplished by (Package 04) (a) repairing water leakages through rehabilitation and replacement of old pipes; (b) 100 metering of all retail and bulk customers (c) controlling overconsumption of water by metered based billing; and (d) avoiding water theft through bulk meters installations. LWASA computerized billing system will also be strengthened and zone-based monitoring system will be introduced which has been successfully implemented in other mega cities. Finally, to ensure the supply of water with the desired

quality standards, some investment is required in the enhancement of existing laboratories besides strengthening the water quality monitoring systems.

42. Given the design of the new Ravi Syphon yet to be developed, an addendum ESIA will be prepared. The current capacity of BRBD canal is of about 7260 cusecs. However, the syphon is injecting only 4600 cusecs of water. The BRBD canal is running under capacity therefore another syphon will be required to fulfil the future demands for water uses.

43. This ESIA report covers the assessment of the last two parts mentioned above, i.e. Package 03 and Package 04. The detailed descriptions of the two parts are presented below.

2.3.1 Water Intake Structure and SWTP (Package 03)

44. The LWASA has planned for the provision of the surface water source, for which 2.45 million cubic meters (1000 cusecs) water will be drawn in phases from the BRBD Canal. In the first phase, Punjab Irrigation Department has agreed to provide 100 cusec water by issuing a No Objection Certificate (letter no.280/124-G dated 16-01-19) provided as **Annexure-A.** Initially 100 cusecs (245,000m^3/day or 54MGD) water from BRBD Canal near Bhaini Road will be supplied to the selected serving areas of Lahore after water treatment.

45. To meet this target, a water intake structure including the raw water channel will be constructed on BRBD canal near Bhaini road, which will divert canal water and transport it to the proposed SWTP. The water from BRBD canal will be controlled by the sluice gate and conveyed to the intake channel through gravity (no pumping required). The water will be finally transported to the SWTP through the 3km long intake channel.

46. An area of 324 acres will be acquired by land acquisition department of LWASA to be used for proposed site of Surface Water Treatment Plant (SWTP), related activities and future extensions. Out of 324 acres of land being acquired, approximately 30 acres will be used for the construction of the 54 MGD SWTP. Layout map of Package 03 is given in **Figure 2.1.** A linear strip of 17 (7 hectare) acres of agriculture land is planned to be acquired by Punjab Irrigation department under a separate package consisting of intake water structure at the BRBD Canal and Raw water intake channel.

47. The Components of the **Package 03** are:

i. Construction of Gated Intake Structure for receiving water from the BRBD canal
ii. Construction of Raw Water Intake Channel (3 km) to transfer canal water from BRBD to SWTP
iii. Construction of SWTP at Ganj Sindhu
iv. Installation of Power Transmission Line (5.7 km): from Mominpura grid station to the proposed SWTP site
v. Water Testing Laboratory at SWTP location for testing quality of incoming raw water and out-going treated water for pH, turbidity (alum dozing), chemical and bacteriological tests

vi. Associated facilities of SWTP includes

- Constriction of Clear water tank with pump house
- Construction of Chlorination Room, Alum Dosing Room and Alum Storage Building
- Construction Sludge Thickener and Sludge Drying Beds
- Construction of Admin Building and Residential Colony

2.3.2 Provision of Transmission and Distribution Network – Package 04

48. Package 04 involves supply of treated water from SWTP to existing distribution network by constructing Transmission Main and Feeding Mains. Under Package 04, total nine (09) different areas of Lahore were considered for supply of treated water from SWTP, based on population, groundwater stress, location and condition of existing pipeline network and four (04) areas (Shadipura, Baghbanpura, Fatehgarh and Mustafabad) were selected.

49. For distribution of water to the four (04) selected areas, direct pumping will be carried out from the SWTP to the existing distribution network. The treated water will be pumped through different feeding mains to the existing distribution network of LWASA in four District Metered Zones (DMZs) of Lahore, namely Shadipura, Baghbanpura, Fatehgarh and Mustafabad.

50. The components of the **Package 04** are:

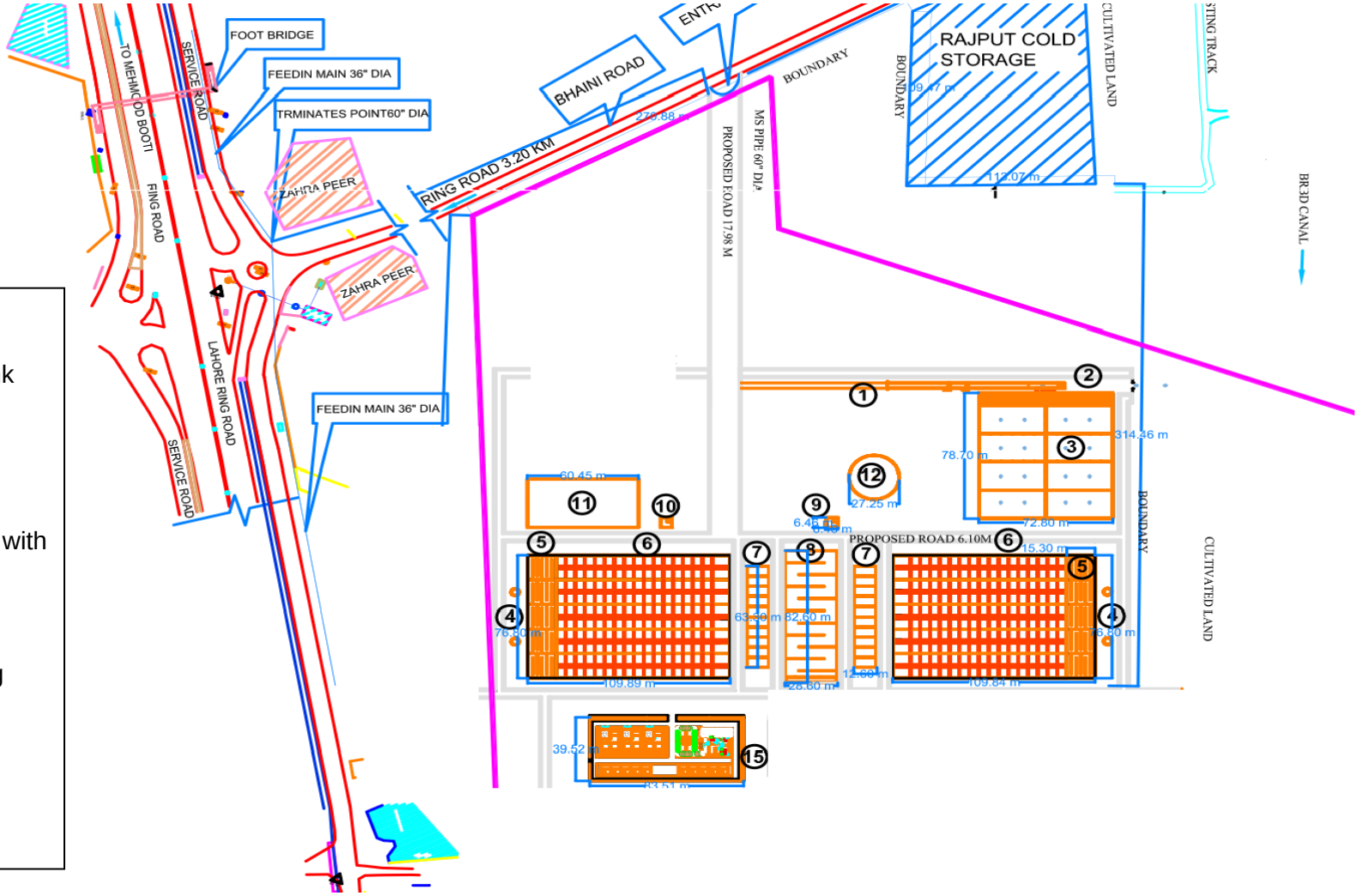
i. Provision and laying of 3.5km-long transmission main pipeline for water supply from the SWTP to feeing mains pipeline; 55 feeding mains pipeline (28 km long) connecting to the existing distribution network of four selected serving areas, and rehabilitation of existing distribution pipes (81km). The transmission main would be laid along Bhaini Road by using High Density Polyethylene (HDPE) pipe with internal diameter of 1500mm, external diameter of 1600 mm and total length of 3500m (138"/11.5') to feeding main through direct Pumping.

ii. Construction of Feeding Mains having different pipe diameters between 1500mm (59"/49') to 450mm (17.7"/1.5') diameter will be used for serving four (04) areas, of new and rehabilitated distribution network of the 04 selected serving areas, having 100% metering system for 24/7 water supply.

iii. Rehabilitation of old pipes in existing distribution network to address the water shortage and quality issues in a comprehensive way and to reduce the non-revenue water (NRW) from the existing 45 percent to less than 20 percent by;

- plugging all the water leakages through replacing the old pipes, which are not only causing water losses but also allowing ingress of wastewaters through these leakages and causing waterborne diseases;
- controlling over consumption of water due to about 90 percent unmetered connections, through metering 100 percent of connection;

- avoiding water theft, through bulk meters installations, and ensuring 100 percent billing and at least 90 percent collection.



1. Intake Channel
2. Screen Chambers
3. Pre-sedimentation tank
4. Coagulation chamber
5. Flocculators
6. Clarifier
7. Rapid Sand Filters
8. Clear water Tank with pump house
9. Chlorination Room
10. Alum Dosing Room
11. Alum Storage Building
12. Sludge Thickener
13. Sludge Drying Beds
14. Admin Building
15. Residential Colony

Figure 2.2: Layout Plan-SWTP (Package 03)

(Source: Appendix-6 Final Feasibility Study Report of LWWMP-Feb, 2019

2.4 Project Categorization

51. As per Pakistan Environment Protection Agency's (Pak-EPA) "Review of IEE and EIA regulations 2000", development projects have been categorized into two categories i.e. Schedule-I and Schedule-II. Initial Environmental Examination (IEE) is required for the projects included in Schedule-I, while Environmental Impact Assessment (EIA) is required for projects listed in Schedule-II. IEE is required for project expected to have less potential adverse impacts, whereas, EIA is required for those projects, which are expected to have significant adverse impacts on all components of environment such as physical, chemical, biological and socio-economic.

52. There is no separate clause for ESIA, but provincial Environmental Protection Act categorizes the proposed project as **Schedule-II (F)** and requires an EIA. However, the present draft ESIA report covers physical, biological and socio-economic aspects of the proposed project just like the EIA. Hence, this ESIA report can be submitted to the EPA Punjab for the environmental approval under section 12 of PEPA 1997, amended 2012.

53. As per Environmental and Social Policy (ESP) of AIIB and ESS 1 (Environmental and Social Impact and Management) and ESS 2 (Invulnerable Resettlement), the proposed project is classified as **Category A**. A project is placed in Category **A** if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works and may be temporary or permanent in nature. The AIIB requires the client to conduct an Environmental and Social Impact Assessment (ESIA) for each Category A project and to prepare an ESMP as per requirement.

2.5 Project Civil Works

2.5.1 Civil Works of Package 03

54. Civil works of the water intake structure will include"

- Cross Regulator at RD 280+500 of BRBD Canal
- Cross Regulator at RD 318+500 of BRBD Canal
- Cross Regulator at RD 280+500 of BRBD Canal for Bypass Channel
- Cross Regulator at RD 318+500 of BRBD Canal for WASA raw water channel
- BRBD bank raising and lining of raised part
- Bypass Channel
- Raw water channel for WASA

55. Civil works of the SWTP will involve the following:

- Raw Water Tank and Raw Water Pump House
- Screening

- Primary Sedimentation Tanks
- Coagulation Tank
- Flocculators and Clarifiers
- Sludge Thickener
- Sludge Drying Beds with Shades
- Rapid Gravity Filtration Unit
- Clear Water Tank and Pump House No. 1 at SWTP
- Disinfection Room, Chemical Storage Building and Alum Dozing Station
- Admin Building
- Residential Colony
- Internal Roads, H.T and Transformers Room
- Water Testing Laboratory at SWTP location for testing quality of incoming raw water and outgoing treated water for pH, turbidity (alum dozing), chemical and bacteriological tests
- Electrical and Mechanical Works including
  - Electricity transmission line connect the Momin-Pura grid station t to the SWTP
  - Supplying and Installation of Mechanical Equipment including Pumping Machinery etc.
  - Supplying and Installation of Electrical Equipment etc.
  - Supervisory Control and Data Acquisition (SCADA) system and Instrumentation

2.5.2 Civil Work of Package 04

56. Civil Works of Package 04 will involve Following:

- Transmission Main (HDPE Pipe)
  - Transmission Main (HDPE Pipe) including Valves, Fittings etc. (Length 3.5 km)
- Feeding Main for 04 Serving Areas (HDPE Pipe)
  - Feeding Main (HDPE Pipe) including Valves, Fittings etc.
- Construction and Rehabilitation of Distribution Network including Water Flow Meters
  - Distribution Network including Valves, Fittings etc. (HPDE Pipe)
  - Rehabilitation of old pipes
  - Supply and Fixing Leakage Detection Equipment (NRW)
  - Water Flow Meters

2.5.3 Miscellaneous Works

- Shifting of Services of Electricity, Sui Gas, Pakistan Telecommunication Company Limited (PTCL) Cable and Electric Poles
- Restoration of Roads
- General Items with Allied Works

2.5.4 Construction Activities

57. The proposed construction methods include; the construction of water intake channel (open channel), the construction of water supply network (open excavation) and the construction of SWTP etc. The construction activities along-with estimated quantities of materials and cost of Package 03 and 04 are provided as **Annexure-B.** Most of the construction material will be locally purchased and the source of purchase will be ascertained after the complete design of proposed project.

2.5.5 Allied Facilities

58. Camp sites for Packages 03 and 04 will be selected keeping in view the availability of adequate area for establishing camp sites, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. Final locations will be ascertained by the contractor as far away as possible from populated areas.

2.5.6 Water Requirement for the proposed project

59. During construction phase of SWTP (Package 03), water consumption will be approximately 80 m3/day whereas wastewater generation will be 64 m3/day (construction activities=45 m3/day and camp sites=19 m3/day).

60. During laying of Transmission Main, Feeding Main and Distribution Network water consumption will be approximately, 35 m^3/day[20] whereas wastewater generation will be 28 m3/day.

2.5.7 Construction Machinery

61. A newly built batching plant will be used for construction phase of Package 03 only. Following **Table** 2.1 provides the list of Electrical and Mechanical equipment[21] to be used in Pack

[20] McGhee, T. J., & Steel, E. W. (1991). Water supply and sewerage (Vol. 6): McGraw-Hill New York.
[21] (PC-1 of LWWMP-Construction of SWTP at BRBD Canal-May, 2019)

Table 2.2 Electrical and Mechanical Equipment of Package 03

Electrical Equipment	Mechanical Equipment
Coagulation/Flocculation and Clarifier Tanks	
Local Distribution Panels and sub panels, all switches, control units, cables, cabling to other buildings and Main Switch Panels, conduits and cable trays.	HDPE and Stainless-Steel piping of various sizes from 25mm to 150mm, for chemical flocculants and polymers, Laminar Filters and support system, stainless steel vacuum pipework for sludge removal, mixing blades, HDPE perforated pipes in Laminar tanks, sludge control valves, compressed air system and compressor, penstocks and aluminium handrails.
Rapid Gravity Filtration Units	
Local Distribution Panels and sub panels, all switches, control units, cables, cabling to other buildings and Main Switch Panels, conduits and cable trays.	Quartz sand 1mm particle size with min 65% silicon content, and gravel filter material 5mm particle size, air diffuser units, Air Blower system and all Stainless-Steel piping for filter backwash, Motive Water Pumps and System and pipework/fittings, back wash pumps and pipework/fittings for filter backwash, Stainless Steel syphon units and gauges, penstocks, aluminium handrails, traps and grills and overhead cranes
Wash Water and Sludge Treatment	
Local Distribution Panels and sub panels, all switches, control units, cables, cabling to other buildings and Main Switch Panels, conduits and cable trays.	Water recovery pumps and pipework, level switches, Sludge pumps and pipework, Penstocks, agitators, pumps and pipework lower to upper tanks, guide rails, chains, HDPE pipework for polymer, perforated HDPE pipes, sludge valves operated by compressed air, compressed air piping, non-corrosive walkways, penstocks, perforated HDPE pipe for

Electrical Equipment	Mechanical Equipment
	sludge beds, aluminium stop logs for sludge beds and aluminium handrails
Chemical Buildings	
Local Distribution Panels and sub panels, all switches, control units, cables, cabling to other buildings and Main Switch Panels, conduits and cable trays.	Lime and Aluminium Sulphate mixers, polymer mixing tank system and special pumps, and interconnecting pipework in HDPE/Stainless Steel including fittings, Lime Special Pumps and controls, Aluminium Sulphate Pumps and controls, Chlorine handing and mixing system including special pumps and controls, Chlorine safety system including vacuum suction system and neutralization tower including sensors, valves, piping, fittings, aluminium handrails, traps and grills.
Wash Water and Sludge Treatment	**Treated Water Tank**
Local Distribution Panels and sub panels, all switches, control units, cables, cabling to other buildings and Main Switch Panels, conduits and cable trays.	Inlet pipe Stainless Steel, overflow Pipe Stainless steel, outlet pipe stainless steel, aluminium handrails, traps and grills.
Exploitation, Administrative and Electrical Buildings	
Local Distribution Panels and sub panels, all switches, control units, cables, cabling to other buildings and Main Switch Panels, Backup Generator with auto start/stop, conduits, cable trays	Fully equipment public health laboratory all office furniture, with facility for real time monitoring of incoming and outgoing water quality, diesel tank for Generator
Pumping Machinery	
Local Distribution Panels and sub panels, all switches, control units, cables, cabling to other buildings and Main Switch Panels, conduits and cable trays.	Centrifugal pump for Raw water, MCU (Motor Control Unit), Base frame, Coupling Guard, Vertical turbine pump, column pipe and bowl assembly, vertical A.C electric motor and erecting clamp motor stool

Electrical Equipment	Mechanical Equipment
Spare Parts	
Breakers all sizes, 03% lengths of cables, conduits and cable trays	Set of critical spares for 1 year for all equipment including bearings, seals, filters and lubricants
Yard Piping	
Collection Pit and pumps for overflow water return to canal wiring	All interconnecting pipes and fittings, penstocks, valves, manholes, service trenches, for raw water, clear water, sludge, waste water, lime milk, Aluminium Sulphate solution, Chlorine solution, polymer to coagulation and recovering tanks, compressed air lines, pipes from 1400mm to 25mm in stainless steel, HDPE, DI, concrete as per design requirements, Collection Pit and pumps for overflow water return to canal, aluminium access ladders, grills and covers.

2.6 Project Location

62. The project is located in Lahore district which is the second largest city in Pakistan. It is situated on the left bank of River Ravi which is the smallest of Indus tributaries in Punjab province. The Lahore district boundary is shown in **Figure 2.4.** It is bounded by India in the East and Kasur in the South. The total land area in the district is around 1770 km^2.

63. The proposed SWTP (Package 03) is located in two villages (i) 90% part is located in village Ganja Sindhu; (ii) and 10% part in village Natt while 3 km long Intake Channel pass through three village (i) Ganja Sindhu (0.7km); (ii) Jandiala (1 km); and (iii) Bhaseen (1.2 km) of Union Council 176 Awan Dhaewala Tehsil Shalimar, District Lahore and of Punjab province of Pakistan. The proposed electricity transmission line will be installed from nearest existing Momin Pura grid station located 5.7 km away.

64. The location can be accessed through Ring Road and G.T Road and down the Bhaini Road while the surface water source (BRBD Canal) is located in the East of SWTP site. The water transmission main, feeding main and distribution network and the distribution pipeline (Package 04) will be laid down along the Bhaini road near Moaza Lakhodair (Bhaini Road connects BRBD Canal West Bank road to the Ring road), and will connect to Shadi Pura Distribution Network of LWASA.

65. Location map of the project area is given as **Figure 2.5.**

2.6.1 Proposed Project Area

66. A parcel of an estimated private agriculture land of 324 acres (131 hectares) will be acquired for the construction of SWTP from two moazas/villages namely Ganj Sindhu, and some (7 hectare) of land is planned to be acquired by Punjab Irrigation Department under a separate package consisting of 3 km long strip of Intake water structure at the BRBD Canal and raw water intake channel, which is passing through 3 mozas (i) Ganja Sindhu (0.7km); (ii) Jandiala (1 km); and (iii) Bhaseen (1.2 km) of Union Council 176 Awan Dhaewala Tehsil Shalimar, District Lahore and of Punjab province of Pakistan.

67. The area for the proposed Transmission Main will be about 3.5 km starting from SWTP at Ganj Sindhwan to a point near Shadi Pura along Bhaini road near Moaza Lakhodair (Bhaini Road connects BRBD Canal West Bank Road to the Ring Road) and will connect to Shadi Pura Distribution Network of LWASA. The treated water will be distributed to a total area of 30.56 km^2 divided in four (04) serving areas (Package 04), detail of these areas is given below in **Table 2.4.**

Table 2.3 Detail of the Land to be acquired for SWTP and In-Take Channel (Package 03)

Sr. No.	Village Name	%age of Total Affected Land	Land Required for SWTP		Land Required for Raw Water Intake Channel		Total	
			Acre	Hectare	Acre	Hectare	Acre	Hectare
1	Ganj Sindhu	86%	275	111	4	1.6	*279*	*112.6*
2	Natt	10%	32	13	-	-	*32*	*13*
3	Jandiala	2%	-	-	6	2.5	*6*	*2.5*
4	Bhaseen	2%	-	-	6.5	2.6	*6.5*	*2.6*
	Total		**307**	**124**	**16.5**	**6.7**	***324***	***131***

Table 2.4 Detail of the Proposed Transmission Main, Feeding Main and Distribution System, Lahore (Package 04)

Sr. No.	Serving Areas	Total Area (km^2)	Population	Distribution Network (Length)	Distribution Network (Diameter Range)
i.	Shadipura	11.45 km^2	228,786	178 km	75 to 600 mm
ii.	Baghbanpura	5.42 km^2	366,499	169 km	75 to 600 mm
iii.	Fateh Garh	10.41 km^2	397,778	237 km	75 to 600 mm
iv.	Mustafabad	3.28 km^2	102,611	127 km	75 to 600 mm
Source: Final Feasibility Study Report for LWWMP-February, 2019					

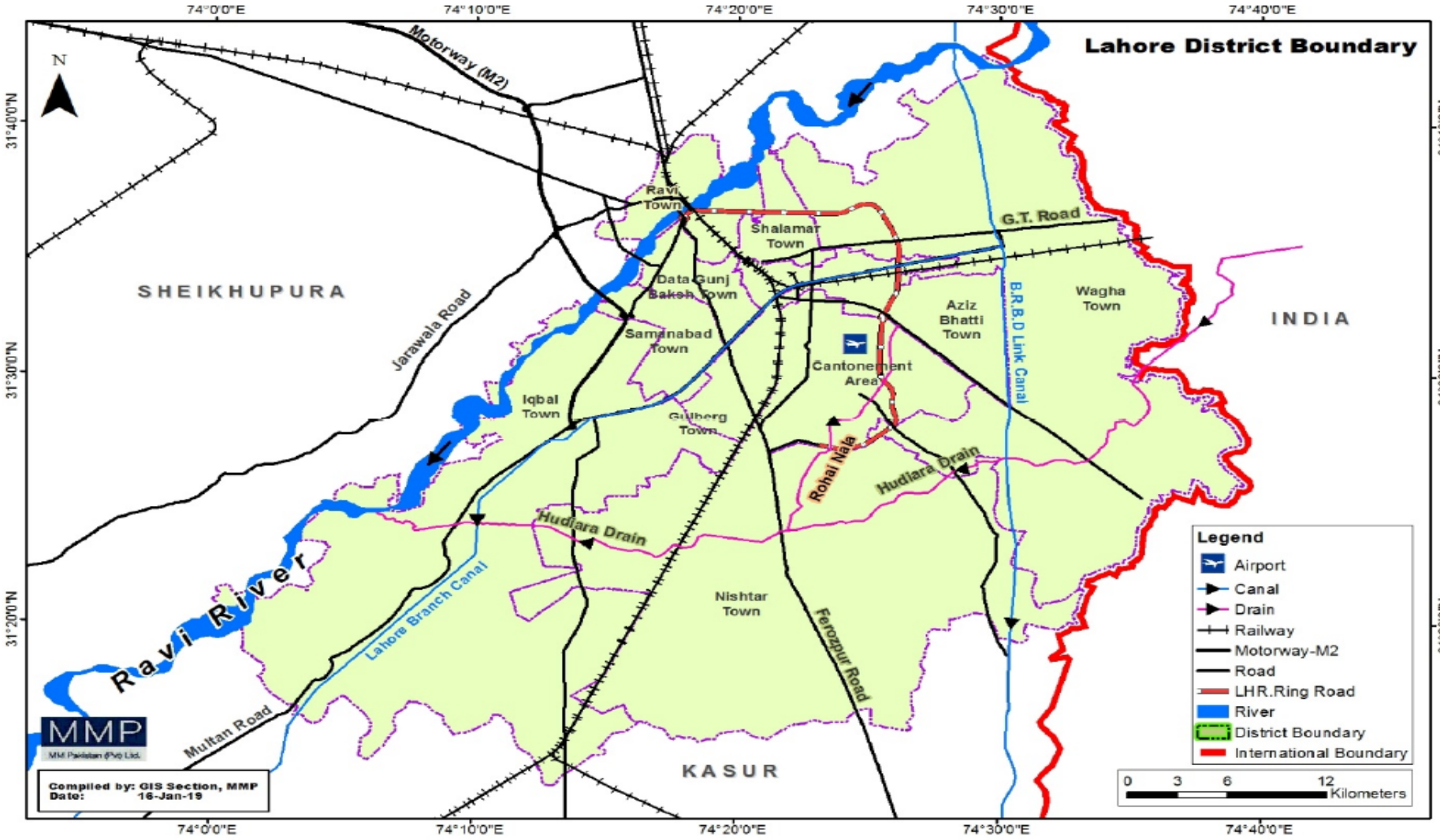


Figure 2.3 District Boundary of Lahore

(Source: Final Feasibility Study Report of LWWMP- Feb, 2019)

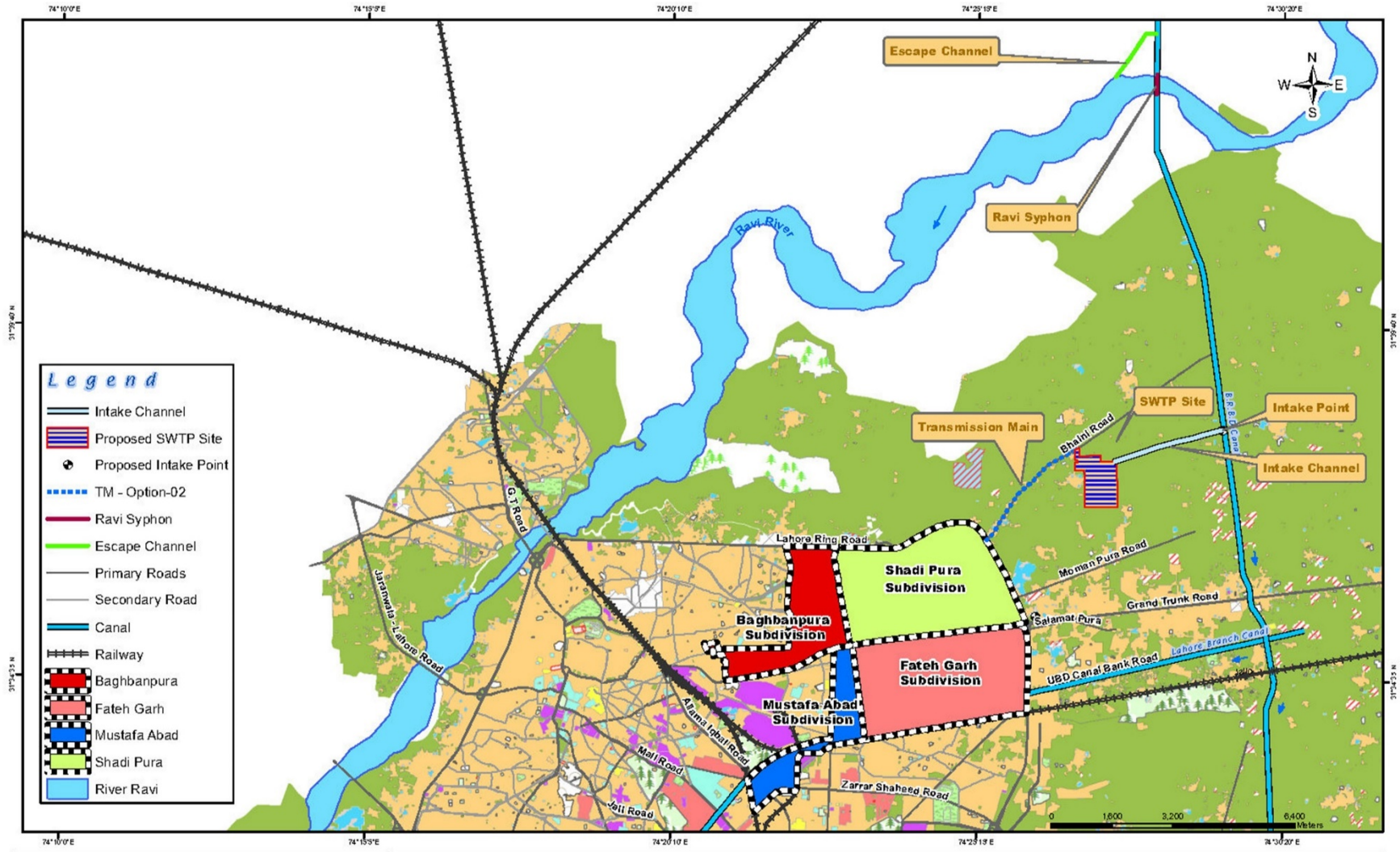


Figure 2.4 Location Map of Project Area (Package 03 and 04)

(Source: Appendix-1 Final Feasibility Study Report of LWWMP Project-Feb, 2019)

2.7 Salient Features of the project

2.7.1 Salient Features of the Water Intake Structure

- **Total Width of Water Intake structure:** 21 meters.
- **Design/Shape of Water intake structure:** Trapezoid
- **Total length of water intake channel from BRBD canal to SWTP:** 3 km

2.7.2 Salient Features of the SWTP

68. Population projection in the service area of the SWPT is carried out for the year 2030 and the growth rate used is 2.41% till year 2020 and for remaining 10 years, the growth rate is assumed to be 1.92%.

- **Population Estimation:** It has been based on Census-2017, published by Pakistan Bureau of Statistics, Islamabad and is 1,069,870, projected to 1,095,654 up to 2018 and projected to 1,389,800 up to 2030 for the 04 serving areas
- **Per Capita Demand:**40 gallons per capita per day (180 Litres per capita per day)
- **Total Water Demand:** Total water demand is 40 GPCD for population of 2018 is 44 MGD while for year 2030, the total water demand is 55.60 MGD, whereas the SWTP capacity for inflow of 100 cusecs is 54 MGD (245,000 m3/day)

Table 2.5 Selected Serving Areas and Population

Sr. No.	Serving Area	Population 2017	Population 2018	Population 2020	Population 2030	
1.	Shadipura	223,384	228,768	239,927	290,184	21%
2.	Baghbanpura	357,875	366,499	384,377	464,892	33%
3.	Fatehgarh	388,415	397,776	417,180	504,565	36%
4.	Mustafabad	100,196	102,611	107,616	130,158	10%
	Total	1,069,870	1,149,100	1,389,799	1,095,653	100%

(Source: Final Feasibility Study Report of LWWMP-February, 2019)

69. Phase-I of SWTP will be designed for 54 MGD (245,000 m3/day) to cater for the population up to year 2030 for the above mentioned 04 serving areas;

- **Treatment Method**: Depending on the results of water samples collected from BRBD canal, various water treatment techniques including membrane filtration were considered for designing of SWTP. Based on the requirements and results of water quality samples, the conventional water treatment method was recommended and selected. This will be rapid gravity filtration method as had been adopted for Rawalpindi WASA (Rawal dam

WTP), Capital Development Authority (Khanpur dam WTP) and Faisalabad WASA (River Chenab). In this regard, samples of raw water from BRBD canal were collected and tested for different parameters in the laboratory. Results showed that the raw water quality varies considerably. The water treatment units designed to meet the quality requirement are; i) Screening, ii) Primary sedimentation, iii) Flash mixing/coagulation, iv) Flocculation and Clarifiers, v) Filter beds and clear water tank, vi) Disinfection, and vii) Directly pumping to be done to supply the treated water to the distribution network and the end users. The process flow diagram (schematic) is given in **Figure 2.6.**

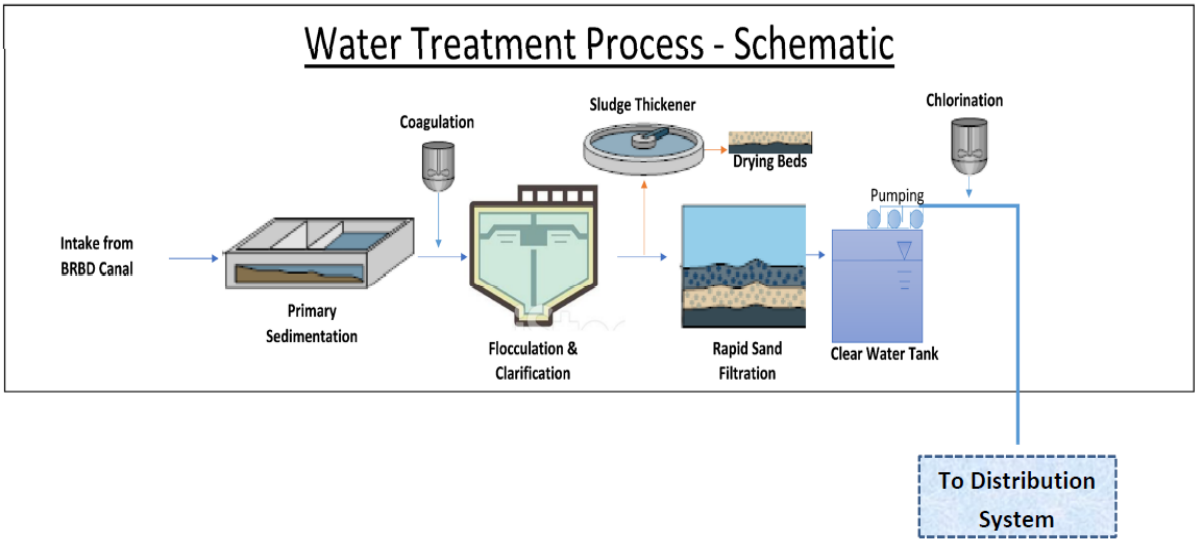


Figure 2.5: Water Treatment Process-Schematic Diagram

(Source: Appendix-4 Final Feasibility Study Report of LWWMP-Feb, 2019)

- **Supervisory Control and Data Acquisition (SCADA) Systems in Water Treatment**
  The proposed SWTP is to be fully automated including its ancillary components, so that it is centrally controlled through SCADA System at SWTP and distribution network in order to overcome any shut-down and overflows in SWTP and distribution network for ensuring 24/7 water supply. SCADA system shall carry out the monitoring of facility operation status, instrument status, and communication status as well as data collection and storage in order to provide information in control centre room.

2.7.3 Salient Features of the Water Supply Network

- **Transmission main of 60 inches / 1600 mm diameter:** Treated water from the SWTP to feeding main near Shadipura will pumped using 60 inches / 1500mm internal and 1600 mm external diameter of HDPE pipe, having total length of 3.5 km. The transmission main will be laid along the recommended shortest route along Bhaini road, having clear space, for which topographic survey has been carried out.

- **Feeding mains:** The treated water from 'Clear Water Tank' at SWTP after disinfection (chlorination) will be pumped to existing distribution network through feeding mains
- **DMAs:** After feeding mains, the water will be distributed through independent distribution network (DMA's) to the consumers
- The existing water distribution system of 04 selected serving areas having good condition is categorized as A, B and C while the new distribution network is to be laid in place of old network of category D and F after leak deduction equipment

Table 2.6 Existing Water Distribution Categorization

Category	Reasons/Actions	Installation Period
A	Only normal maintenance required	2004-2016
B	Minor maintenance and rehabilitation required	2000-2014
C	Significant maintenance and minor rehabilitation required	1995-2015
D	Significant renewal/ Upgrade required	1990-2000
F	Major renewal/ Replacement Required/ Non-operational due to technical failures	1985-1995
(Source: Final Feasibility Study Report of LWWMP -Feb, 2019)		

70. Entire length of existing distribution network of LWASA for 04 selected areas is 701.64 km. Total length of pipes that need to be replaced is 161.66 km, out of which lump-sum provision of 81 km has been made on the basis of leakage detections.

Table 2.7 Length of Existing Distribution Pipes

Sr. No.	Description	Total Length (Km)
1.	Category A	134.64
2.	Category B	265.3
3.	Category C	150.23
Sub Total		550.17
Poor Condition of Pipe/ Need replacement		
4.	Category D	146.18
5.	Category F	15.48
Sub Total		161.66
Total		711.83
(Source: Final Feasibility Study Report of LWWMP -February, 2019)		

2.7.4 Implementation Schedule (42 Months)

71. The implementation of the project is divided into two parts. The first part will be the preconstruction stage of six (06) months and the second part will be the construction stage of 36 months.

i. **Pre-Construction Stage - 06 months:** It includes the preparation of updated feasibility study report, topographic and geo-technical survey, rough cost estimates, PC-1, prequalification and the bidding documents International Certification Board (ICB) on Engineering Procurement Construction (EPC) mode (as agreed with LWASA) and finally the Contracts award.

ii. **Construction Stage - 36 months:** After award of Contracts under ICB, the Contractors will start engineering design, procurement and construction work on EPC mode and will complete the project as per their 'work schedule' to be the part of their Contract documents. The work will be completed by the Contractors under resident supervision by the Project Consultants in the light of technical specifications and the construction drawings in 36 months with 02 years operation and maintenance (O&M).

2.8 Description of other Project related Facilities

2.8.1 Water Testing Laboratory (Package 03)

72. Provision of water testing laboratory has also been made at SWTP location for testing quality of in-coming raw water and out-going treated water for pH, turbidity (alum dozing), chemical and bacteriological tests. In addition, doze of chlorine at SWTP and Underground Tank will be given, so that the supplied water conforms to World Health Organization (WHO)/ National Standards for Drinking Water Quality (NSDWQ) standards.

2.8.2 Power Supply (Package 03)

73. The works of provision of electricity / power for SWTP by LESCO and shifting of services by different agencies including restoration of roads, have been proposed to be executed under 'deposit work' by the different government departments/agencies, for which lump sum provisions have been made in the cost estimates and the PC-I submitted to LWASA and P&D department, Govt. of Punjab. Approximately 4.5 MW of energy will be required at SWTP site for operating SWTP.

74. There shall be a need for installation of two 11 kV feeders on DOG conductor from nearest existing Momin Pura 132/11kV Grid station located 5.7 km away. The power would be supplied through erection of suitable number of tubular poles to cope with connected load of about 4 MW, including pumping stations and buildings. The cost of grid station equipment and power transmission to the site is to be worked out by LESCO, for which LWASA will apply on the basis of design load of electricity required for the SWTP.

The proposed route map of power line from Momin Pura Grid Station is shown in **Figure 2.2.**

2.8.3 Septic Tank (Package 03)

75. During construction phase, temporary septic tank for estimated 300-350 workers will be built. Whereas during operation phase, a permanent septic tank with at least 3 chambers for estimated 100 workers will be built

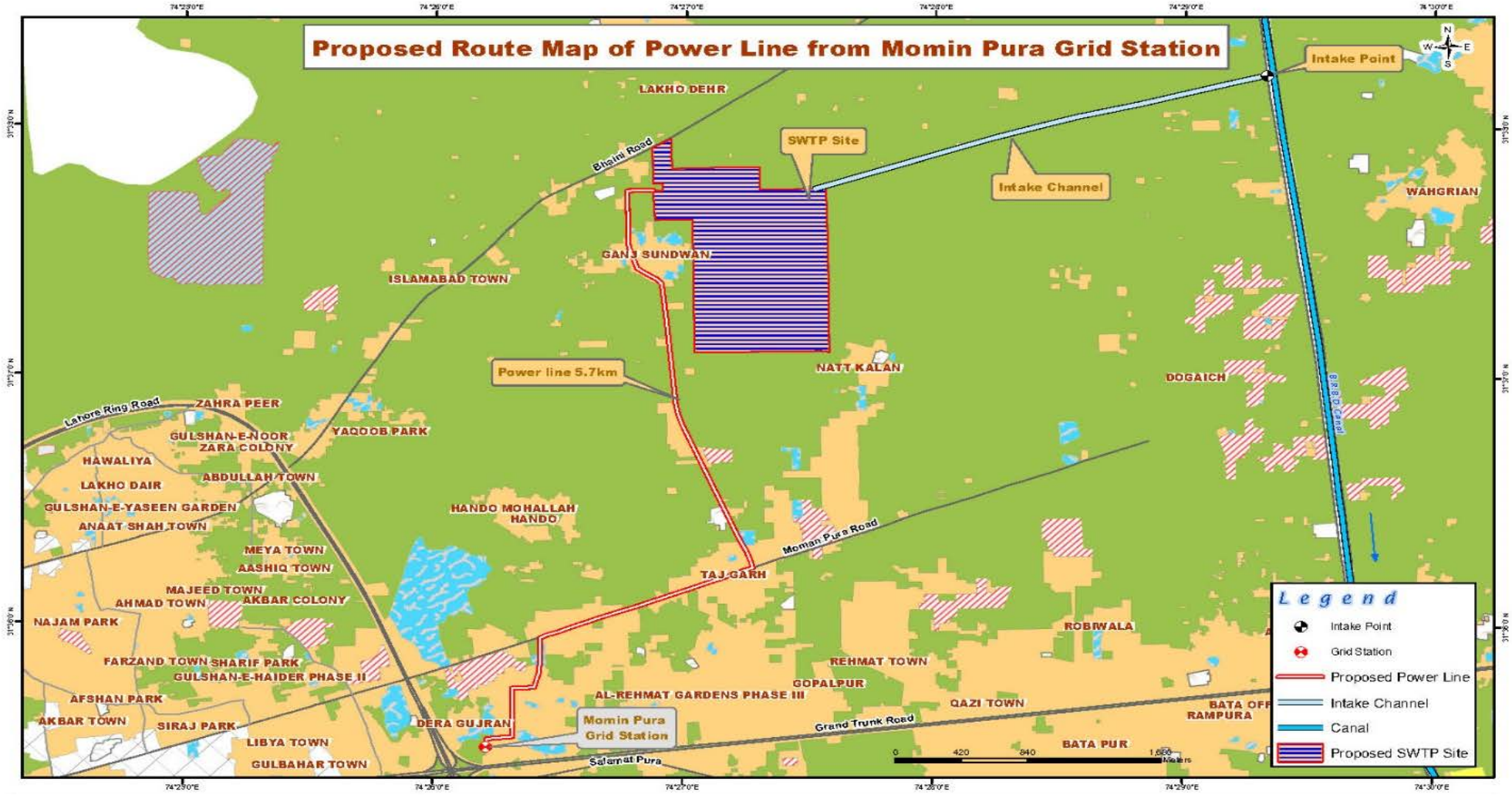


Figure 2.6 Proposed Route Map of Power Line from Momin Pura Grid Station

(Source: Figure 7-1 Final Feasibility Study Report of LWWMP-Feb, 2019)

2.9 Human Resource Requirement for the Project (Package 03 and 04)

Package 03

76. Estimated Manpower requirement during Construction Phase will be 300-350 persons and whereas about 96 persons will be hired for Operation and Maintenance activities.

Package 04

77. Estimated Manpower requirement during Construction Phase will be 100-150 persons and whereas about 5-10 persons will be hired for Operation and Maintenance activities.

2.10 Operation and Maintenance phase of Package 03 and Package 04

2.10.1 Description of Activities - Package 03

78. Operation and Maintenance phase will involve following activities:

- Water intake channel
- The surface water treatment process
- Testing of raw and treated water
- Raw Water Pumping
- Treated Water Pumping
- Sludge handling processes from Clarifiers
- Sludge drying
- Handling of Chemicals like Alum and Chlorine
- Operate the SCADA system,
- Plant and equipment maintenance
- SWTP operation staff training
- Quality Control monitoring
- Periodic maintenance of SWTP and transmission line: non-destructive and integrity testing
- Auditing

2.10.2 Sustainable O&M Models

79. To cater for the increased demand of water, LWASA has planned to develop surface water source as an alternate source, for which 1000 cusecs (540 MGD) water will be drawn in phased manner from BRBD Canal. Under phase-1 of the project, 100 cusecs i.e. 54 MGD (245,000 m3/day) water has been proposed to be brought to the four (04) selected service areas of Lahore after water treatment. The total cost proposed for this project is PKR 18,330.25 Million including PKR 1,378.96 Million for O&M cost of 02 years.

80. LWASA's operating expenditures in 2017-18 were PKR 9,731.5 million and operating revenues were PKR 3,841 million. This shows an operating deficit of PKR 5,890.5 million, which is met by subsidy from the Government of Punjab. The main reason of this deficit is that tariffs are unrealistically low, and water being supplied is not charged on actual volumetric consumption but on plot size, which were last revised in 2004. In the absence of bulk and domestic metering, it is difficult to calculate the exact non-revenue water (NRW) but LWASA has estimated the NRW as more than 45%, which is extremely high. It is worth mentioning that LWASA operations expenditures are currently subsidized substantially by the government (greater than 33% of earnings), a clear need for adaptation of tariffs to cover the future additional operational expenditures of the SWTPs, is required.

2.10.3 Considerations in taking over operations of SWTP (Package 03)

81. In order to operate the SWTP in future, the basic institutional / organizational framework needs to be set, and requirements ensured by LWASA. In order to take over the operations, following measures are to be undertaken:

2.10.3.1 Decision About the Institutional Model for SWTP Operations (WASA Operations or Out-Sourcing)

82. This basic decision needs to be taken between the relevant stakeholders, i.e. Government of

83. Punjab, WASA Lahore and the relevant donors, in due time before the commencement of the operational phase, in order to be clear on the operational rights and responsibilities of both LWASA and the Contractor during that phase.

2.10.3.2 Development of A Management or Lease Contract for Third Party SWTP Operator (Only If Decision was Taken for External Operator)

84. It is advisable for LWASA to contract an external Institutional Consultant with the development of such a contractual set-up. The contractual document would need to be harmonized with the relevant stakeholders.

2.10.3.3 Creation of An Operational Concept and Structure Plan for SWTP, Including Organization, Staffing, Functions, Roles, Operational Budgets

85. This needs to form the basis for the operations of the SWTP by LWASA. The HR requirements will be fine-tuned based on the experience during commissioning and the initial operational phase undertaken by the Contractor. This should be undertaken after sufficient experience has been made under the operational phase of the Contractor.

2.10.3.4 Recruitment / Development of SWTP Staff at LWASA

86. The timing of recruitment / assignment of LWASA SWTP staff depends on the stipulations of the Contract, with regard to plant operation. Various options for this can be considered such as the contractor supplies all the operational staff or an alternate to this can be that operational staff is shared by LWASA and the Contractor. The persons should be recruited well ahead of the handing-over of the SWTP. It is advisable to include into the Contractor's scope of works the obligation to undertake training for the future LWASA staff.

2.10.4 Development of necessary SWTP Operational Procedures – Package 03

87. In order to conduct the operations sustainably, LWASA will require relevant O&M / work procedures for the SWTP, which should include:

2.10.4.1 Monitoring Plan

88. A monitoring plan in cooperation with the partner should be prepared to ensure that:

- Both parties have an understanding of what is being monitored and why
- Monitoring is seen as a tool for learning and improving the work, not as a demand from the donor

2.10.4.2 Standard Operating Procedures (SOPs)

89. Operational Procedures to be developed should include the necessary instructions regarding the facilities, process flow of the plant, sludge management and Operations and Maintenance procedures.

2.10.5 Training for SWTP Operations – Package 03

90. LWASA personnel shall be suitably qualified and have an appropriate level of training and experience in the operation and maintenance of SWTPs. The basic set of skills required to, but not confined to are given below:

- Operational management
- Maintenance management
- Plant and equipment maintenance
- Administration
- Quality systems implementation and management
- Health and safety planning
- Auditing

91. If required foreign qualified personnel having Operational and Maintenance experience in SWTPs for the key positions / engineers and management staff might be hired. Special training related to operation of SWTP will be required for rest of staff.

92. The overall purpose of the training is to enable the staff to:

- Understand the surface water treatment process
- Sludge handling processes from Clarifiers
- Handling of chemicals like Alum and Chlorine
- Operate and understand the SCADA system,
- Intervene in case of disturbance, and
- Understand Health and Safety precautions

2.10.5.1 Organization of a professional Handing-Over of the SWTP and clear responsibilities during warranty / Defects Liability Period

93. It is recommended to involve a third-party Consultant (Operational Advisor) to accompany the procedure up the taking-over certificate, and to advise LWASA where required. LWASA needs to ensure that all components of SWTP are operational at the time of handing over from the Contractor.

2.10.6 Institutional Strengthening Program for LWASA

94. It is strongly recommended to undertake an institutional strengthening program for LWASA with the support from an external Institutional Consultant to ensure commercial sustainability and project implementation of the SWTP. It is further recommended to support LWASA especially in the following fields:

- Improvement or Adaptation of Organizational Structure and Human Resources
- Commercial or Financial Strengthening to increase collections and Operational Cost Coverage
- Public Awareness Campaign
- Development of a Sludge Management / Disposal Concept
- Project Management Unit (PMU) Staff Training

2.10.7 Non-Revenue Water (NRW) Reduction Program (Package 04)

95. NRW is a good indicator for water utility performance; high levels of NRW typically indicate a poorly managed water utility. In addition, published NRW data are often problematic, suspicious, inaccurate, or provide only partial information.

96. The reduction in NRW can be done by adopting following measures:

- Rehabilitation/Replacement of Old pipes
- Water Metering
- Establishing DMZs

2.10.7.1 Rehabilitation/Replacement of Old pipes

97. The existing water supply system consists of large segments of worn out pipelines responsible for major leakages leading to high level of NRW (according to LWASA data). The

major volume of water is being wasted and don't get any revenue to leakage of water that result from faulty, corroded, and old water transmission and distribution mains Substantial water losses and leakage occur due to the following:

- An aging network lacking maintenance and repair
- No planned leakage control system
- Poor workmanship and materials used for pipe and joint repairs
- Household water systems comprising ground and overhead tanks and an electric pump usually directly connected to the distribution pipe cause large losses due to leakage and overflows which go unchecked because there is no volume charge

98. As LWASA has categorized existing pipes into different categories according to the health and condition of the pipes. The Category A, B and C are the only pipes of good and sound condition which only need minor rehabilitation or maintenance. All pipes other than these categories will be replaced, as these pipes are not in a condition and most of them are 30 years old and cannot serve the future purpose of the project to reduce leakage and NRW status. If these old and corroded pipes are not replaced, the NRW reduction program will be unable to implement in its actual form. Eventually the desired results will not be achieved.

2.10.7.2 Water Metering

99. The need to prevent NRW losses and protect precious water resources has become increasingly important. In absence of metering, it is not possible to report the actual NRW value. A complete hierarchy of bulk and domestic metering is necessary in order to make accurate estimates of the various types of water losses. The final feasibility report of the project advocates the adoption of a commercial approach for managing and operating the distribution systems. This is to ensure that there is a correlation between the volume of water produced and the volume of water sold through proper water metering. This would improve service levels and LWASA's revenues.

100. The total number of water connections in these 04 serving areas is 114,165 having domestic and commercial connections as 110,106 and 4,059 respectively (as provided by LWASA). The domestic and commercial water meters will also be provided / installed on these connections for 24/7 water supply system in these 04 serving areas[22].

2.10.7.3 Establishment of District Metering Zones (DMZs)

101. There are four (04) DMZs and is further comprised of twenty-seven (27) District metric Areas (DMAs) through which the supply of water, evaluation of losses and control on NRW would be managed. Shadipura Zone having seven (07) DMAs, Baghbanpura Zone having four

[22] PC-1 of LWWMP-Construction of SWTP on BRBD Canal-May, 2019

(04) DMAs, Fatehgarh Zone having eleven (11) DMAs, and Mustafabad Zone having five (05) DMAs. Layout maps for Proposed District Metered Zones (DMZs) and District Metered Areas (DMAs)[23] are given as **Figure 2.7, 2.8 , 2.9, 2.10, 2.11 and 2.12.**

[23] Section 8.3: Final Feasibility Study Report of LWWMP- Feb,2019

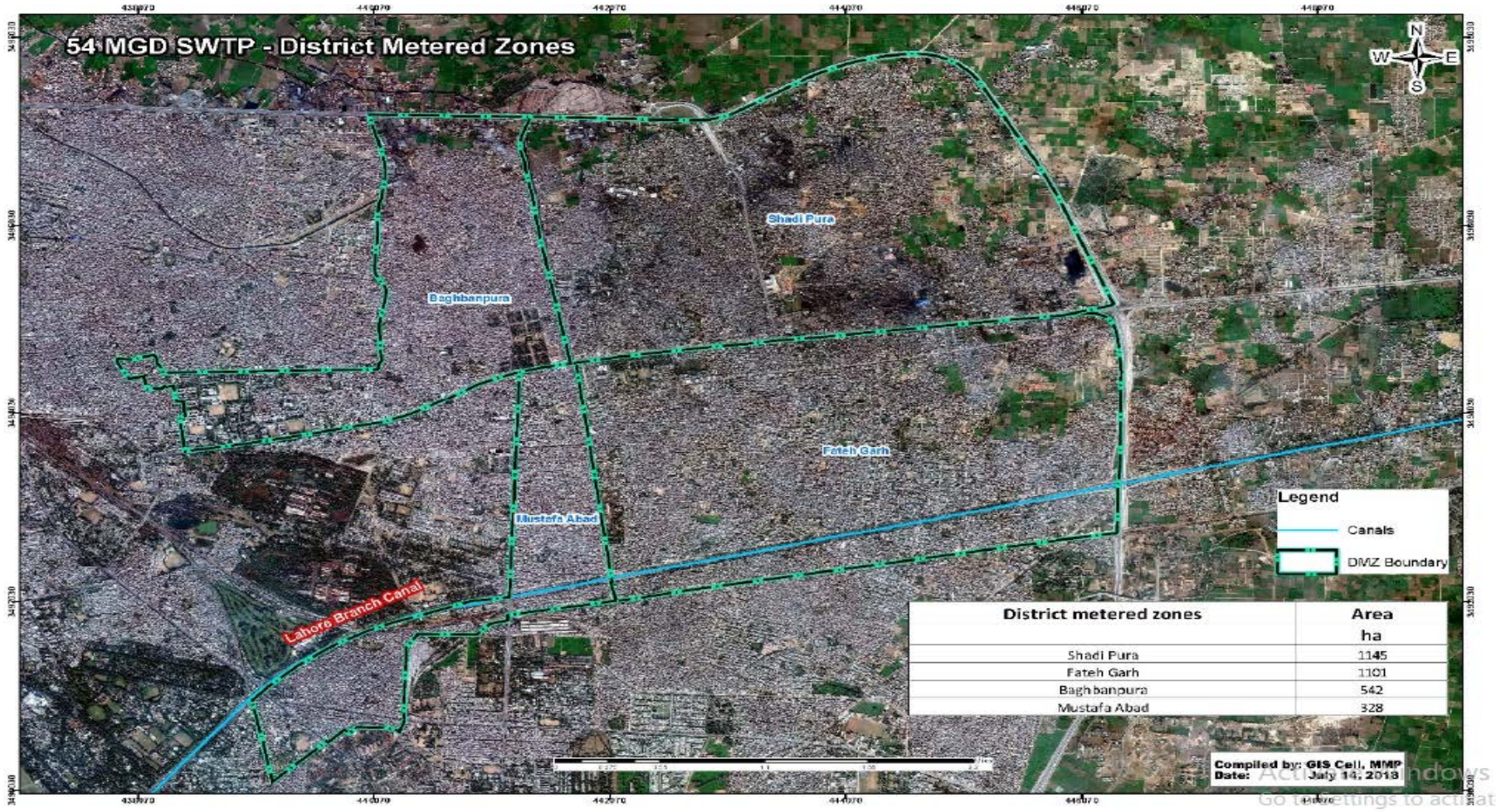
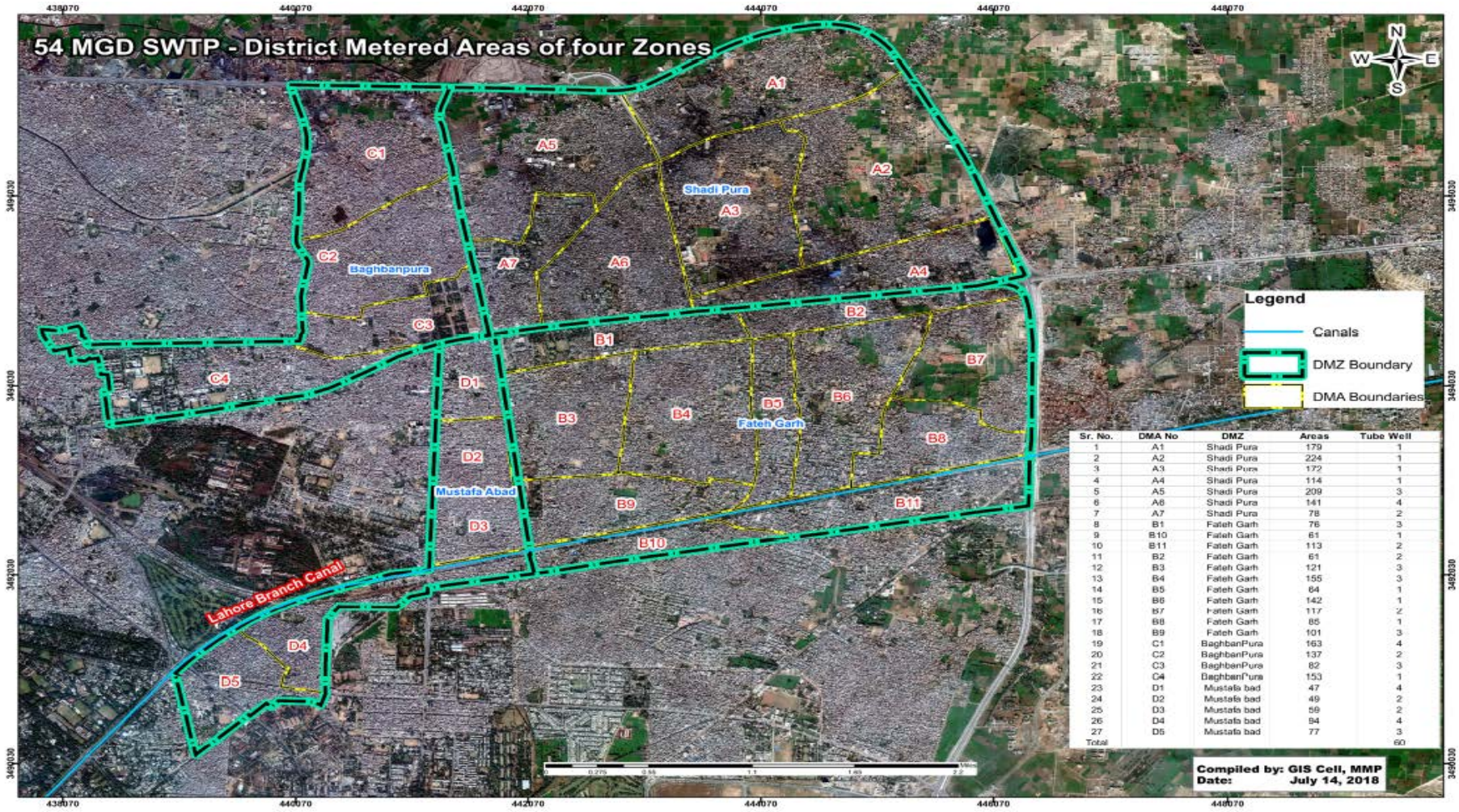


Figure 2.7 District Metered Zones (DMZs)

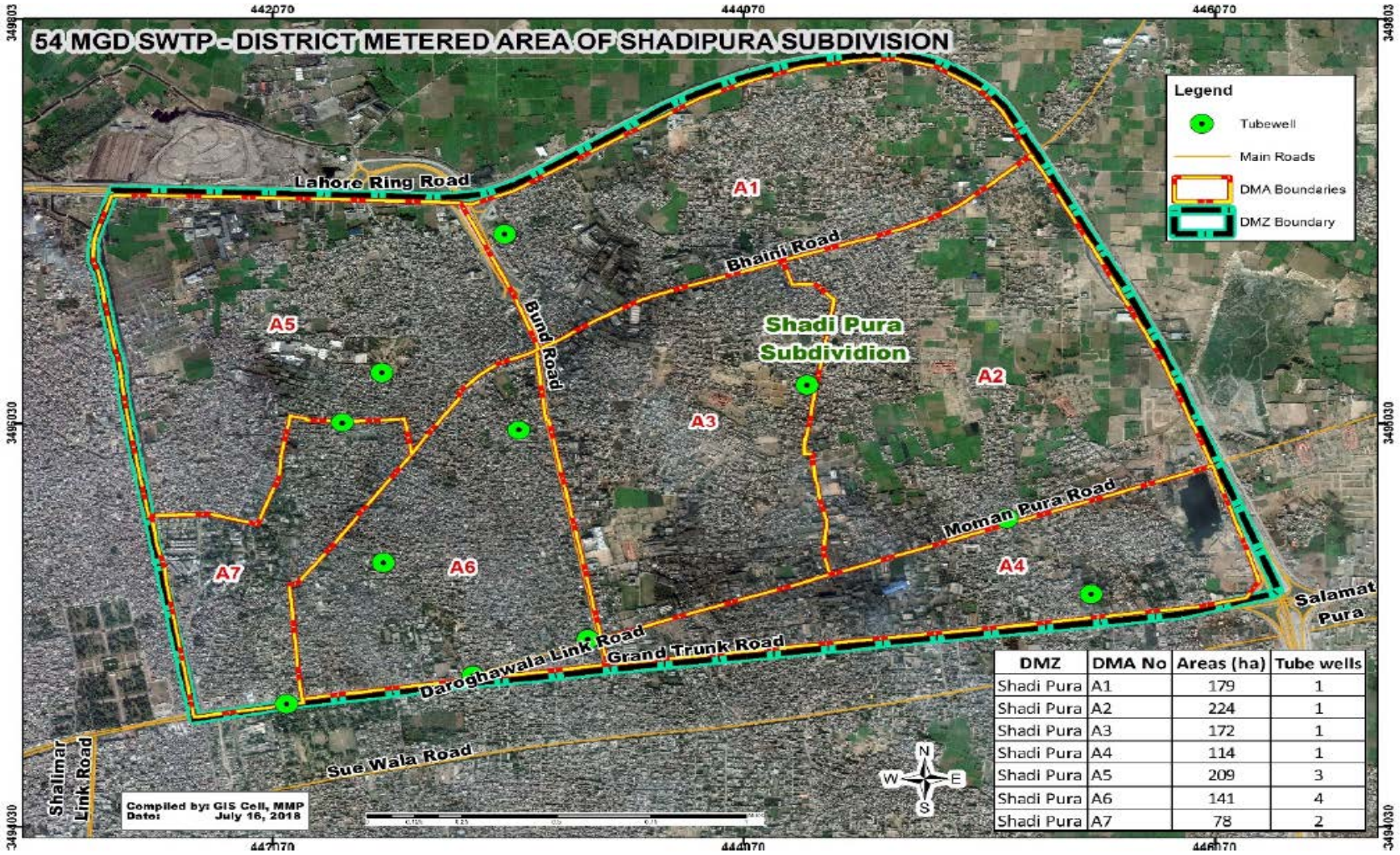
(Source: Appendix-7 Final Feasibility Study Report on LWWMP -February, 2019)



Sr. No.	DMA No	DMZ	Areas	Tube Well
1	A1	Shadi Pura	179	1
2	A2	Shadi Pura	224	1
3	A3	Shadi Pura	172	1
4	A4	Shadi Pura	114	1
5	A5	Shadi Pura	209	3
6	A6	Shadi Pura	141	4
7	A7	Shadi Pura	78	2
8	B1	Fateh Garh	76	3
9	B10	Fateh Garh	61	1
10	B11	Fateh Garh	113	2
11	B2	Fateh Garh	61	2
12	B3	Fateh Garh	121	3
13	B4	Fateh Garh	155	3
14	B5	Fateh Garh	64	1
15	B6	Fateh Garh	142	1
16	B7	Fateh Garh	117	2
17	B8	Fateh Garh	85	1
18	B9	Fateh Garh	101	3
19	C1	BaghbanPura	163	4
20	C2	BaghbanPura	137	2
21	C3	BaghbanPura	82	3
22	C4	BaghbanPura	153	1
23	D1	Mustafa bad	47	4
24	D2	Mustafa bad	49	2
25	D3	Mustafa bad	59	2
26	D4	Mustafa bad	94	4
27	D5	Mustafa bad	77	3
Total				60

Figure 2.8 District Metered Areas (DMAs)

(Source: Final Feasibility Study Report of LWWMP-Feb, 2019)



DMZ	DMA No	Areas (ha)	Tube wells
Shadi Pura	A1	179	1
Shadi Pura	A2	224	1
Shadi Pura	A3	172	1
Shadi Pura	A4	114	1
Shadi Pura	A5	209	3
Shadi Pura	A6	141	4
Shadi Pura	A7	78	2

Figure 2.9 District Metered Area of Shadipura Subdivision

(Source: Final Feasibility Study Report of LWWMP-Feb, 2019)

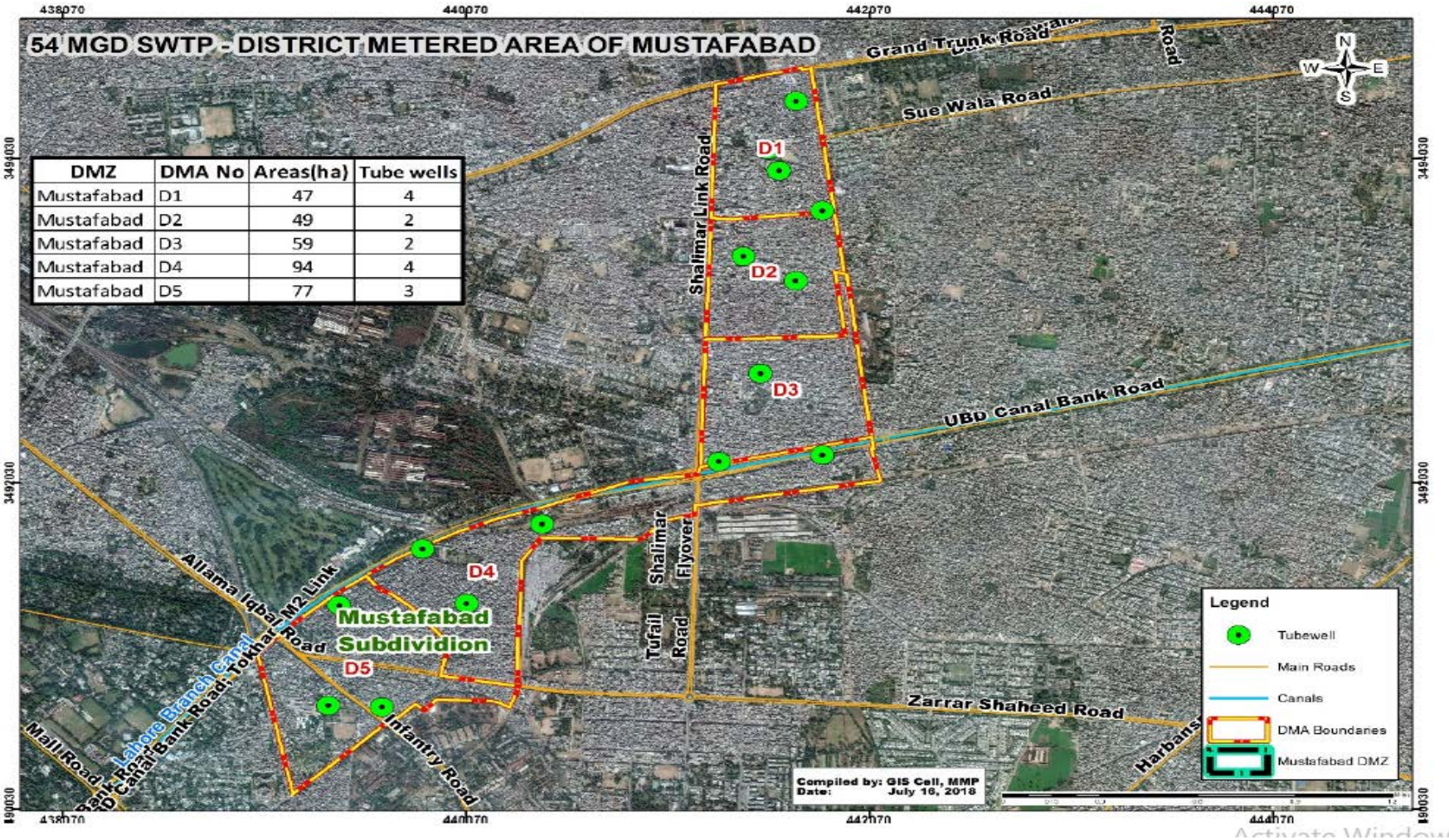
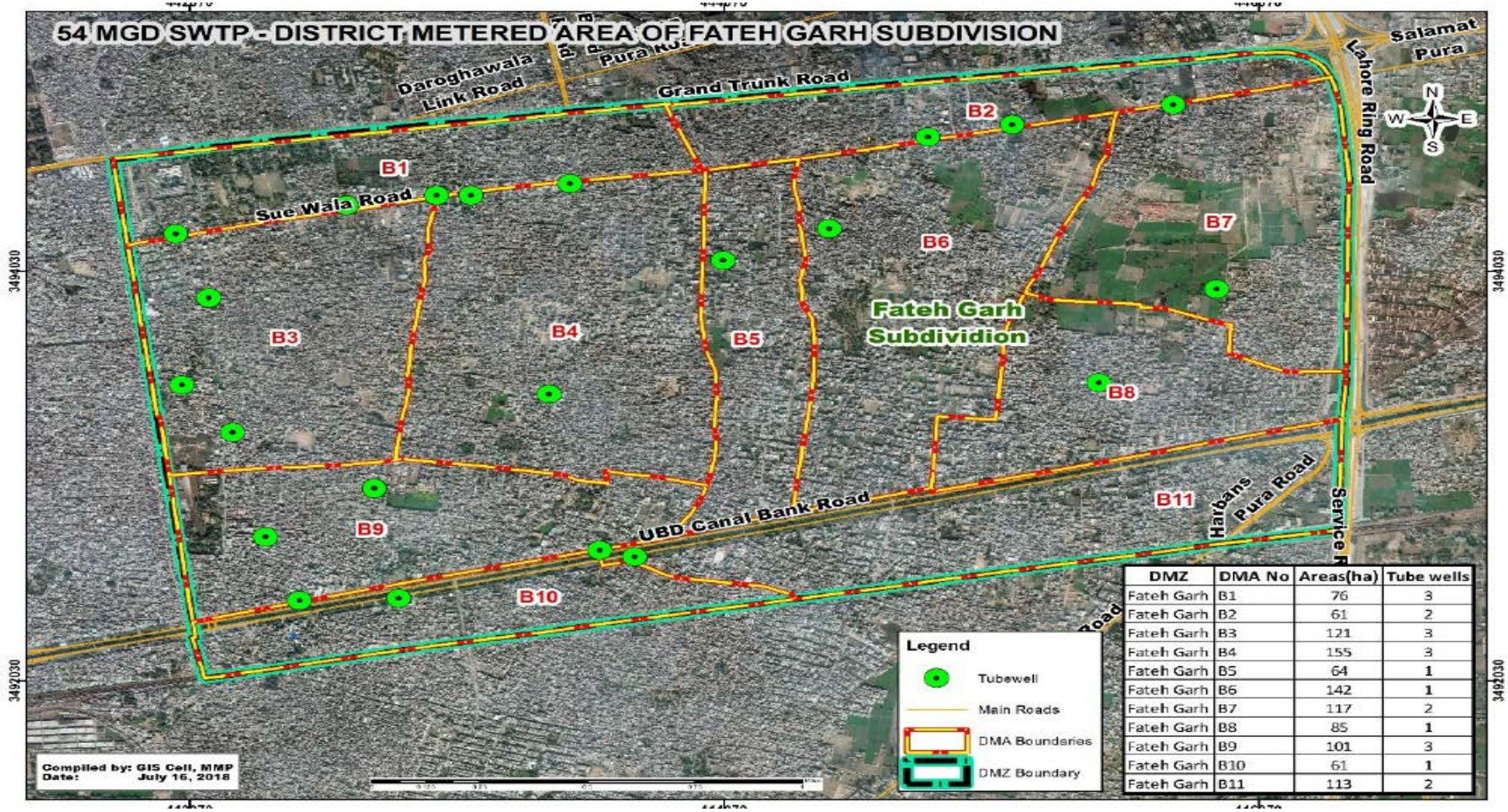


Figure 2.10 District Metered Area of Mustafabad Subdivision

(Source: Final Feasibility Study Report of LWWMP Feb, 2019)



DMZ	DMA No	Areas(ha)	Tube wells
Fateh Garh	B1	76	3
Fateh Garh	B2	61	2
Fateh Garh	B3	121	3
Fateh Garh	B4	155	3
Fateh Garh	B5	64	1
Fateh Garh	B6	142	1
Fateh Garh	B7	117	2
Fateh Garh	B8	85	1
Fateh Garh	B9	101	3
Fateh Garh	B10	61	1
Fateh Garh	B11	113	2

Figure 2.11 District Metered Area of Fateh Garh Subdivision

(Source: FinalFeasibility Study Report of LWWMP Feb, 2019)

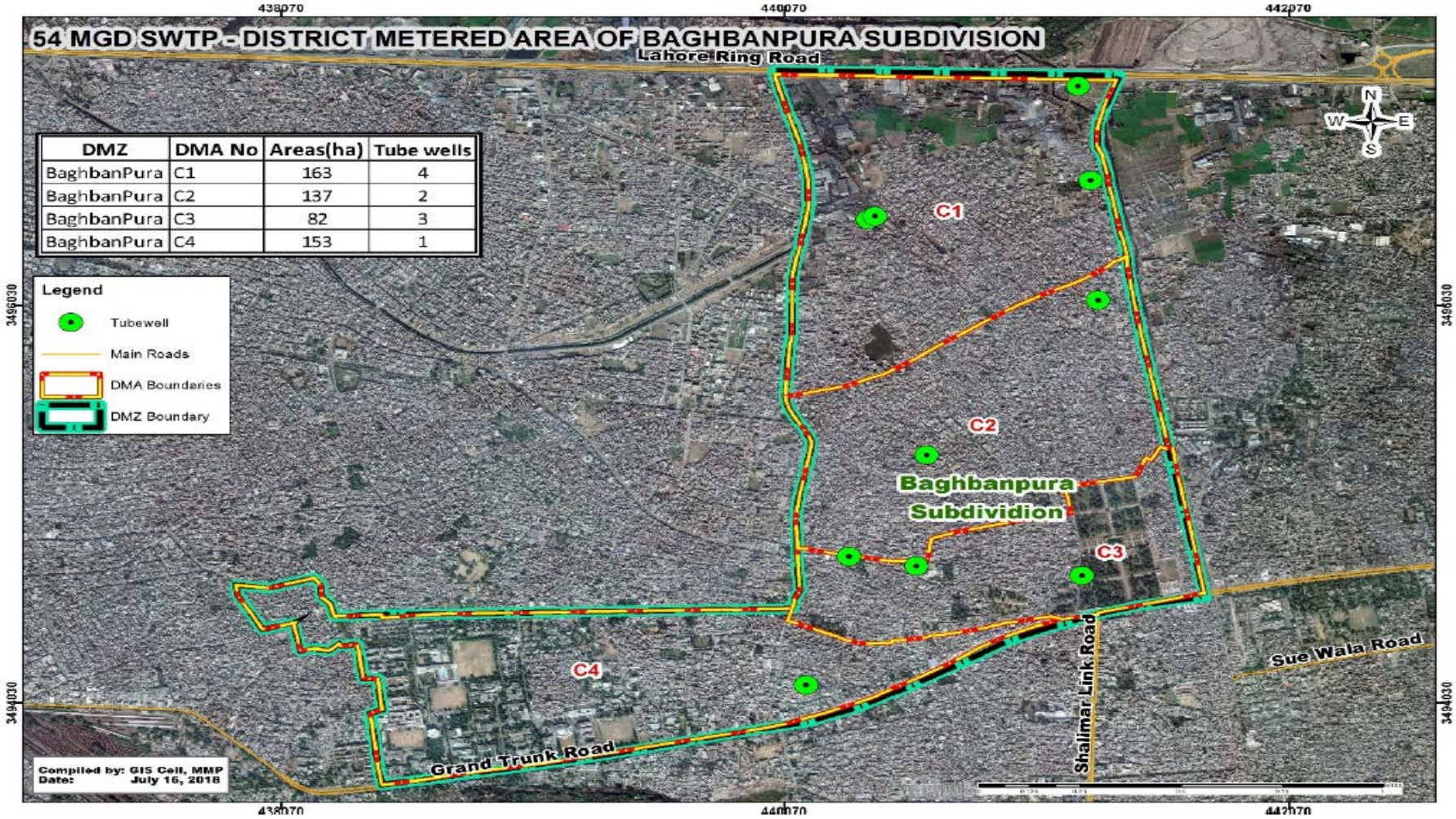


Figure 2.12 District Metered Area of Baghbanpura Subdivision

(Source: Final Feasibility Study Report of LWWMP Feb, 2019)

2.10.8 Waste and Sludge Generation and Management (Package 03 Operation Phase)

102. During operations, the main waste generated will be sludge from SWTP known as Water Treatment Sludge (Annexure) during the purification of raw water. In surface water treatment plant, the considerable amount of wastewater is produced due to backwashing of rapid sand filters and release of accumulated sludge in sedimentation tanks. So, this sludge has to undergo with some stages to finally get it dispose-off or reuse.

2.10.8.1 Sludge Production

103. Most of suspended particles and turbidity is removed in the clarifiers. As a result of which sludge is formed due to suspended solid particles which coalesce together on the mixing of coagulants and the coagulant themselves add to the sludge concentration in terms of solids. The solid concentration of clarified sludge ranges from 1 to 2% of the sludge volume while the total sludge volume is in the range of 2 to 3 % of the product water. The total amount of coagulant sludge anticipated to generate from SWTP would be 73.5 tons/day.

2.10.8.2 Sludge Reuse or Disposal

104. There is a need to adopt a proper approach to manage Water Treatment Sludge (WTS) and to make sure that it is effectively managed, stored, transported and re-used or disposed of in a sustainable way, to the benefit of the public and the environment we all live in.

105. In principle, primarily there are two options for the final outlet for sludge from water treatment plants: i) Landfilling (after stabilization or/and incineration), ii) Recycling in agricultural land, building and construction industry.

106. Final plan will be developed after consultation with AIIB, once the construction is completed; agreement with Lahore Waste Management Company (LWMC) for the disposal in landfill site or composting (if possible).

CHAPTER 03

3 POLICY AND LEGAL FRAMEWORK

3.1 Introduction

107. A number of laws concerning to protection of the environment exist in Pakistan. However, the first legislation on environmental protection was made in 1983. The Pakistan Environmental Protection Ordinance, 1983 was the first legislation promulgated for the protection of environment.

108. In 1993, the Pakistan Environmental Protection Agency (Pak-EPA) was established under Section 6 (d) of the Pakistan Environmental Protection Ordinance, 1983. No significant environmental policy, guidelines and regulations were carried out till early 1990's. The National Conservation Strategy (NCS) was developed and approved by the Federal Cabinet in 1992. Punjab Environmental Protection Act (PEPA) 1997 Amended 2012 was formulated and after 18th Amendment, Punjab Environmental Quality Standards (PEQS) were established in 2016.

3.1.1 Policy Guidelines

109. The National Conservation Strategy (1992) is the primary document addressing environmental issues of the country. National Conservation Strategy (NCS) is duly recognized as the National Environmental Action Plan (NEAP) by various international donor agencies including the AIIB. The document identifies 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural environment.

1. Biodiversity conservation
2. Restoration of rangelands
3. Pollution prevention and abatement
4. Preservation of cultural heritage

110. The Pakistan Environmental Protection Act (PEPA) 1997 is the key legislation empowering the government to frame regulations for protection of the environment. Detailed rules, regulations and guidelines required to enforce the Environmental Protection Act are still in various stages of development.

111. Pakistan is signatory to the Convention on Biological Diversity (CBD) and is thereby obligated to develop a national strategy for the conservation of biodiversity. A Biodiversity working group has been constituted under the Ministry of Environment, Local Government and Rural Development to develop a Biodiversity Action Plan for the country. The Biodiversity Action Plan has been developed after an extensive consultative process and compliments the NCS and the proposed provincial conservation strategies. It identifies the causes of biodiversity loss in Pakistan and suggests a series of proposals for action to conserve. The Pakistan Environmental Protection Council (PEPC) approved the plan and while the provincial

steering committees are in the process of being formed, a federal steering committee is already in place.

3.1.2 Environmental Institutions and Administration

112. The Constitution of Pakistan distributes the legislative powers between the federal and the provincial governments through "Federal and Concurrent Lists" attached to the Constitution as appendices. The Federal list depicts the areas and subjects on which the Federal government has exclusive powers. The second, concurrent list contains areas and subjects on which both Federal and Provincial governments can enact laws.

113. The Ministry of Climate Change is responsible to handle environmental issues at federal level. The NCS unit within the Ministry ensures implementation of the National Conservation Strategy.

114. The Punjab Environmental Protection Agency is responsible for administering the provisions of the Punjab Environmental Protection Act. It is responsible to ensure compliance with the Punjab Environmental Quality Standards (PEQS), develop monitoring and evaluation systems and initiate legislation when necessary.

115. The Punjab Environmental Protection Agency (Environmental Protection Directorate in Punjab) is responsible for environmental planning and development, approval of Initial Environmental Examination (IEE) and Environmental Impact Assessments (EIA) of new projects at provincial level. Wildlife conservation and management is also a provincial subject. Provincial Wildlife and Forestry Departments are responsible for implementation of provisions of provincial Wildlife Protection Ordinances, Acts and Regulations.

116. Details of the laws applicable are described below:

3.2 National Water Policy 2018

117. 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. Pakistan has a federal system of government and the provinces enjoy a considerable degree of 2 autonomy. Thus, this policy is a national framework within which the provinces can develop their master plans for sustainable development and management of water resources. The water resource is a national responsibility but irrigation and agriculture, as well as rural and urban water supply, environment and other water related sub-sectors are provincial subjects.

Policy Objectives

118. The National Water Policy is based on the concept of Integrated Water Resources Management primarily aimed at the following policy objectives:

- **"**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.
- Improving availability, reliability and quality of fresh water resources to meet critical municipal, agricultural, energy, security and environmental needs.
- Improving urban water management by increasing system efficiency and reducing non-revenue water through adequate investments to address drinking water demand, sewage disposal, handling of wastewater and industrial effluents.
- Promoting behavioural 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.
- Hydropower development to increase the share of renewable energy.
- Providing food security and expanding water availability to help adapt to climate change, population and other large-scale stresses.
- Treatment and possible reuse of waste water - domestic, agricultural and industrial.
- Upgrading water sector information systems for improved asset management and to derive evidence and data driven decision making.
- Improving watershed management through extensive soil conservation, catchment area treatment, preservation of forests and increasing forest cover.
- Restoring and maintaining the health of the environment and water related eco systems.
- Flood management to mitigate floods and minimize their damages.
- Drought management with emphasis on long term vulnerability reduction.
- Security of benefit streams of the water related infrastructure for sustained provision of services.
- 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.
- Adequate water pricing (Abiana) for irrigation and proper operation and maintenance of the irrigation system as well as other user sectors.
- Promoting measures for long term sustainability of the Irrigation System.
- Encouraging beneficiary participation and public private partnerships.
- Strengthening and Capacity building of water sector institutions.
- Profitable use of flood water towards promotion of local irrigation practices.
- Exploitation of vast potential of water generated through hill torrents.

- Protection of wet lands and Ramsar Sites for the prevention of wild life, flora and fauna.
- Stoppage of further sea water intrusion into Sindh (upstream from coastline) for the sustainability of coastal environment, flora and fauna and mangrove growth including the use of skimming dug- wells in coastal areas.
- Establishment of Hydro-meteorological disaster risk reduction complied integrated water resources management regime.
- Enhancing water productivity through infrastructure development and adoption of improved technologies in a sustainable manner.
- Climate change impact assessment and adaptation for sustainable water resources development and management.
- Promoting research on water resources related issues of national importance and building capacity/delineating roles and responsibilities of Federal research institutions and promoting coordination among them.
- Setting major national targets for the water sector including those for water conservation, water storage, Irrigation, water treatment and drinking water. These targets can be firmed up in consultation with the Provincial Governments and reviewed periodically for inclusion in the 12th and 13th Five Year Plans and future plans.
- Secure Kacha areas and economy thereof.
- Preserve delta area by providing sufficient supplies regularly.
- Rainwater management in plains where it cannot be disposed of or diverted to the river.
- Effective implementation of the 1991 Water Apportionment Accord in letter and spirit".

Conservation of Water

119. The criticality of fresh-water for sustenance of human life, coupled with scarcity warrants recognition of water conservation to be accorded the highest national priority. In the choice of conservation technology due care shall be exercised to select the most appropriate technology which:

120. **"**has the proven record of performance - is the economically viable option - has the potential to generate multi-benefits and - is environment friendly**"**

121. It is recognized that the large annual and seasonal variability of fresh-water availability makes it necessary to: -

122. **"**build large dams for system augmentation with consensus of all federating units - build small and medium dams for local and regional use - build check dams and delay action dams for recharge of aquifers and to reduce the flow velocities and erosion - recharge the underground aquifers during floods and surplus water flow periods for later use provide subsurface dams, wherever feasible**"**

123. The Water Conservation Plans shall include:

124. **"**re-use and recycling of municipal and industrial waste water effluent after appropriate treatment at source - adoption of rainwater harvesting technology - adoption of water conservation techniques/technologies at the farm level - adoption of technology for sustainable use of drainage water in agriculture, horticulture and forestry sub sectors**"**

3.3 National Drinking Water Policy 2018

- **"**Plans and initiatives shall be undertaken to progressively provide access to clean and safe drinking water and sanitation facilities to the urban and rural population of the country.
- Full financial sustainability shall be aimed at for the Urban Water Supply and Sanitation Systems through effective reduction in wastage, theft and non-revenue water allocation and 100% metering, with effective safety-nets for the urban and peri-urban poor. Similarly, urban water tariffs must be revised to ensure financial sustainability.
- The Rural Water Supply and Sanitation Services shall be priced at affordable rates.
- Under no circumstances, shall the quality of drinking water, urban or rural, be allowed to fall below the specified standards. Each agency responsible for delivery of such services shall prepare Quality Monitoring Plans and shall be responsible for their rigorous enforcement.
- The sources of water, surface as well as underground, shall be diligently protected from contamination and always maintained in a healthy state, through enforcement of legislation for controlling water pollution in coordination with provinces.
- In remote area of the country, solar desalination of water will be promoted to provide the communities safe drinking water.
- The groundwater levels have dropped to alarming depths and are falling further – potentially reaching the highly saline ancient sea water level in the coming few years. Alternative sources of surface water need to be urgently developed and adequate ground water re-charge ensured
- Drinking water and sanitation plans will be adopted in line with the National Drinking Water and Sanitation Polices and Sustainable Development Goals".

3.4 Punjab Drinking Water Policy 2011

125. The key policy principles to be highlighted are as follows:

- **"**Water is a finite and essential resource, the use of which needs to be regulated and measured in order to avoid wastage and misuse.
- Drinking water allocation for domestic purposes will have priority over all other usages.

- Saving underground water aquifer as well as surface water from contamination of all kinds will be given top priority through legislation / regulation as well as increasing public awareness.
- Resource allocation for provision and conservation of drinking water will be based on need based criteria and will be aimed at creating an equitable distribution between urban and rural Punjab. Areas where drinking water is scarce or contaminated will be given priority.
- The community, particularly in rural areas, will be organized and provided administrative, technical and financial backup in order to effectively operate and maintain rural water supply schemes.
- Public service provision institutions (WASAs, TMAs and others) will follow a reform program which will be based on rationalization of tariff, reduction of inefficiency cost and improvement of service delivery.
- The private sector and non-governmental organizations will be encouraged to develop and implement service delivery models, in line with the objectives and principles of this policy.
- The Policy is a step in the direction to introduce a performance-based service delivery culture and releases to service providers (WASAs, TMAs and other public entities) will be linked to achievements to their performance targets set by this Policy and recognition of Community Based Organizations (CBOs) by awarding them performance awards**"**

3.5 National Environmental Policy 2005

126. Government of Pakistan has notified National Environmental Policy 2005, for different projects/aspects in which guidelines/priorities have been given to undertake/commence the projects having significant environmental impacts. The National Environmental Policy (2005) provides a framework for addressing the environmental issues (particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification etc.) confronting Pakistan. It recognizes the goals and objectives of the Pakistan National Conservation Strategy (PNCS, 1992), National Environmental Action Plans, and other existing environment related national policies, strategies, and action plans. It also provides broad guidelines to the Federal Government, Provincial Governments, federally administrated territories and local governments to address their environmental concerns and to ensure effective management of their environmental resources.

Water Supply and Management

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

- **"**Develop legal and policy framework for promotion of safe drinking water in Pakistan.

- Increase coverage of water supply and water treatment facilities.
- Establish a water quality monitoring and surveillance system.
- Make installation of water treatment plans as an integral component of all drinking water supply schemes.
- Promote low-cost water treatment technologies at the community and household levels.
- Promote appropriate technologies for rain water harvesting in rural as well as urban areas.
- Encourage artificial recharge of ground water in arid and semi-arid areas.
- Promote meeting of water consumption to discharge the indiscriminate use of water for industrial and municipal purposes.
- Enact water conservation act and relevant standards to forest water conservation.
- Promote integrated waste management.
- Monitor sustained fresh water flows into the marine environment.
- Establish standards for classification of surface water bodies.
- Launch phased programs for clean-up and gradual up-gradation of the quality of water bodies".

3.6 Adaptation of Sustainable Development Goals (SDGS) Indicators by Pakistan

128. The Project is aligned with UNO sustainable development goals. As per goal No. 6 'Clean Water and Sanitation' water scarcity, poor water quality and inadequate sanitation negatively impact food security, livelihood choices and educational opportunities for poor families across the world. At the current time, more than 2 billion people are living with the risk of reduced access to freshwater resources and by 2050, at least one in four people is likely to live in a country affected by chronic or recurring shortages of fresh water. Drought in specific afflicts some of the world's poorest countries, worsening hunger and malnutrition.

129. The UN Millennium Development Goals MDGs have officially ended in 2015, but SDGs acceleration framework still continues. "Pakistan adopted 16 targets and 41 indicators against which progress towards achieving eight goals of MDGs is measured. Relevant Goals have been reproduced here:

130. **Goal 6.** Combat HIV/AIDS, malaria and other diseases

131. **Target 7.** Have halted by 2015 and begun to reverse the spread of HIV/AIDS

- AIDS deaths
- Condom use to overall contraceptive use among currently married women 15-49 years old, percentage
- Contraceptive use among currently married women 15-49 years old, any method, percentage

- Contraceptive use among currently married women 15-49 years old, condom, percentage
- Contraceptive use among currently married women 15-49 years old, modern methods, percentage
- People living with HIV, 15-49 years old, percentage

132. Target 8. Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases

- Tuberculosis death rate per 100,000 population
- Tuberculosis detection rate under DOTS, percentage
- Tuberculosis prevalence rate per 100,000 population
- Tuberculosis treatment success rate under DOTS, percentage

133. Goal 7. Ensure environmental sustainability

134. Target 9. Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources

- Carbon dioxide emissions (CO2), metric tons of CO2 per capita (CDIAC)
- Carbon dioxide emissions (CO2), thousand metric tons of CO2 (CDIAC)
- Consumption of all Ozone-Depleting Substances in ODP metric tons
- Consumption of ozone-depleting CFCs in ODP metric tons
- Energy use (Kg oil equivalent) per $1,000 Purchasing Power Parity (PPP) GDP
- Land area covered by forest, percentage
- Protected area to total surface area, percentage
- Protected areas, sq. km.

135. Target 10. Halve by 2015 the proportion of people without sustainable access to safe drinking water

- Proportion of the population using improved drinking water sources, rural
- Proportion of the population using improved drinking water sources, total
- Proportion of the population using improved drinking water sources, urban
- Proportion of the population using improved sanitation facilities, rural
- Proportion of the population using improved sanitation facilities, total
- Proportion of the population using improved sanitation facilities, urban

136. Target 11. By 2020 to have achieved a significant improvement in the lives of at least 100 million slum dwellers

- Slum population as percentage of urban, percentage
- Slum population in urban areas

Goal 8. Develop a global partnership for development

137. Target 12. Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term

- Debt service as percentage of exports of goods and services and net income from abroad

138. Target 13. In cooperation with developing countries, develop and implement strategies for decent and productive work for youth

- Ratio of youth unemployment rate to adult unemployment rate, both sexes
- Ratio of youth unemployment rate to adult unemployment rate, men
- Ratio of youth unemployment rate to adult unemployment rate, women
- Share of youth unemployed to total unemployed, both sexes
- Share of youth unemployed to total unemployed, men
- Share of youth unemployed to total unemployed, women
- Share of youth unemployed to youth population, both sexes
- Share of youth unemployed to youth population, men
- Share of youth unemployed to youth population, women
- Youth unemployment rate, aged 15-24, both sexes
- Youth unemployment rate, aged 15-24, men
- Youth unemployment rate, aged 15-24, women

139. Target 14. In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

- Internet users
- Internet users per 100 population
- Personal computers
- Personal computers per 100 population
- Telephone lines and cellular subscribers
- Telephone lines and cellular subscribers per 100 population

3.7 Government of Punjab Laws and Regulations

140. The GoPb Environmental, and Land Acquisition Law and Regulations: (Including Polices, Guidelines, International Treaties Signed by Pakistan; National and Provincial Environmental Authorities; Environmental Procedures), their applicability, and compliance status for the project:

Policy Framework:

141. The present document includes the first part of the Operations manual, the Resettlement and compensation Policy Framework. This policy framework provides principles and instructions to compensate persons, families, organizations negatively affected by the

project to ensure that regardless of tenure status, they will be assisted to improve, or at least restore their living standards, income, earnings and/or production capacity to pre-project levels.

142. This policy framework is based on the following Guidelines and GoPb Policies:

a) Land Acquisition Act of GoPb and Regulations 1983

b) AIIB ESP and ESS1 and ESS2 Environmental and Social Standard (ESS) 1: Environmental and Social Assessment and Management and ESS 2: Involuntary Resettlement

Principles and Objectives on Involuntary Resettlement

143. The resettlement policy for the LWWM Project evolved after a number of consultation meetings with APs and other stakeholders. By following the objectives and principles of AIIB, the core involuntary resettlement principles for this project are:

i. land acquisition, and other involuntary resettlement impacts will be avoided or minimized by exploring all viable alternatives of the project design;

ii. where unavoidable, time-bound Resettlement Plan (RP) will be prepared and APs will be assisted in improving or at least regaining their pre-project standard of living;

iii. provision of income restoration and rehabilitation to agriculture tenants, vendors, employees of shopkeepers etc.;

iv. consultations with APs on compensation and resettlement options, disclosure of resettlement information to APs, and participation of APs in planning and implementation of project will be ensured;

v. payment of compensation to APs including non-titled persons (e.g., informal dwellers/squatters and encroachers) for acquired assets at replacement rates;

vi. vulnerable groups and severely affected displaced persons will be provided special assistance;

vii. payment of compensation and resettlement assistance prior to the construction contractor taking physical acquisition of the land and prior to the commencement of any construction activities; and

viii. establishment of appropriate institutional, grievance redress, internal and external monitoring and reporting mechanisms.

3.8 Land Acquisition Act 1894

144. In Pakistan, Land Acquisition Act 1894 is the main law regulating land acquisition for public purpose. The Act facilitates the provincial governments and project executing / implementing agencies (EAs/IAs) in development projects which involve acquisition of land for public purposes. The Act does not inherently mandate specifically for resettlement assistance

and rehabilitation provisions benefiting the non-title holders and other vulnerable groups, or severely affected APs, nor directly provides for rehabilitation of income/livelihood losses or resettlement costs. The Act mandates only for titleholders and registered sharecroppers of land and associated assets attached to affected land such as structures, crops and trees. The Act will be applied for the land acquisition and compensation payments to the titleholders and registered non-titleholders (sharecroppers) for loss of land and associated assets in this Project.

145. Section 4 of Land Acquisition Act, 1894 deals with the publication of preliminary notification by Board of Revenue and the powers of officers thereupon.

- **"**Publication is made by the he District Collector/Deputy Commissioner when a land is needed or is likely to be needed for a public purpose or for a company.
- Publication should be in Official Gazette or District Gazette and in two daily newspapers, one of which should be in regional language.
- A public notice of the publication should be made within 40 days in the locality in a convenient place and mentioning the last dates of the publication, referred as the date of publication of the notification.
- Section 4(2) allows the appropriate Government or the District Collector or any officer generally or specially authorized, his servants or workmen to do certain acts including:
  - Entering into, and surveying, and taking levels of the land
  - Dig or bore into sub-soil of the land to be acquired
  - Do acts that ascertain whether the land is adoptable for the purpose for which it will be acquired
  - Placing marks and cutting trenches and clear away any crop, fence or jungle in making the survey
  - Seven-day notice should be given before a person is allowed to enter into a building, court or a garden related to the land to be acquired".

3.9 AIIB Environmental and Social Policy

146. An Environmental and Social Policy (ESP), which sets forth mandatory environmental and social requirements for each Project. The objective of this overarching policy is to facilitate achievement of these development outcomes, through a system that integrates sound environmental and social management into Projects.

Together, the ESP and the ESSs comprise an environmental and social management approach designed to:

- Support decision-making by the Bank.

- Provide a robust structure for managing operational and reputational risks of the Bank and its shareholders in relation to environmental and social risks and impacts in Projects.
- Provide for environmental and social screening and categorization of Projects.
- Analyse potential environmental and social risks and impacts of Projects.
- Identify actions to avoid, minimize, mitigate, offset or compensate for environmental and social impacts of Projects.
- Support integration of environmental and social management measures into Projects.
- Specify environmental and social management provisions to be included in agreements governing Projects.
- Provide a mechanism for public consultation and disclosure of information on environmental and social risks and impacts of Projects.
- Provide for monitoring and supervision of environmental and social management measures under Projects.
- Facilitate development and dissemination of lessons learned from Projects to improve environmental and social management practices.

Requirements

- Screening and Categorization
- Environmental and social due diligence
- Environmental and social assessment
- Assessment Documentation and Instruments
- Environmental and social management plan
- Environmental and social management planning framework
- Special circumstances
- Use of country and corporate systems
- Information disclosures
- Monitoring and reporting
- Grievances redressal mechanism

3.10 AIIB Environmental and Social Standards

147. The following two associated Environmental and Social Standards (ESSs), which set out more detailed mandatory environmental and social requirements relating to the following:

- Environmental and Social Assessment and Management (ESS1)
- Involuntary Resettlement (ESS 2)

148. When the Bank has determined, in consultation with the Client, that the Project has potentially adverse environmental or social risks and impacts, it requires the Client:

1. Environmental and Social Standard 1 (ESS1): Assessment and Management of Environmental and Social Risks and Impacts;
   i. ESS1 sets out the Borrower's responsibilities for assessing, managing and monitoring environmental and social risks and impacts associated with each stage of a project supported by the Bank through Investment Project Financing, in order to achieve environmental and social outcomes consistent with the Environmental and Social Standards (ESSs).
   ii. The Borrower will assess, manage and monitor the environmental and social risks and impacts of the project throughout the project life cycle so as to meet the requirements of the ESS1 in a manner and within a timeframe acceptable to the Bank. The environmental and social assessment will apply a mitigation hierarchy which will:
      a) Anticipate and avoid risks and impacts;
      b) Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels;
      c) Once risks and impacts have been minimized or reduced, mitigate; and
      d) Where significant residual impacts remain, compensate for or offset them, where technically and financially feasible.
2. Involuntary Resettlement.

149. The objectives of the ESS2: Involuntary Resettlement is to avoid Involuntary Resettlement wherever possible or to minimize Involuntary Resettlement by exploring Project alternatives; where avoidance of Involuntary Resettlement is not feasible, to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-Project levels; to improve the overall socioeconomic status of the displaced poor and other vulnerable groups; and to conceive and implement resettlement activities as sustainable development programs, providing sufficient resources to enable the persons displaced by the Project to share in Project benefits.

3.11 Good International Industry Practices

Waste Water and Ambient Water Quality

150. In the context of their overall Environmental Social Health and Safety management system, facilities should:

1. Understand the quality, quantity, frequency and sources of liquid effluents in its installations. This includes knowledge about the locations, routes and integrity of internal drainage systems and discharge points.
2. Plan and implement the segregation of liquid effluents principally along industrial, utility, sanitary, and storm water categories, in order to limit the volume of water requiring

specialized treatment. Characteristics of individual streams may also be used for source segregation.

3. Identify opportunities to prevent or reduce wastewater pollution through such measures as recycle/reuse within their facility, input substitution, or process modification (e.g. change of technology or operating conditions/modes).
4. Assess compliance of their wastewater discharges with the applicable: (i) discharge standard (if the wastewater is discharged to a surface water or sewer), and (ii) water quality standard for a specific reuse (e.g. if the wastewater is reused for irrigation).

151. Additionally, the generation and discharge of wastewater of any type should be managed through a combination of:

1. Water use efficiency to reduce the amount of wastewater generation.
2. Process modification, including waste minimization, and reducing the use of hazardous materials to reduce the load of pollutants requiring treatment.
3. If needed, application of wastewater treatment techniques to further reduce the load of contaminants prior to discharge, taking into consideration potential impacts of cross-media transfer of contaminants during treatment (e.g., from water to air or land).

152. When wastewater treatment is required prior to discharge, the level of treatment should be based on:

1. Whether wastewater is being discharged to a sanitary sewer system, or to surface waters.
2. National and local standards as reflected in permit requirements and sewer system capacity to convey and treat wastewater if discharge is to sanitary sewer.
3. Assimilative capacity of the receiving water for the load of contaminant being discharged wastewater if discharge is to surface water.
4. Intended use of the receiving water body (e.g. as a source of drinking water, recreation, irrigation, navigation, or other).
5. Presence of sensitive receptors (e.g., endangered species) or habitats · Good International Industry Practice (GIIP) for the relevant industry sector.

3.12 Other Relevant Rules, Laws and Policies

3.12.1 Factories Act 1934

Section-20 Drinking Water

153. In every factory:

1. **“**Effective arrangement shall be made to provide and maintain at suitable points conveniently situated for all workers employed therein a sufficient supply of whole-some drinking water.

2. All such points shall be legibly marked "Drinking Water" in a language understood by the majority of the workers and no such point shall be situated within twenty feet of any washing place, urinal or latrine, unless a shorter distance is approved in writing by the Chief Inspector.
3. In every factory wherein more than two hundred and fifty workers are ordinarily employed, provision shall be made for cooling the drinking water during the hot weather by effective means and for distribution thereof and arrangements shall also be made for:
   a) the daily renewal of water if not laid on; and
   b) a sufficient number of cups or other drinking vessels, unless the water is being delivered in an upward jet.
4. The Provincial Government may, in respect of all factories or any class or description of factories, make rules for securing compliance with the provisions of this section".

Section-21 Latrines and Urinals

154. In every factory:

i. **"**sufficient latrines and urinals of prescribed types shall be provided conveniently situated and accessible to workers at all times while they are in the factory;
ii. enclosed latrines and urinals shall be provided separately for male and female workers;
iii. such latrines and urinals shall be adequately lighted and ventilated and no latrine and urinal shall, unless specially exempted in writing by the Chief Inspector, communicate with any workroom except through an intervening open space or ventilated passage;
iv. all such latrines and urinals shall be maintained in a clean and sanitary condition at all times with suitable detergents or disinfectants or with both;
v. the floors and internal walls of the latrines and urinals and the sanitary blocks shall, up to a height of three feet, be finished to provide a smooth polished impervious surface; and
vi. washing facilities shall be provided near every sanitary convenience".

3.12.2 Pakistan Environmental Protection Ordinance (PEPO) 1983

155. In 1983, the Government of Pakistan issued an Environmental Protection Ordinance (EPO). It was the first legislation promulgated for protection of the environment. According to PEPO 1983, it was necessary to carry out IEE / EIA for all development projects, but there were no IEE / EIA regulations under that ordinance.

3.12.3 Pakistan Environmental Protection Act (PEPA), 1997

156. The Act is applicable to a broad range of issues and extends to air, water, soil, marine and noise pollution, as well as the handling of hazardous substances. Some portions from the Act are reproduced below for reference purposes.

- **Section-11 (1):** "Subject to the provisions of this Act and the rules and regulations made there under no person shall discharge or emit or allow the discharge or emission of any effluent or waste or air pollution or noise in an amount, concentration or level which is in excess of the National Environmental Quality Standards".
- **Section-12 (1): "**No proponent of a project shall commence construction or operation unless he has filed with the Federal Agency an Initial Environmental Examination (IEE) or, where the project is likely to cause an adverse environmental effect, an Environmental Impact Assessment (EIA), and has obtained from the Federal Agency approval in respect thereof**".**
- **Section-14:** "Subject to the provisions of this Act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle or import any hazardous substance except (a) under a license issued by the Federal Agency and in such manner as may be prescribed; or (b) in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Pakistan is a party"

3.12.4 The Constitution (Eighteenth Amendment) Act 2010

157. It gives provincial governments exclusive powers to legislate on the subject of "Environmental Pollution and Ecology". When the Pakistan Environmental Protection Act (PEPA) 1997 operated as a federal law, any contradictory provisions in other laws, whether federal or provincial, were nullified because PEPA 1997 had overriding effect. Prior to the enactment of the Eighteenth Amendment, PEPA 1997 governed all operations and activities that have the potential to cause environmental damage. This included subjects such as nuclear power for which only the federal government may legislate. This too is no longer the case. The federal government retains exclusive authority over a number of subjects that should be regulated by environmental law, but the ambit of that law will now no longer extend to them.

3.12.5 Punjab Environmental Protection Act (Amendment) Act, 2012

158. The Act is applicable to a broad range of issues and extends to air, water, soil, marine and noise pollution, as well as the handling of hazardous waste. Some portions from the Act are reproduced below for reference purposes.

- **Section-11 (1):** "Subject to the provisions of this Act and the rules and regulations made there under no person shall discharge or emit or allow the discharge or emission of any effluent or waste or air pollution or noise in an amount, concentration or level which is in excess of the National Environmental Quality Standards".

- **Section-12 (1): "**No proponent of a project shall commence construction or operation unless he has filed with the Federal Agency an Initial Environmental Examination (IEE) or, where the project is likely to cause an adverse environmental effect, an Environmental Impact Assessment (EIA), and has obtained from the Federal Agency approval in respect thereof**".**
- **Section-14:** "Subject to the provisions of this Act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle or import any hazardous substance except (a) under a license issued by the Federal Agency and in such manner as may be prescribed; or (b) in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Pakistan is a party"

3.12.6 Canal and Drainage Act, 1873

159. This Act entails provisions for the prevention of pollution of natural or man-made water bodies.

3.12.7 Pakistan Penal Code (Act XLV), 1860

160. This defines the penalties for violations concerning pollution of air, water bodies and land. Sections 272 and 273 of this Act deals with the adulteration of food or drink. Noise pollution has been covered in section 268, which defines and recognizes noise as a public nuisance. ''A person is guilty of a public nuisance who does any act or is guilty of an illegal omission which causes any common injury, danger of annoyance to the public or the people in general who dwell or occupy property in the vicinity, or which must necessarily cause injury, obstruction, danger or annoyance to persons who may have occasion to use any public right''.

3.12.8 Punjab Environmental Quality Standards (PEQS) 2016

161. Environment Protection Agency (EPA) sustains qualitative and quantitative standards for the discharge of effluents, wastes, air emissions or noise either for general applicability or for a particular area or from a particular source in the form of Punjab Environmental Quality Standards (PEQS). Pakistan Environmental Protection Act 1997 (Amended 2012) establishes the following discharge concentration standards:

- **"**Maximum allowable concentration of the Pollutants, (32 parameters) in emission and liquid industrial effluents discharged to inland waters, sewerage treatment and the sea
- Maximum allowable concentration of pollutants (16 parameters) in gaseous emission
- Maximum allowable exhaust emissions and noise emission from vehicles.
- Maximum allowable noise level from vehicles
- Maximum allowable limits for Drinking Water
- Maximum allowable limits for Ambient Air Quality**"**

Table 3.1 Effluent Discharge Standards (PEQS 2016)

Sr. No.	Determinant	Into Inland Waters	Into Sewage Treatment
1	Temperature	≤3 ^{O}C	≤3 ^{O}C
2	pH	6 – 9	6-9
3	BOD5	80 mg/l	250
4	Chemical Oxygen Demand (COD)	150 mg/l	400
5	Total Suspended Solid (TSS)	200 mg/l	400
6	Total Dissolved Solids	3500 mg/l	3500 mg/l
7	Grease and Oil	10 mg/l	10 mg/l
8	Phenolic compounds (as phenol)	0.1 mg/l	0.3 mg/l
9	Ammonia	40 mg/l	40 mg/l
10	Chlorine	1.0 mg/l	1.0 mg/l
11	Chloride	1000.0 mg/l	1000.0 mg/l
12	Sulphate	600 mg/l	1000 mg/l
13	Manganese	1.5 mg/l	1.5 mg/l
14	Fluoride	10 mg/l	10 mg/l
15	Cyanide (as CN') total	1.0 mg/l	1.0 mg/l
16	An-ionic detergents (as MB As)	20 mg/l	20 mg/l
17	Sulphide (S-2)	1.0 mg/l	1.0 mg/l
18	Pesticides	0.15 mg/l	0.15 mg/l
19	Cadmium	0.1 mg/l	0.1 mg/l
20	Chromium trivalent and hexavalent	1.0 mg/l	1.0 mg/l
21	Copper	1.0 mg/l	1.0 mg/l
22	Lead	0.5 mg/l	0.5 mg/l
23	Mercury	0.01 mg/l	0.01 mg/l
24	Selenium	0.5 mg/l	0.5 mg/l
25	Nickel	1.0 mg/l	1.0 mg/l
26	Silver	1.0 mg/l	1.0 mg/l
27	Total Toxic metals	2.0 mg/l	2.0 mg/l
28	Zinc	5.0 mg/l	5.0 mg/l
29	Arsenic	1.0 mg/l	1.0 mg/l
30	Barium	1.5 mg/l	1.5 mg/l
31	Iron	8.0 mg/l	8.0 mg/l
32	Boron	6.0 mg/l	6.0 mg/l

Table 3.2 Punjab Environmental Quality Standards (PEQS) for Drinking Water 2016

Sr. No.	Properties/Parameters	Standard Values for Pakistan	WHO Standards	Remarks
		Bacterial		
1	All water is intended for drinking (*E. Coli* or Thermotolerant Coliform bacteria)	Must not be detectable in any 100ml sample	Must not be detectable in any 100ml sample	Most Asian Countries also follow WHO Standards
2	Treated water entering the distribution system (*E. Coli* or Thermotolerant Coliform and total Coliform bacteria)	Must not be detectable in any 100ml sample	Must not be detectable in any 100ml sample	Most Asian Countries also follow WHO Standards
3	Treated water entering the distribution system (*E. Coli* or Thermotolerant Coliform and total Coliform bacteria)	Must not be detectable in any 100ml sample. In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Must not be detectable in any 100ml sample. In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Most Asian Countries also follow WHO Standards
		Physical		
4	Colour	≤15 TCU	≤15 TCU	--
5	Taste	Non Objectionable/ Acceptable	Non Objectionable/ Acceptable	--
6	Odour	Non	Non	--

Sr. No.	Properties/Parameters	Standard Values for Pakistan	WHO Standards	Remarks
		Objectionable/ Acceptable	Objectionable/ Acceptable	
7	Turbidity	<5 NTU	<5 NTU	--
8	Total hardness as $CaCO_3$	<500mg/l	--	--
9	TDS	<1000	<1000	--
10	pH	6.5-8.5	6.5-8.5	--
Radioactive				
11	Alpha Emitters bq/L or pCi	0.1	0.1	--
12	Beta Emitters	01	01	--
Chemical				
Essential Inorganics		**mg/litre**	**mg/litre**	
13	Aluminium (Al) mg/l	≤0.2	0. 2	--
14	Antimony (Sb)	≤0.005	0.02	--
15	Arsenic (As)	≤0.05	0.01	Standard for Pakistan similar to most Asian developing Countries
16	Barium (Ba)	0.7	0.7	--
17	Boron (B)	0.3	0.3	--
18	Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing Countries
19	Chloride (Cl)	<250	250	--
20	Chromium (Cr)	≤0.05	0.05	--
21	Copper (Cu)	2	2	--
Toxic Inorganics		**mg/litre**	**mg/litre**	--
22	Cyanide (CN)	≤0.05	0.07	Standard for Pakistan similar

Sr. No.	Properties/Parameters	Standard Values for Pakistan	WHO Standards	Remarks
				to most Asian developing Countries
23	Fluoride (F)	≤1.5	1.5	**--**
24	Lead (Pb)	≤0.05	0.01	Standard for Pakistan similar to most Asian developing Countries
25	Manganese (Mn)	≤0.5	0.5	**--**
26	Mercury (Hg)	≤0.001	0.001	**--**
27	Nickel (Ni)	≤0.02	0.02	**--**
28	Nitrate (NO_3)	≤50	50	**--**
29	Nitrite (NO_2)	≤3	3	**--**
30	Selenium (Se)	0.01	0.01	**--**
31	Residual Chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	--	**--**
32	Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing Countries
		Organics		
33	Pesticides mg/L	---	PSQCA No. 4639-2004, Page No.4, Table No. 3, Serial No. 20-58 may be consulted	**Annex-II**
34	Phenolic Compounds (as Phenols) mg/L	---	≤0.002	**--**
35	Poly nuclear aromatic		0.01 (By GC/MS method)	--

Sr. No.	Properties/Parameters	Standard Values for Pakistan	WHO Standards	Remarks
	hydrocarbons (as PAH) g/L			

162. Punjab Environmental Quality Standards (PEQS) are attached as **Annexure-D**

3.12.9 Wildlife Act 2015

163. Section-16 Wildlife Sanctuary

1. Government may, by notification in the official Gazette, declare any area which is the property of Government or over which Government has proprietary rights to be wildlife sanctuary and may demarcate in such manner as may be prescribed.
2. The wildlife sanctuary shall be set aside as undisturbed breeding ground for the protection of wildlife and access thereto for public shall, except in accordance with the rules, be prohibited and no exploitation of forest therein shall be allowed except for reducing fire hazards, epidemic or insect attacks or other natural calamities.
3. No person shall;
   - **a)** enter or reside
   - **b)** cultivate any land
   - **c)** damage or destroy any vegetation
   - **d)** hunt, kill or capture any wild animal or fire any gun or other firearm within one mile of the boundaries
   - **e)** introduce any exotic species of animal or plant
   - **f)** introduce any domestic animal or allow it to stray
   - **g)** cause any fire
   - **h)** pollute water, in a wildlife sanctuary: Provided that Government may for specific purposes, as are deemed expedient, authorize the doing of the aforementioned acts

164. Section-17 National Park

1. With a view to the protection and preservation of flora and fauna in the natural state, Government may, by notification in the official Gazette, declare any area which is the property of Government or over which Government has proprietary rights to be a national park and may demarcate it in such manner as may be prescribed.
2. A national park shall be accessible to public for recreation, education and research subject to such restrictions as Government may impose.
3. Provision for access roads to and construction of rest houses, hostels and other buildings in the national park along with amenities for public may be so made and the forest therein

shall be so managed, and forest produce so obtained as not to impair the object of the establishment of the national park.

4. The following acts shall be prohibited in a national park;
   - **a)** hunting, shooting, trapping, killing or capturing of any wild animal in a national park or within one-and-a-half-mile radius of its boundary;
   - **b)** firing any firearm or doing any other act which may disturb any animal or bird or doing any act which interferes with the breeding places;
   - **c)** felling, tapping, burning or in any way damaging or destroying, taking, collecting or removing any plant or tree therefrom;
   - **d)** clearing or breaking up any land for cultivation, mining or for any other purpose; and
   - **e)** polluting water flowing in and through the national park: Provided that Government may, for specific purposes, as are deemed expedient, authorize the doing of the aforementioned prohibited acts.

3.12.10 The Punjab Occupational Health and Safety Act 2019

165. It is necessary to make and consolidate the law for the occupational safety and health of the persons at workplace and to protect them against risks arising out of the occupational hazards; to promote safe and healthy working environment catering to the physiological and psychological needs of the employees at workplace and to provide for matters connected therewith or ancillary thereto.

166. Be it enacted by Provincial Assembly of the Punjab as follows:

1. Short title, extent and commencement:
   - **a)** **"**This Act may be cited as the Punjab Occupational Safety and Health Act 2019.
   - **b)** It extends to whole of the Punjab.
   - **c)** It shall come into force at once.
   - **d)** The Government may, by order, exempt specified workplaces from the operation of the Act, either wholly or partially, and for such period as may be specified".

Safety and Health

2. The Government may in consultation with the Council, by notification in the official Gazette, provide for safety and health of persons in any establishment or a class of establishments in the prescribed manner.
3. Without prejudice to the generality of the foregoing provision, the rules made under subsection (1) may include but not be limited to the following matters:
   - **a)** design, siting, structural features, installation, maintenance, repair and alteration of workplaces and means of access thereto and egress therefrom;

b) lighting, ventilation, odour, temperature, noise, dust, fume, artificial humidification and cleanliness of workplaces;

c) design, construction, use, maintenance, testing and inspection of machinery and equipment liable to present hazards and, as appropriate, their removal and transfer;

d) prevention of harmful physical or mental stress due to conditions of work;

e) handling, stacking and storage of loads and materials, manually or mechanically;

f) guarding and fencing of the machinery and work at or near machinery in motion;

g) instructions, training and supervision in relation to employment on dangerous machine and fencing or casing of machinery, wet floors, open wiring, safety escapes, emergency exits, safe electric wiring and fitting etc.;

h) manufacture, packing, labelling, transport, storage and use of dangerous substances and agents, disposal of their wastes and residues and, as appropriate, their replacement by other substances or agents which are not dangerous, or which are less dangerous;

i) control of the atmosphere and other ambient factors of workplaces;

j) prevention and control of hazards due to high and low barometric pressures;

k) prevention of fires and explosions and measures to be taken in case of fire or explosion;

l) design, manufacture, supply, use, maintenance and testing of personal protective equipment and protective clothing;

m) sanitary installations, washing facilities, facilities for changing and storing clothes, supply of drinking water and any other welfare facilities connected with occupational safety and health;

n) use, handling and storage of excessive weights;

o) use and handling of loading and earth moving machinery;

p) use, handling and storage of cranes, hoist, lifts and other lifting operations;

q) installation and use of scaffolding and work at height;

r) first-aid treatment;

s) establishment of emergency plans; and

t) supervision of the health of employees.

3.12.11 WAPDA Act 1958

Powers Regarding Certain Matters

1. The Authority may take such measures and exercise such powers as it considers necessary or expedient for the carrying out of the purposes of this Act.

2. Without prejudice to the generality of the power conferred by the preceding sections and the provisions of sub-section (1) of this section, the Authority may for carrying out the purposes of this Act:

- **a)** undertake any works, incur any expenditure, procure plant, machinery and materials required for its use and enter into and perform all such contracts as it may consider necessary or expedient;
- **b)** acquire by purchase, lease, exchange or otherwise and dispose of by sale, lease, exchange or otherwise any land or any interest in land;
- **c)** place wires, poles, wall brackets, stays, apparatus and appliances for the transmission of electricity or for the transmission of telegraphic or telephonic communications necessary for the proper execution of a scheme;
- **d)** direct the owners of private lands to:
  - **i.** carry out measures for training of streams;
  - **ii.** undertake anti-erosion operations, including conservation of forests and re-afforestation;
- **e)** restrict or prohibit by general or special order the clearing and breaking up of land in the catchment area of any river
- **f)** direct that any work which has been required to be done by any person under the two preceding clauses, and which remains undone, shall, after due notice to such person and consideration of any objection raised by him, be executed by the Authority and specify the proportion in which the risk and expense of such work shall be borne by such person, or by any other person who, after being given a reasonable notice and after such inquiry as the Authority considers necessary, is held by the Authority to be responsible for the execution of such work in whole or in part; and
- **g)** seek and obtain advice and assistance in preparation or execution of a scheme from any local body or agency of the Government, and such local body or agency shall give the advice and assistance sought by the Authority to the best of its ability, knowledge and judgement:
- **h)** Provided that the Authority shall pay the cost of such advice and assistance if the giving of such advice and assistance entails additional expenditure to the local body or the agency.

3. The acquisition of any land or any interest in land for the Authority under this section, or for any scheme under this Act, shall be deemed to be an acquisition for a public purpose within the meaning of the Land Acquisition Act, 1894 and the provisions of the said Act shall apply to all such proceedings.

3.12.12 The Punjab Fisheries Ordinance 1961

Section-6 Destruction of fish by explosives

167. No person shall use any dynamite or other explosive substance in any water with intent thereby to catch or destroy any of the fish that may be therein.

Section-7 Destruction of fish by poisoning water

168. No person shall put any poison, lime or noxious material into any water with intent thereby to catch or destroy any fish that may be therein.

Section-8 Fish that shall not be taken

169. No person shall kill, capture, or possess any species of fish specified in the second column of the First Schedule, of a size less than that specified in the third column of the said Schedule against such species.

Section-(9A) Quality Control

1. The Government may prescribe standards and quality of fish and require inspection of fish.
2. A person shall not sell or commercially transfer a fish unless it conforms to the prescribed standards and quality.

3.12.13 The Indus Water Treaty 1960

ARTICLE XII Final Provisions

1. This Treaty consists of the Preamble, the Articles hereof and **Annexures A** to **H** hereto, and may be cited as “The Indus Waters Treaty 1960”.
2. This Treaty shall be ratified, and the ratifications thereof shall be exchanged in New Delhi. It shall enter into force upon the exchange of ratifications and will then take effect retrospectively from the first of April 1960.
3. The provisions of this Treaty may from time to time be modified by a duly ratified treaty concluded for that purpose between the two Governments.
4. The provisions of this Treaty, or the provisions of this Treaty as modified under the provisions of Paragraph (3), shall continue in force until terminated by a duly ratified treaty concluded for that purpose between the two Governments. IN WITNESS WHEREOF the respective Plenipotentiaries have signed this Treaty and have hereunto affixed their seals. Done in triplicate in English at Karachi on this Nineteenth day of September 1960.
5. Gap Analysis between World bank policies and Pakistan Laws and Regulations is given as **Annexure-E.**

CHAPTER 04

4 ENVIRONMENT AND SOCIAL BASELINE CONDITIONS OF THE PROPOSED PROJECT AREA (PACKAGE 03 AND PACKAGE 04)

4.1 Study Area

170. The study area of proposed project (Clean Drinking Water Supply) is located in Lahore district in Punjab province of Pakistan.

4.1.1 Geographical Background

171. Lahore commands a strategic political and administrative role as the capital of Punjab Province and the second largest city of Pakistan. Lahore District lies between 31º -15' and 31º -42' North latitude, 74º -01' and 74º -39' East longitude. It is situated in the north-eastern part of Pakistan with its centre lying within 25 km of the international border with India. It occupies a focal position in the Upper Indus Plain and is located along the eastern bank (left bank) of River Ravi. Lahore is bounded on the north and west by the Sheikhupura District, on the east by Wagah, and on the south by Kasur District. Lahore city covers a total land area of 404 square kilometres (156 square miles) and is still growing[24].

172. The Proposed Project site is located at the South-East of Lahore near the Indian Border, famous BRBD canal and Bhaini Road. The proposed project area is less developed than the other parts of Lahore like Gulberg, Model Town, Cantonment etc. although having industrial and commercial setting along with ongoing agriculture.

Package 03

173. Geographical Coordinates of the Package 03 are as follow:

Latitude: 31.264078 to 31.591541 N

Longitude: 74.435500 to 74.490833 E

Package 04

174. Geographical Coordinates of the Package 04 are as follow:

Latitude: 31.54400556 to 31.61412778 N

Longitude: 74.3450000 to 74.43527778 E

175. The location map of project area (Packages 03 and 04) is provided as **Figure 4.1**

[24] Malik, A. (2015). Geotechnical statistical evaluation of Lahore site data and deep excavation design

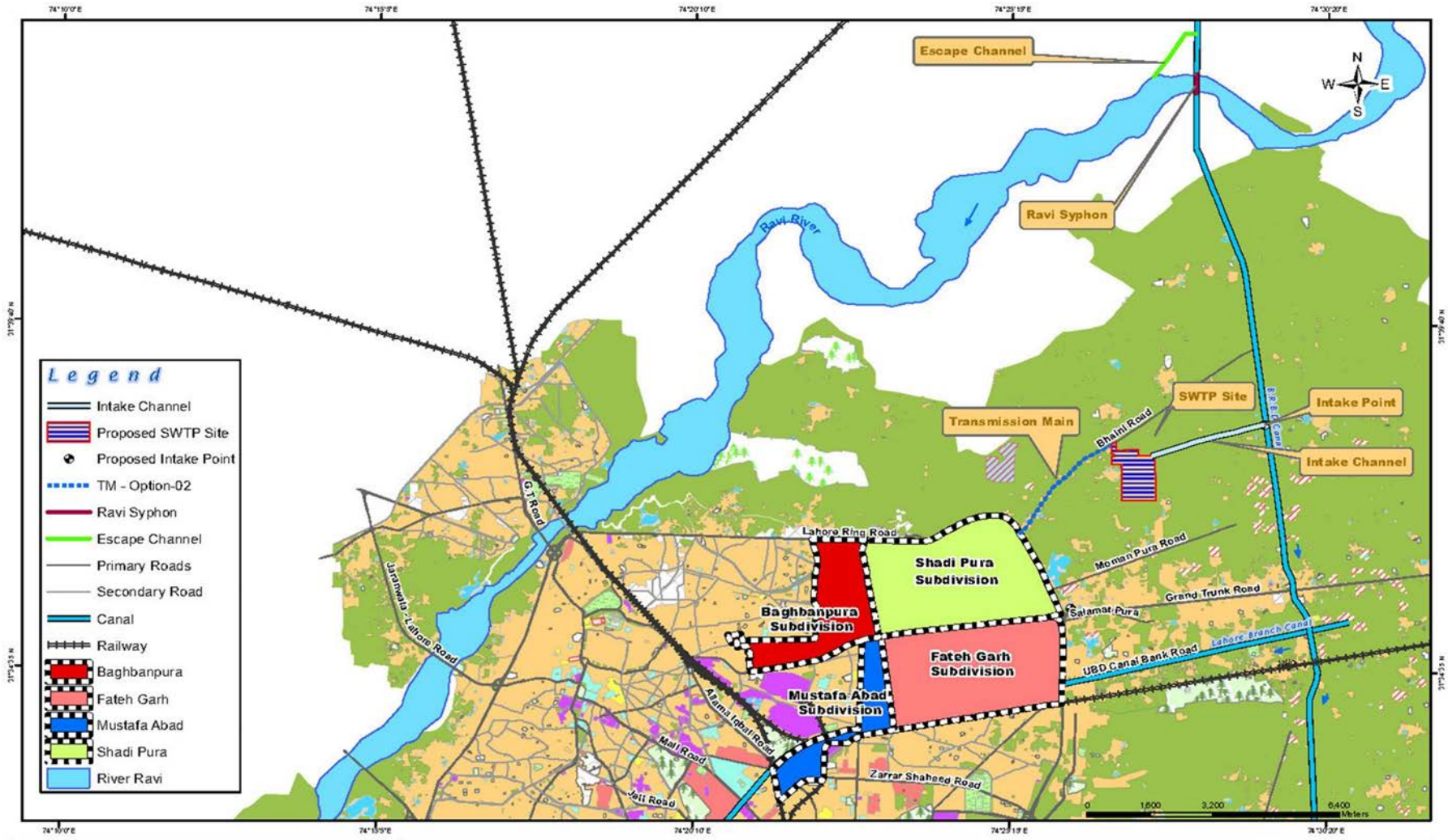


Figure 4.1 Location Map of Project Area (Package 03 and 04)

Source: Appendix-1 Final Feasibility Study Report of LWWMP Project-Feb, 2019

4.1.2 Area of Influence

176. The potential impacts of the proposed project on its surrounding physical environments include air and water quality impacts, noise generation, land transformation and changes to soil. The direct area of influence consists of (i) Ganj Sindhu village and some parts of Moazza Natt for the construction of SWTP. (ii) The area of about 3.5 km for the proposed Transmission Main starting from SWTP at Ganj Sindhu to a point near Shadi Pura along Bhaini road to four (04) serving areas i.e. Shadipura, Baghbanpura, Fatehgarh and Mustafabad of district Lahore (Package 04).

177. The adverse impacts are expected to be more severe in areas located near to the project and will reduce as the distance increases from the project and its associated activities (broader area of impact). For this purpose, a study area of one kilometre around each of water intake structure and channel, SWTP, transmission main, feeding main and distribution network was delineated in view of potential impacts, to assess the baseline conditions in the areas likely to be affected by the project due to its proximity to the project site. Maps showing corridor of Impact of Package 03 and Package 04 are given in Chapter 1, as **Figure 1.1** and **1.2.**

4.2 Physical Environment (Package 03 and 04)

178. The proposed project site is located in the South-East of District Lahore. The Lahore district is divided into two parts, a low lying or riverine area and upland area[25], however the proposed site falls in the first category i.e., Low lying area. The water level in this area is higher and the soil is loamy. As District Lahore falls in the Rice/Wheat agro-climatic zone of Punjab, the proposed site experiences sub-tropical continental climate with sufficient rainwater. The hottest months of the project area are June and July while December and January are the coldest months of the year. Wind blows calmly in the area from North-West direction. Nearby roads of project area include Bhaini Road and Link Road to Syphon. Annual Average Traffic Rate on these roads is 3618 Vehicles/day. Complete traffic count with methodology and picture evidence is provided as **Annexure-F.**

179. Physical Environment of the proposed area is further discussed below in detail.

4.2.1 Topography and Land Cover

180. The districts divided into two parts, a low lying or riverine area along the two bordering rivers and upland, away from the rivers. The riverine area is generally inundating during monsoon season. The proposed project site is in low-lying area. The water level in this area is higher than in the upland and the soil is loamy. On the other hand, the upland area

[25] Malik, A. (2015). Geotechnical statistical evaluation of Lahore site data and deep excavation design

comprised of flat plains sloping from North-West to South-West. The general height of the area is from 150 to 200 meters above the sea level[26].

4.2.2 Geology, Soils and Seismic Hazards

4.2.2.1 Geology

181. The Lahore District derives itself naturally between the central uplands and alluvial lands of Ravi, having no hills or mountains of any kind. The alluvial land of Lahore can be sub-divided into the following two categories:

- Uttar Land
- Hither land

182. Uttar lies in the north and constitutes about two thirds of the entire land. The low lands are known as Hither whereby project area and intake channel are located. The Hither Land, which is generally inundated by the water of the Ravi River during monsoon floods. The Ravi flows in the West District along its boundary with Sheikhupura District. The general altitude of the area is 150 to 200 meters above sea level. The only minerals worth any value are Kallar (combination of Sodium sulphate with more or less sodium carbonate and Sodium chloride) and Kankar (limestone). They are used for manufacturing of crude saltpeter (potassium nitrate) also as manure for top dressing of young cotton and tobacco plant. The soil is very different in character and generally inclined to be dry. However, it is rich in plant nutrients[27].

4.2.2.2 Soil Quality

183. The soil of Lahore is alluvial in nature, generated from the erosion of the mountain ranges to the north. It has been deposited by the large meandering rivers and streams and comprises of a random distribution of fine to coarse sand with lenses of silty clay. The infiltration rate of this type of soil is 1-5 mm/hour. As per data collected from Rapid Soil Fertility Research Institute Lahore, the soil of the project site is loamy in nature. Detailed soil analysis results of the project site are discussed in section **4.2.5.3** of this chapter.

4.2.2.3 Seismology

184. Seismic hazard assessment must be taken into account while designing and construction of a project. Pakistan is situated at the junction of three tectonic plates, namely Indian, Eurasian and Arabian. Due to the continental plate drift of the Indian Plate and Asian Plate, Pakistan has suffered from devastating earthquakes in past. According to the Geological Survey of Pakistan, whole country is divided into the following 5 zones:

[26] Sheikh, M. I. (2010). *Role of Environmental Geology for Urbanization of Lahore City Pakistan* (Doctoral Dissertation, University of the Punjab, Lahore, Pakistan).
[27] Malik, A. (2015). Geotechnical statistical evaluation of Lahore site data and deep excavation design

Table 4.1 Seismic Zones of Pakistan

Seismic zone	Peak horizontal ground acceleration
1	0.05 to 0.08g*
2A	0.08 to 0.16g
2B	0.16 to 0.24g
3	0.24 to 0.32g
4	>0.32g
*: "g" is the acceleration due to gravity	
Source: Geological Survey of Pakistan	

185. The area of Lahore falls within zone 2A according to the zoning developed by the Government of Pakistan (GoP). This zone represents the area of negligible damage (medium to low risk category) from a potential earthquake. Lahore does not possess many and strong earthquake generating source in close proximity, but distant seismic sources are strong and active.

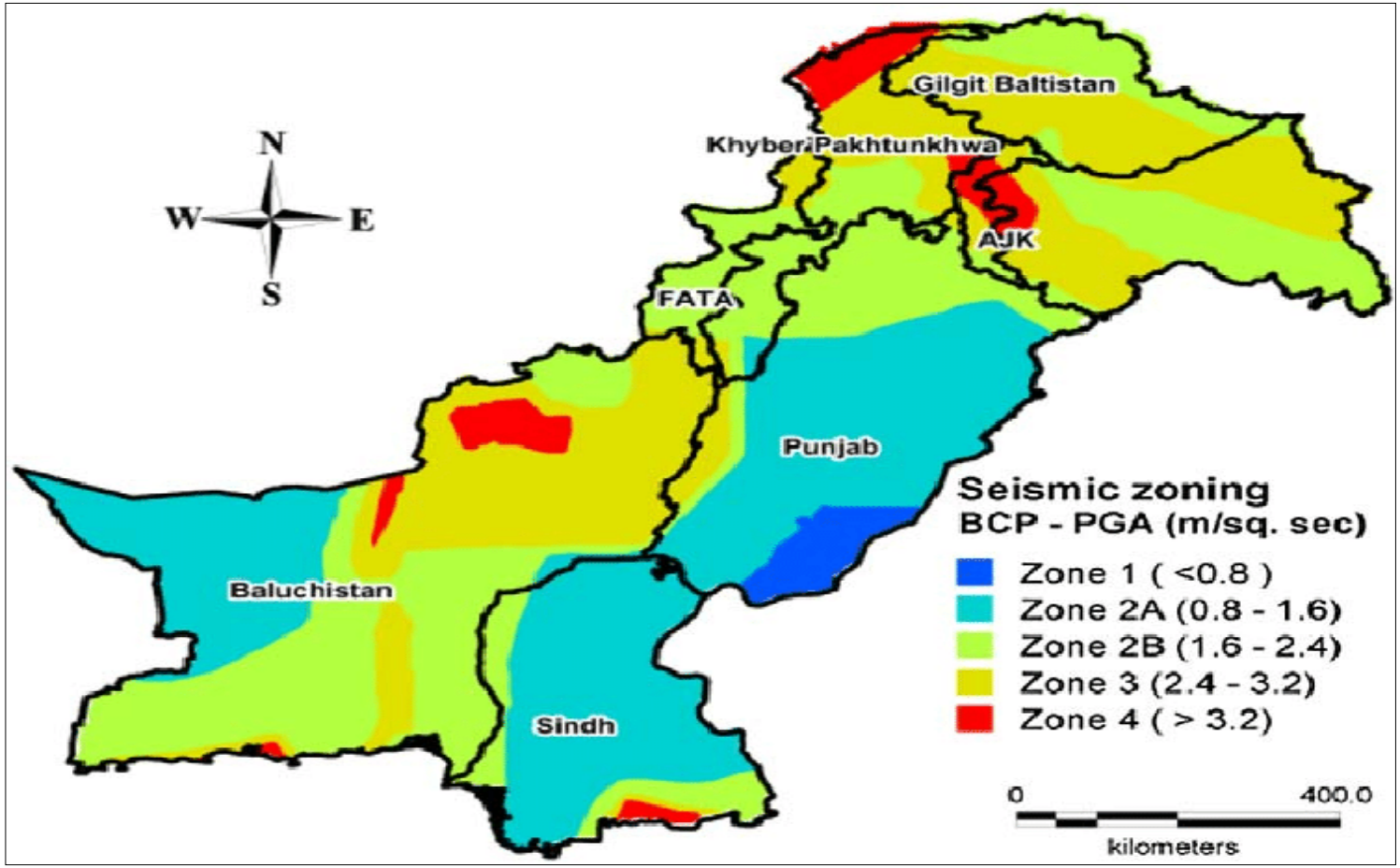


Figure 4.2: Seismic zoning map of Pakistan

(Source: Building Code of Pakistan (BCP 2007)).

4.2.3 Climate Baseline

186. Around more than two thirds of Pakistan is arid to semi-arid, which receives less than 254 mm of rainfall. Likewise, increasing rainfall variability and temperature rise are also very common.

4.2.3.1 Agro-Climatic Zone

187. Lahore falls in the Rice/Wheat agro-climatic zone of Punjab, Pakistan.

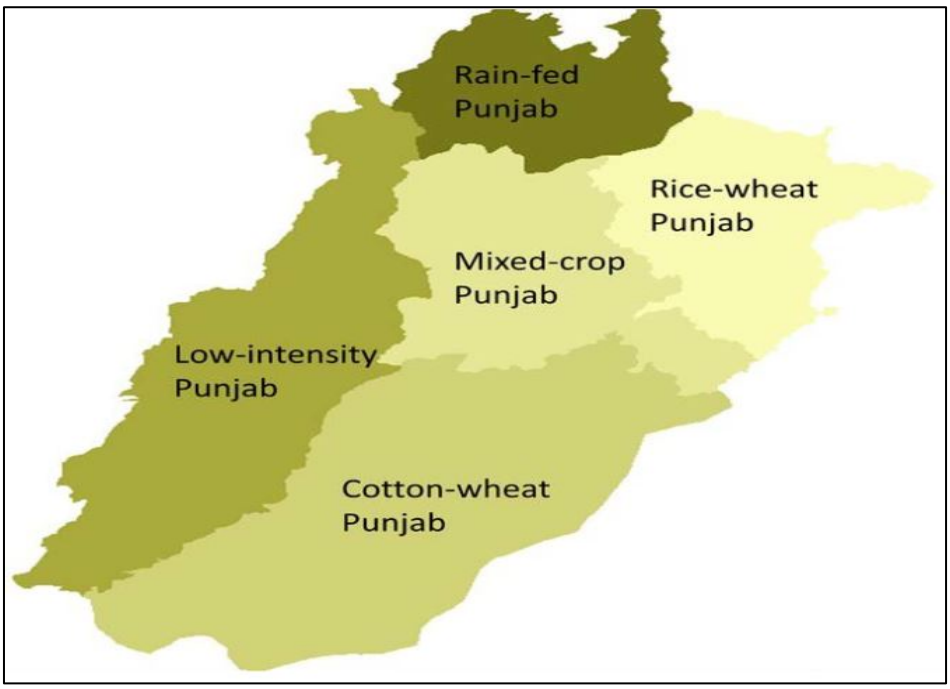


Figure 4.3 Agro-climatic zones of Punjab, Pakistan[28]

188. Lahore belongs to sub-tropical continental climate with sufficient rainwater. The winter begins from November to the February of the next year, and the summer covers May, June, July, August and September. Monsoon rains are concentrated during July ~ September, and the weather during the period is hot and dry in the day and night. Climate data of Lahore is given in **Table 4.2**.

Table 4.2 Climate Data of Lahore

Month	Mean Temperature (°C)		Precipitation (mm)	Relative Humidity (%)	Mean Sunshine (hr.)	Potential Evaporation (mm)
	Max.	Min.				
January	19.8	5.9	23.11	64.6	195	10.92

[28] Ahmad, T. I. (2013). The role of rural women in livestock management: socio-economic evidences from diverse geographical locations of Punjab (Pakistan) (Doctoral dissertation, Université Toulouse le Mirail-Toulouse II).

Month	Mean Temperature (ºC)		Precipitation (mm)	Relative Humidity (%)	Mean Sunshine (hr.)	Potential Evaporation (mm)
	Max.	Min.				
February	22.0	8.9	28.44	57.6	212	17.02
March	27.1	14.0	41.15	51.1	257	58.93
April	33.9	19.6	19.81	37.9	288	132.1
May	38.6	23.7	22.35	31.9	304	200.9
June	40.4	27.3	36.32	39.8	279	212.1
July	36.1	26.8	202.2	63.3	223	210.1
August	35.0	26.4	163.8	68.8	254	189.9
September	35.0	24.4	61.21	59.6	270	163.1
October	32.9	18.2	10.92	53.2	301	114.0
November	27.4	11.6	4.31	61.4	270	38.1
December	21.6	6.8	13.97	67.8	226	13.97
Annual	30.8	17.8	628.7	54.7	3079	1360.9

Source: https://www.worldweatheronline.com

4.2.3.2 Temperature

189. Lahore experiences extremes of climate. The summer season starts in April and continues till September. The hottest months are June and July. The mean maximum and minimum temperatures during these months vary between 40.4 ºC and 27.4 ºC. The winter season lasts from November to March. The coldest months are December, January and February. The mean maximum and minimum monthly temperatures during this period (winter) are 26 ºC and 5.9 ºC respectively.

Table 4.3 Temperature (ºC) of Lahore (Maximum, Average and Minimum)

Temperature (ºC) of Lahore (Maximum, Average and Minimum)												
2011												
Max.	21	23	31	37	44	45	41	36	35	35	30	25
Min.	10	20	20	26	35	36	34	30	29	27	22	14
Avg.	16	19	27	33	41	41	38	34	33	32	26	20
2012												
Max.	20	21	28	35	43	47	46	39	37	36	30	24
Min.	10	11	18	26	34	39	37	32	31	27	21	14
Avg.	15	17	25	32	39	44	42	36	35	32	26	19
2013												

Max.	22	22	31	38	45	47	44	40	41	38	30	26
Min.	11	14	21	28	36	38	36	32	33	30	21	15
Avg.	17	19	27	34	42	43	41	37	38	35	26	21
2014												
Max.	21	21	28	34	40	45	43	41	35	33	28	22
Min.	8	8	13	20	27	32	31	28	24	21	15	10
Avg.	12	13	19	27	33	39	37	34	29	26	20	14
2015												
Max.	21	26	27	35	41	41	38	38	37	34	28	23
Min.	7	11	14	22	28	32	31	29	25	22	17	11
Avg.	12	17	20	28	35	37	35	33	31	27	22	16
2016												
Max.	22	26	30	37	41	43	40	39	39	36	30	26
Min.	8	10	16	22	29	33	31	29	26	20	16	11
Avg.	13	17	22	29	36	38	36	34	32	27	21	17
2017												
Max.	20	26	30	39	42	42	40	40	39	36	28	24
Min.	8	10	13	22	28	31	31	30	26	22	17	13
Avg.	13	16	21	30	35	36	36	35	32	28	22	17
2018												
Max.	23	25	32	36	41	42	39	39	38	36	30	24
Min.	10	12	17	22	29	33	32	30	27	28	21	15
Avg.	15	18	24	29	36	38	35	34	31	33	27	21
2019												
Max.	20	22	27	38	42	46	-	-	-	-	-	-
Min.	12	13	16	26	31	34	-	-	-	-	-	-
Avg.	17	18	24	35	39	42	-	-	-	-	-	-

Source: https://www.worldweatheronline.com

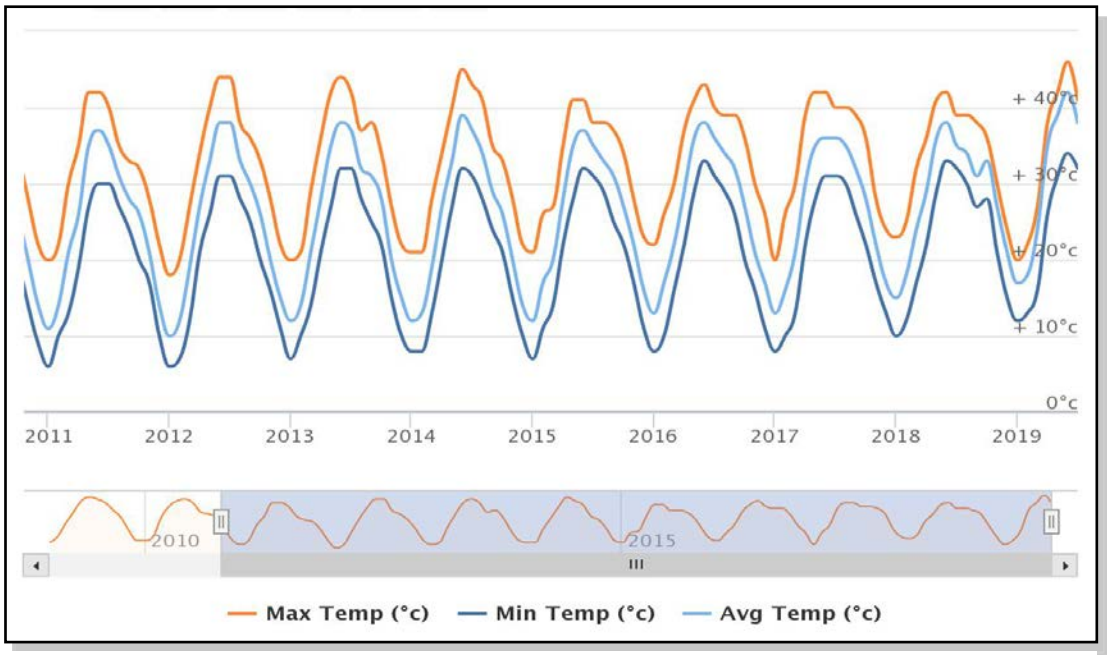


Figure 4.4: Max. Min. and Avg. Temperature of Lahore

(Source: https://www.worldweatheronline.com)

4.2.3.3 Rainfall

190. Rainfall varies from year to year and also from month to month. Maximum rainfall, however, occurs in July and August when the monsoon depression travels westward. Maximum rainfall is observed during the month of July that records about 30 % of the average annual rainfall.

Table 4.4 Average Rainfall and Rain days Lahore

Year	Rainfall (mm)	Rainfall Days
Jan-Mar 2010	7.22	7
Apr-Jun 2010	1.83	5
Jul-Sep 2010	143.48	52
Oct-Dec 2010	10.48	6
Jan-Mar 2011	28.02	16
Apr-Jun 2011	53.94	21
Jul-Sep 2011	83.30	51
Oct-Dec 2011	2.49	3
Jan-Mar 2012	14.2	13
Apr-Jun 2012	14.49	13
Jul-Sep 2012	87.37	41
Oct-Dec 2012	4.63	5

Year	Rainfall (mm)	Rainfall Days
Jan-Mar 2013	41.84	7
Apr-Jun 2013	13.5	13
Jul-Sep 2013	68.85	31
Oct-Dec 2013	1.33	4
Jan-Mar 2014	6.92	12
Apr-Jun 2014	6.58	6
Jul-Sep 2014	31.97	10
Oct-Dec 2014	1.43	4
Jan-Mar 2015	17.62	15
Apr-Jun 2015	8.60	21
Jul-Sep 2015	37.45	33
Oct-Dec 2015	0.58	4
Jan-Mar 2016	5.73	8
Apr-Jun 2016	7.61	20
Jul-Sep 2016	11.99	22
Oct-Dec 2016	0.48	1
Jan-Mar 2017	4.76	6
Apr-Jun 2017	6.43	8
Jul-Sep 2017	5.92	13
Oct-Dec 2017	1.06	1
Jan-Mar 2018	6.41	7
Apr-Jun 2018	28.47	24
Jul-Sep 2018	17.01	18
Oct-Dec 2018	4.36	6
Jan-Mar 2019	84.39	30
Apr-Jun 2019	43.33	39
Source: https://www.worldweatheronline.com		

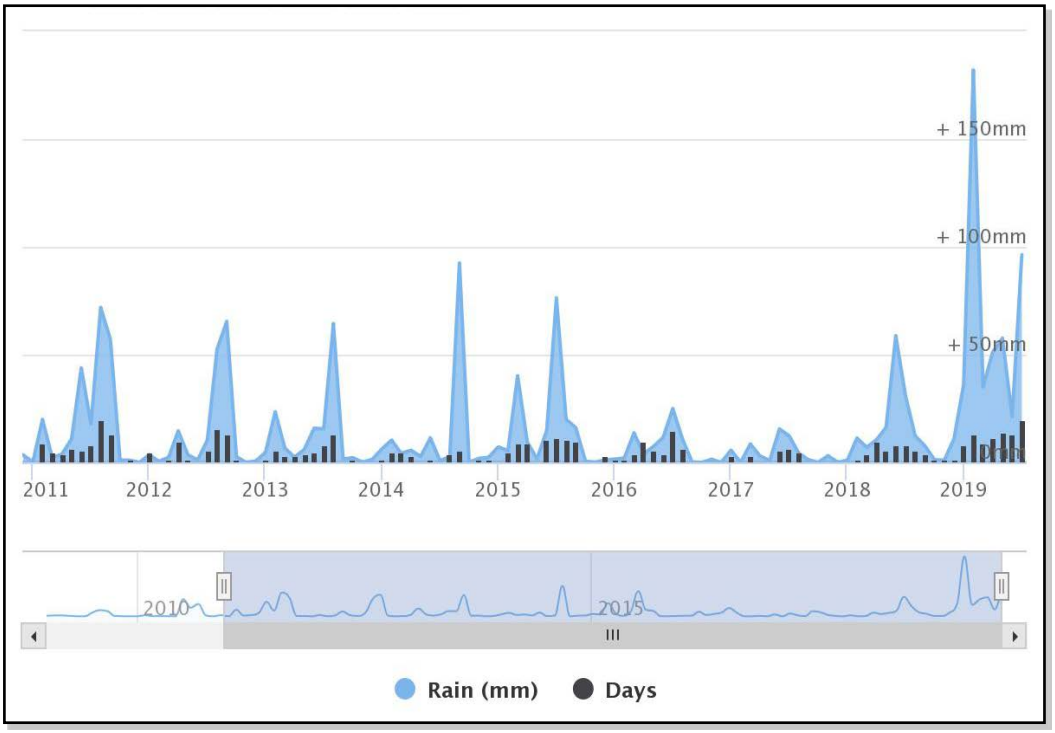


Figure 4.5: Average Rain (mm) and Rain Days of Lahore

Source: https://www.worldweatheronline.com

4.2.3.4 Seasons

191. Based on climatic elements, five seasons[29] are recognized in the Lahore:

4.2.3.4.1 Pre-monsoon Season

192. Pre-monsoon refers to the period from May to June prior to the setting in of the monsoon. These are the hottest and the driest season, with persistent dry and hot winds. Day time temperature rises to 47ºC. The flows in the river begin to rise simultaneously due to snow-melt water in the high mountains. The water table falls to the maximum depth.

4.2.3.4.2 Monsoon Season

193. Monsoon is the main rainy period, which starts at the beginning of July, reaches its climax in August and gradually, subsides in September. High intensity Rainfall causes soil erosion which is a function of erosivity and erodibility. The cool monsoon winds followed by heavy showers lower the temperature to great extent. The part of rain percolates into the soil and is conserved in the subsoil and part adds to the groundwater. The conserved moisture in the soils is generally sufficient to rejuvenate the vegetation. All plants grow rapidly and mature towards the end of the season. With the start of monsoon season, the rivers flow at their peak

[29] Malik, A. (2015). Geotechnical statistical evaluation of Lahore site data and deep excavation design.

level. The groundwater level is improved towards the end of the season in September and October.

4.2.3.4.3 Post-monsoon Season

194. Post monsoon season refers to autumn (October-November). The temperature starts falling but the extreme aridity prevents plants to flower early and set seed toward mid-seasons. Groundwater level rises as a result of infiltration from rainfall.

4.2.3.4.4 Winter Season

195. Winter refers to the period from December to January. The lowest temperatures (9 ºC) and cold winds characterize this season. The plants become dormant and most of them dry out. Most of the trees shed their leaves and few remain green or partly green. Sometimes this season becomes severe due to cold Siberian winds. Groundwater level declines in this season due to low flows in the rivers and no or little rains which usually fall in light showers causing little soil erosion.

4.2.3.4.5 Spring Season

196. Spring refers to the period from March to April. Temperatures become pleasant. The mean maximum temperature is 39ºC with the highest precipitation of 185.5 mm and relative humidity of 40 percent. Some light showers of rain may also fall without generating run off. The vegetation sprouts again because of conserved moisture from winter and spring rains, if any the water table starts falling.

4.2.3.4.6 Evaporation

197. As per the data collected from Pakistan Meteorological Department Lahore, the evaporation from open surface water depends upon temperature, sunshine hours and humidity. The annual evaporation is about 53 mm in Punjab.

4.2.3.4.7 Wind Speed and Direction

198. Wind speed and direction are important parameters for the dispersion of gases and odours generated at the project site. Wind blows calmly in Lahore from North-West direction.

Table 4.5 Average Wind Speed and Wind Direction of Lahore

Average Wind Speed (kmph)										
	Years									
Months	2011	2012	2013	2014	2015	2016	2017	2018	2019	Wind Direction
Jan	7.2	7.3	7.4	7.4	7.3	6.5	7.4	5.9	6.6	NW
Feb	8.3	9.5	9.2	7.3	9.5	8.2	8.1	6.9	7.2	NW
Mar	8.2	8.9	8.0	8.8	8.7	9.9	8.1	7.6	8.1	NW
Apr	8.3	8.0	8.4	8.9	9.7	10.9	10.3	9.5	9.2	NW
May	8.2	8.6	8.6	7.8	9.2	10.3	8.6	10.0	9.3	NW
June	8.4	7.2	7.0	7.5	8.9	9.4	8.6	9.4	10.4	SE
Jul	6.8	6.8	7.3	6.6	9.8	7.7	7.9	8.3	11.2	SE
Aug	6.9	6.4	6.6	5.8	8.2	6.8	7.3	8.5	-	SE
Sep	5.1	5.4	5.4	5.6	7.3	7.0	5.3	7.5	-	SE
Oct	5.6	5.5	5.1	5.8	6.7	5.6	5.0	7.3	-	NW
Nov	6.1	7.0	7.4	7.6	7.6	6.9	4.7	7.4	-	NW
Dec	6.3	8.4	7.4	7.0	7.4	6.3	6.2	5.5	-	NW

Source: https://www.worldweatheronline.com

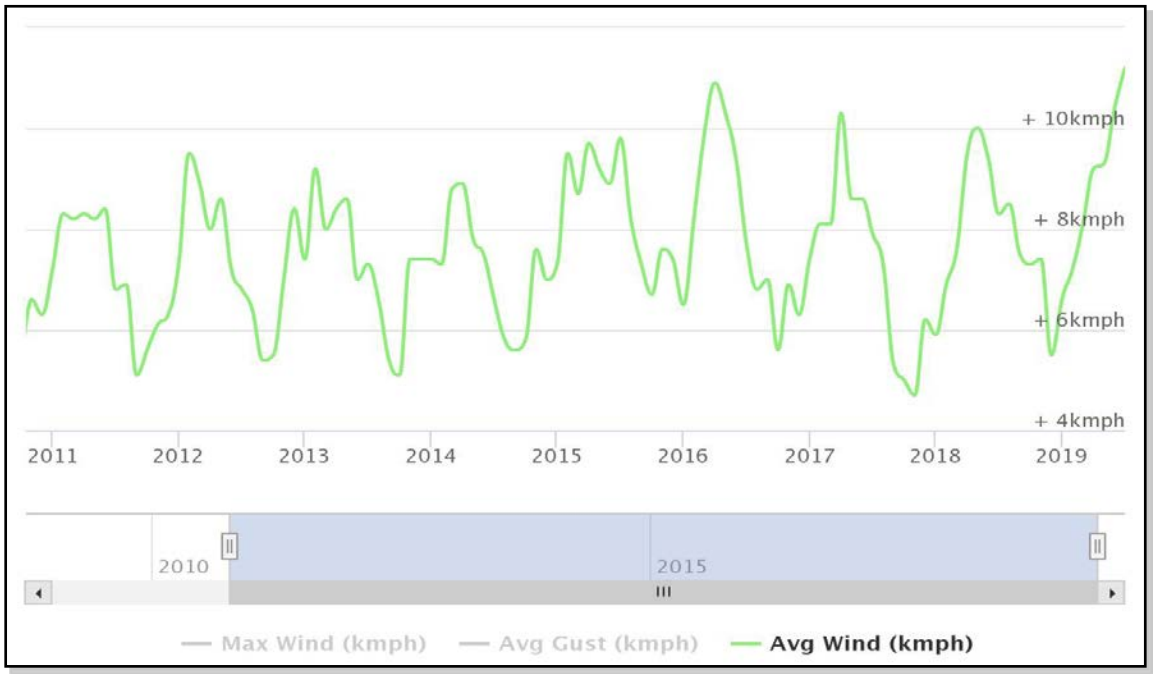


Figure 4.6: Average Wind Speed & Wind Direction of Lahore

(Source: https://www.worldweatheronline.com)

4.2.3.4.8 Humidity and Clouds

199. July, August and September are the most humid months in the Lahore, whereas May and June are the least humid months.

Table 4.6 Average Cloud and Humidity (%) in Lahore

Year	Cloud %	Humidity %
Jan-Mar 2011	17.33	165
Apr-Jun 2011	8.66	91
Jul-Sep 2011	23.66	184
Oct-Dec 2011	5.33	103
Jan-Mar 2012	13.66	166
Apr-Jun 2012	8.33	74
Jul-Sep 2012	18.0	147
Oct-Dec 2012	7.33	96
Jan-Mar 2013	18.33	166
Apr-Jun 2013	7.66	65
Jul-Sep 2013	18.33	139
Oct-Dec 2013	07.0	98
Jan-Mar 2014	18.0	163
Apr-Jun 2014	07.0	73
Jul-Sep 2014	15.66	129
Oct-Dec 2014	07.0	90
Jan-Mar 2015	22.0	146
Apr-Jun 2015	10.0	68
Jul-Sep 2015	22.33	121
Oct-Dec 2015	9.66	77
Jan-Mar 2016	14.66	111
Apr-Jun 2016	8.66	61
Jul-Sep 2016	19.33	112
Oct-Dec 2016	07.33	60
Jan-Mar 2017	21.66	125
Apr-Jun 2017	05.0	67
Jul-Sep 2017	12.33	105
Oct-Dec 2017	10.33	66
Jan-Mar 2018	14.66	95

Year	Cloud %	Humidity %
Apr-Jun 2018	22.0	23
Jul-Sep 2018	25.0	46
Oct-Dec 2018	11.0	25
Jan-Mar 2019	30.3	52
Apr-Jun 2019	20.0	21

Source: https://www.worldweatheronline.com

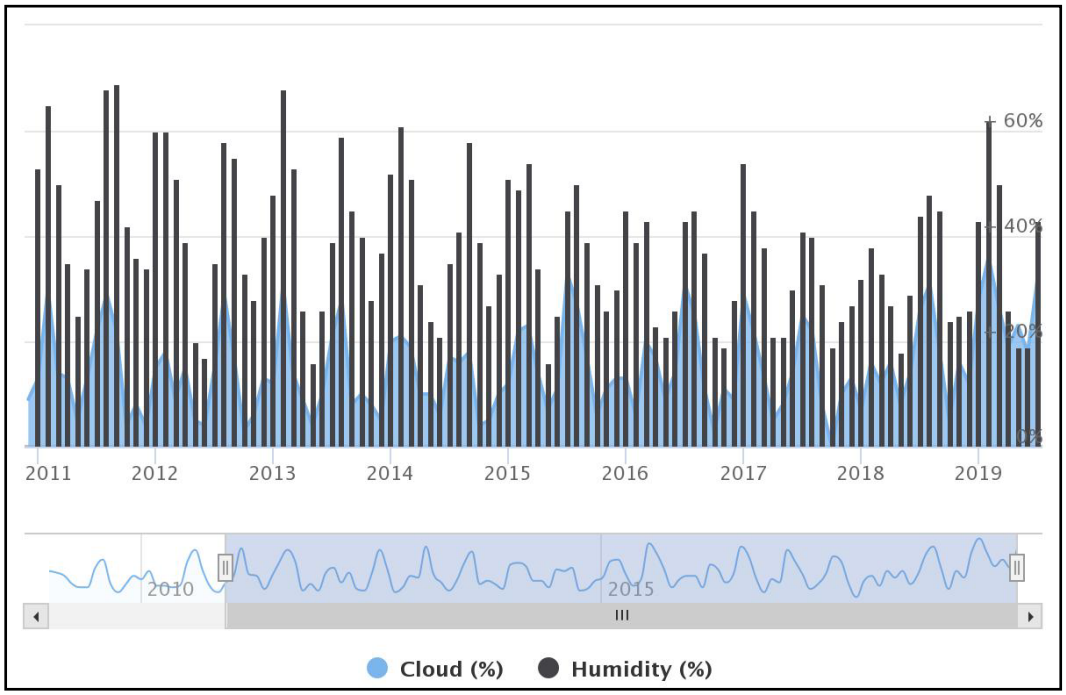


Figure 4.7 Average Cloud and Humidity (%) in Lahore

(Source: https://www.worldweatheronline.com)

4.2.4 Sensitive Receptors

200. There are a number of sensitive receptors along the project routes that may be adversely affected by the air emissions from the project. The physical, environmental and socio-economic sensitive receptor include:

- The religious Institutions,
- Educational and administrative institutions
- Project Affected Persons
- The vulnerable/disadvantage people (women, elderly, children, socially excluded people, minorities
- Differently abled persons
- Health Facilities
- Graveyard

- Fishery Farm
- Ranger Area
- Historical Sites

201. Figure 4.8, 4.9, 4.10, 4.11, 4.12 and **4.13** shows the sensitive receptors of the proposed project sites (Package 03 and Package 04).

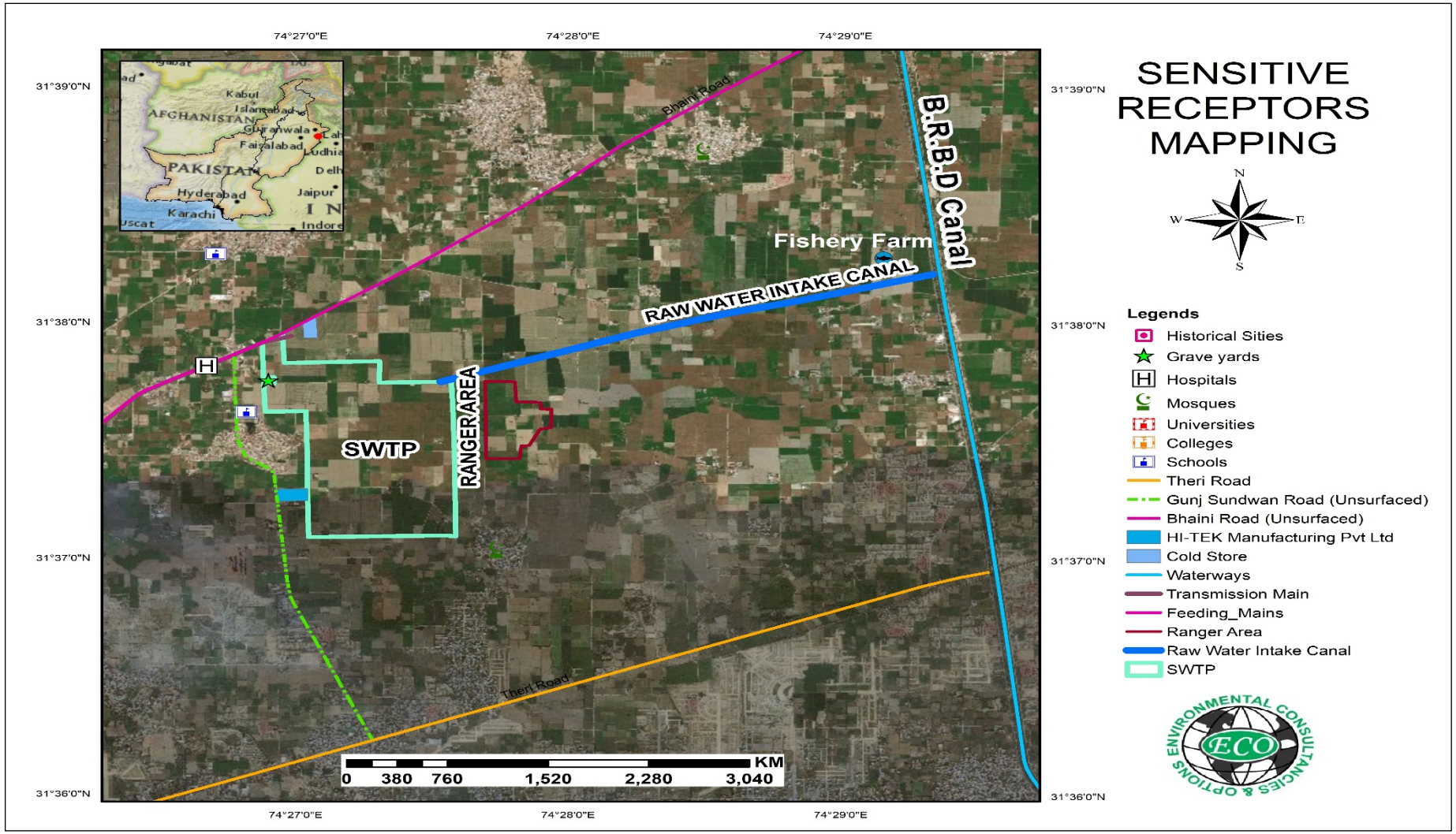


Figure 4.8 Sensitive Receptors Mapping of the Proposed SWTP Area (Package 03)

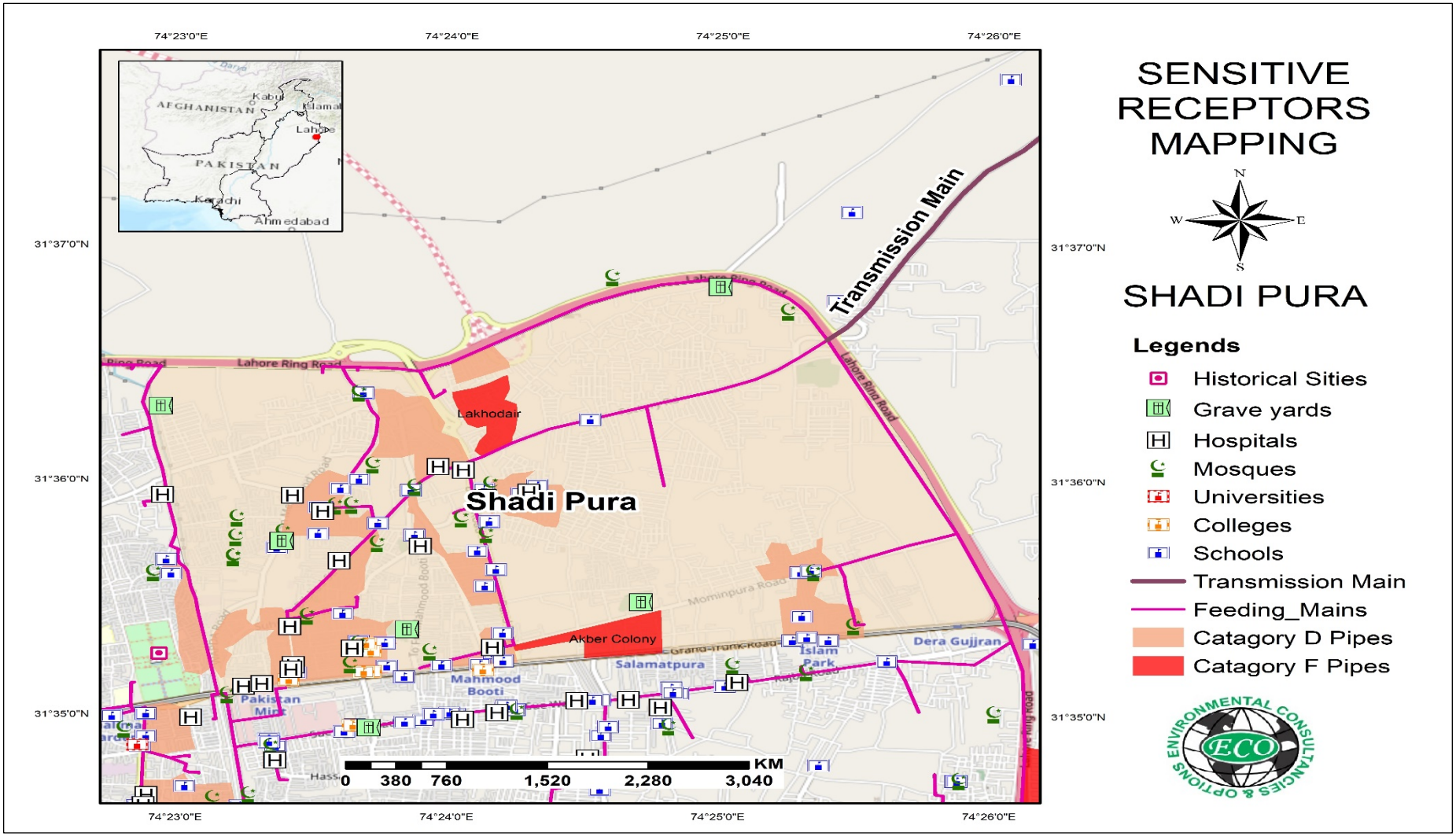


Figure.4.9 Sensitive Receptors Mapping Shadi Pura (Package 04)

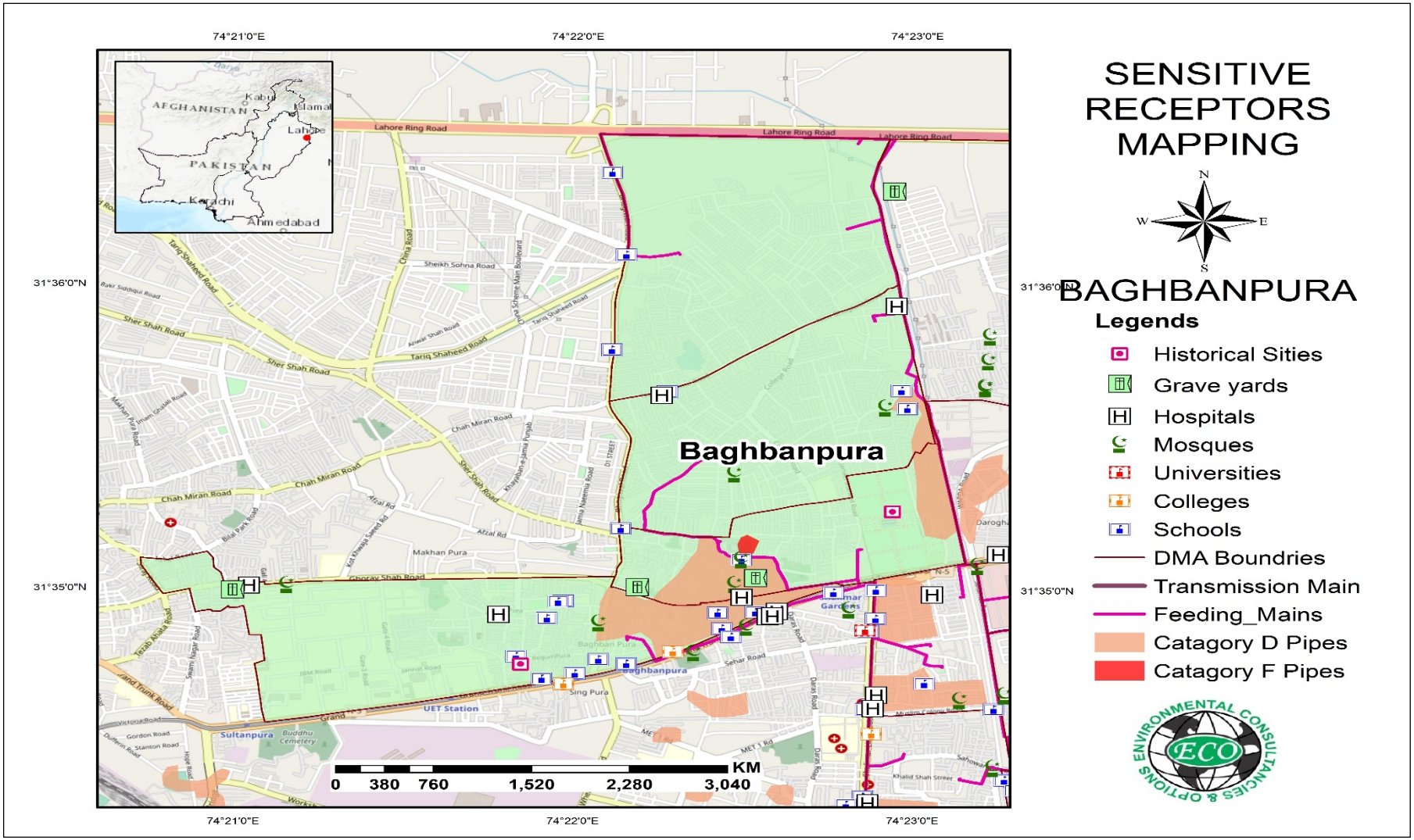


Figure 4.10 Sensitive Receptors Mapping Baghbanpura (Package 04)

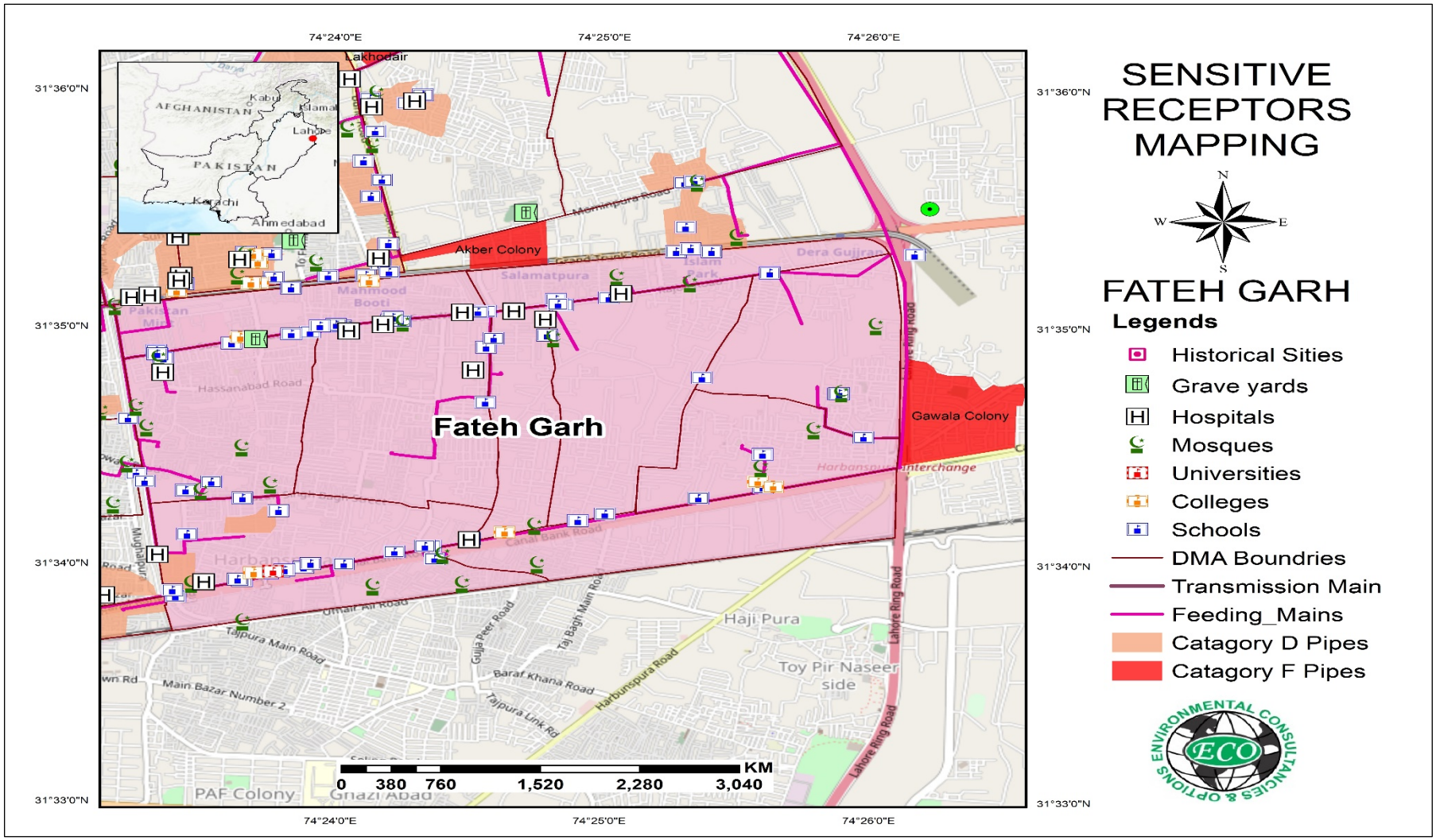


Figure 4.11 Sensitive Receptors Mapping Fateh Garh (Package 04)

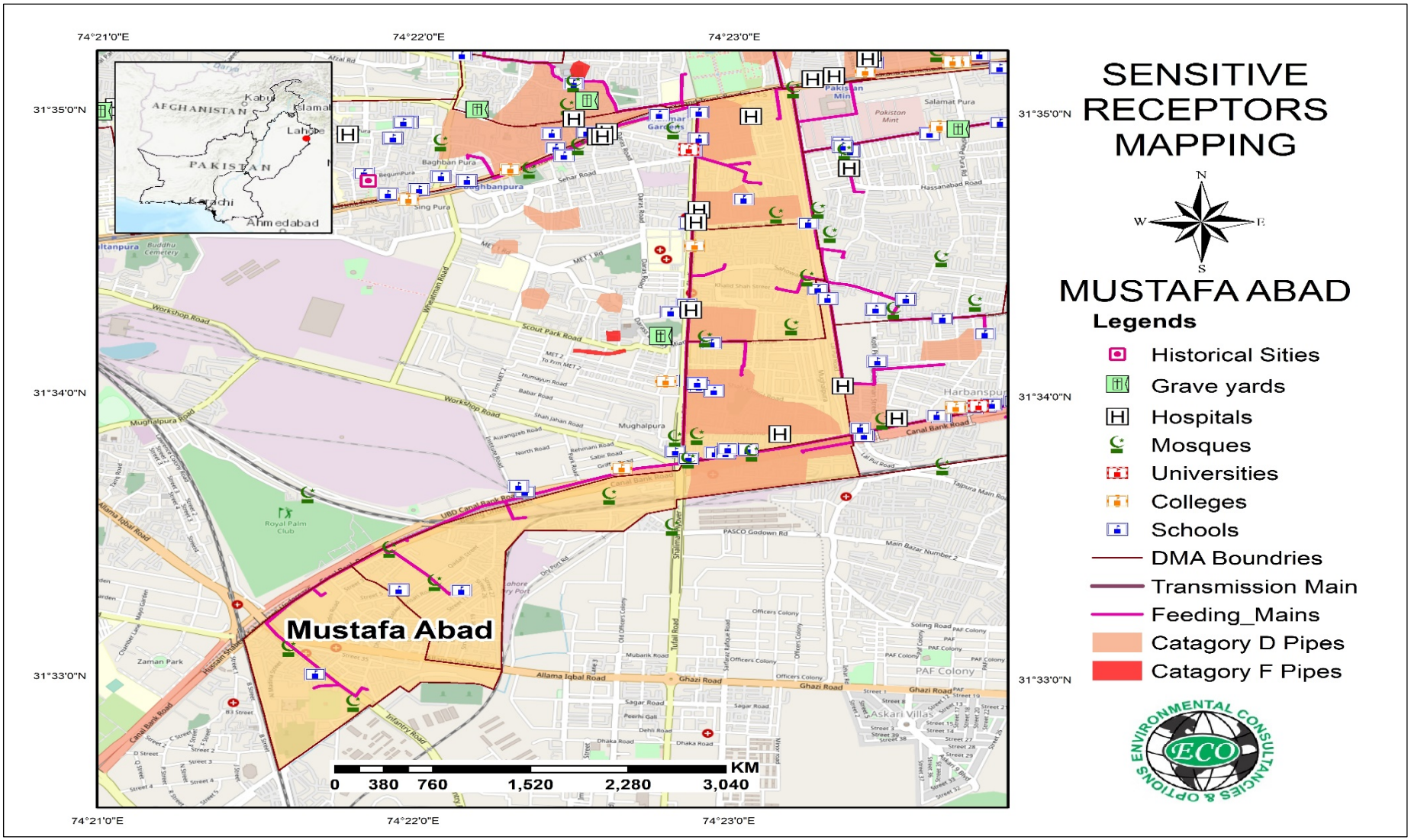


Figure 4.12 Sensitive Receptors Mapping (Package 04)

4.2.5 Hydrology and Water Resources

202. Hydrology of the project area is referred to water circulation through atmosphere, surface and subsurface strata. In Lahore, there are two sources of clean water, one is surface water which is no more available while the second is ground water which is being extracted through 585 tube wells (In the city and later pumped to distribution system) operated by Lahore Water and Sanitation Authority (L-WASA). Currently, the groundwater extraction by LWASA is 2.45 million m^3/day (540 MGD)[30].

[30] https://wasa.punjab.gov.pk/

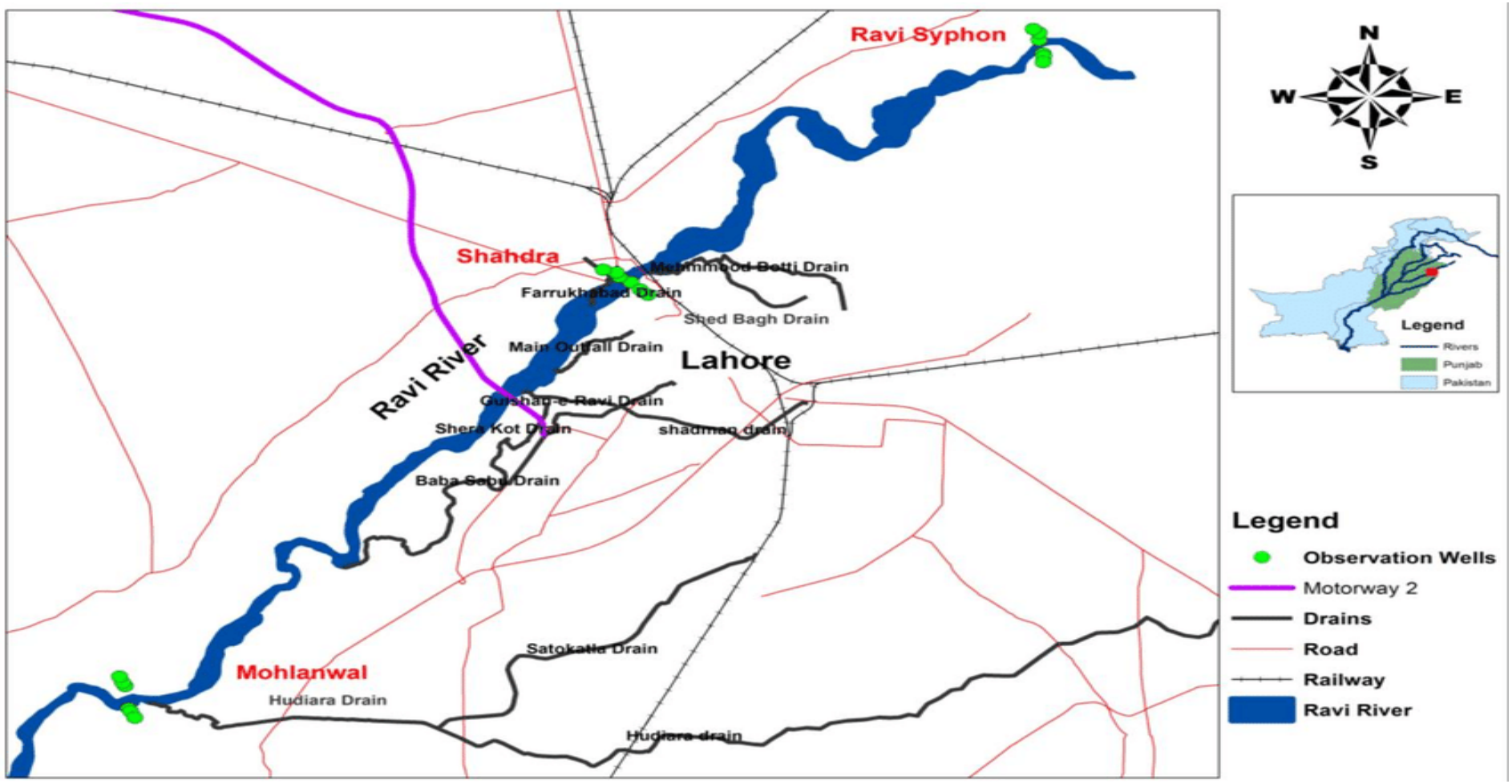


Figure 4.13: Location of Major drains in Lahore

(Source: Hassan, G. Z., Hassan, F. R., & Akhtar, S. (2016). Environmental Issues and concerns of Groundwater in Lahore. Proceedings of the Pakistan Academy of Sciences., Life and Environmental Science, 53(3), 163-178.

4.2.5.1 Surface Water Sources

203. The total surface water diverted to Lahore is 6.02 million cubic metre per day (MCM/day) and is mainly used for agricultural purposes. The Bambawala-Ravi-Badian-Deplapur (BRBD) Canal mainly feeds the command area of Upper Bari Doab Canal on the Pakistan side of the Pak-India border. The Upper Bari Doab Canal irrigates command areas of Lahore Branch, Khaira distributary, Butcher Khana distributary, Main Branch Lower and other smaller channels. The remaining flow of the BRBD Canal supplements Depalpur Canal[31].

204. The main sources of surface water that can be used, as alternative to groundwater in Lahore are Ravi River, Lahore Branch Canal, Khaira Distributary and the BRBD canal. To reduce the stress on groundwater of Lahore, water from one of these four sources needs to be collected and treated for domestic, commercial and industrial use.

4.2.5.1.1 Ravi River

205. The Ravi River is a trans-boundary river crossing north western India and eastern Pakistan. It is one of six rivers of the Indus system in Punjab region. The water of Ravi is allocated to India under Indus water treaty. The Ravi River is an integral part of the Indus River basin and forms the headwaters of the Indus basin. The waters of the Ravi River drain into the Arabian Sea (Indian Ocean) through the Indus River in Pakistan. The river rises in the Bara Bhangal, District Kangra in Himachal Pradesh, India. The river drains a total catchment area of 14,442 square kilometres in India.

206. Ravi River having a total length of about 720 km flows across the city of Lahore. However, besides monsoon season the river is mostly dry due to the fact that water is diverted in India for irrigation and domestic purposes. In the past, River Ravi was the main source for recharge of groundwater aquifer, but due to increasing water demand and diversion of its water in India, it can no longer meet the required aquifer recharge of Lahore city. The quality of water of Ravi River has a direct impact on quality of water present in the adjacent aquifer.

207. As per Indus basin treaty, the Ravi including Beas and Sutlej were allocated for exclusive use of India. Moreover, the River Ravi is highly polluted because of continuous disposal of large amount of domestic sewage and industrial waste with the passage of time and hence it cannot be utilized as water source because of negligible discharges during most of the month of a year.

[31] (Jahangir, W.A "Conjunctive water management for sustainable irrigated agriculture in South-Asia, 2002)

4.2.5.1.2 River Chenab

208. The Chandra and Bhaga rivers in the upper Himalayas join to form the Chenab River. Chenab flows through Jammu and Kashmir. After cutting across the Pir Panjal Range, it enters the Sialkot District in the Pakistan. Here the Marala Barrage was built across the river in 1968 with a maximum discharge of 1.1 million ft^3/s (31,000 m^3/s). Two major water channels originate at the Marala Headworks; the Marala Ravi link canal and the Upper Chenab Canal (UCC).

209. It is then joined by the Jhelum River at Trimmu, a flood control mechanism near Jhang and on moving further it merges with the Sutlej near Uch Sharif in Pakistan. Chenab River is nearly 960 kilometres long.

4.2.5.1.3 Upper Chenab Canal (UCC)

210. UCC also serves as link canal transferring water from Chenab to Ravi and is discharging above Balloki in River Ravi. It takes-off from the River Chenab at Marala Head Works with full discharge capacity of 16000 cusecs. At Bombanwala Head Works, UCC bifurcates as Bombanwala-Ravi-Bedian (B.R.B) mainly a carrier channel to feed Lower Bari Doab (L.B.D) taking off from River Ravi at Balloki Headworks.

4.2.5.1.4 BRBD Canal

211. BRBD canal flows in the east of Lahore, from North to South. It crosses Grand Trunk Road, at a distance of about 6 km; from Lahore Ring Road. The Canal takes off from Upper Chenab Canal (UCC) at Bambanwala. itself off takes from Marala Barrage with full discharge. The BRBD is about 175 km long. It is an earthen channel except a short lined central segment. Although design capacity at head is 7260 cusecs, the maximum discharge is around 4600 cusecs. Among others, one of the reasons of limiting discharge to 4600 cusecs is the limited design capacity of Syphon for crossing of River Ravi. This means that water from BRBD canal is a better/dependable source as compared to Ravi River that can be used to supply water to residents of Lahore after treatment. The Canal is brick lined from RD 260 to RD 373 and crosses the River Ravi and GT road at RDs 281 and 325 respectively.

212. After considering all the available options of surface water in the city of Lahore, It has been concluded that the BRBD canal is a better option than the other three sources of water. However, this water source needs proper treatment for making it drinkable.

4.2.5.1.5 Lahore Branch Canal

213. The other surface water source is the Lahore Branch Canal (LBC), which takes off from BRBD canal at about RD 230. It is an open channel with lining at both sides. Due to its limited discharge of about 400 cusecs, this canal cannot be considered as surface water source for Lahore, even to draw 100 cusec discharge, for the subject project.

4.2.5.1.6 Khaira Distributary

214. This water source lies in the south of Lahore and it also takes off from BRBD canal, and flows from east to west, its flow is even less than the Lahore Branch Canal, and hence cannot be utilized for the supply of water to 100 cusecs water treatment plant.

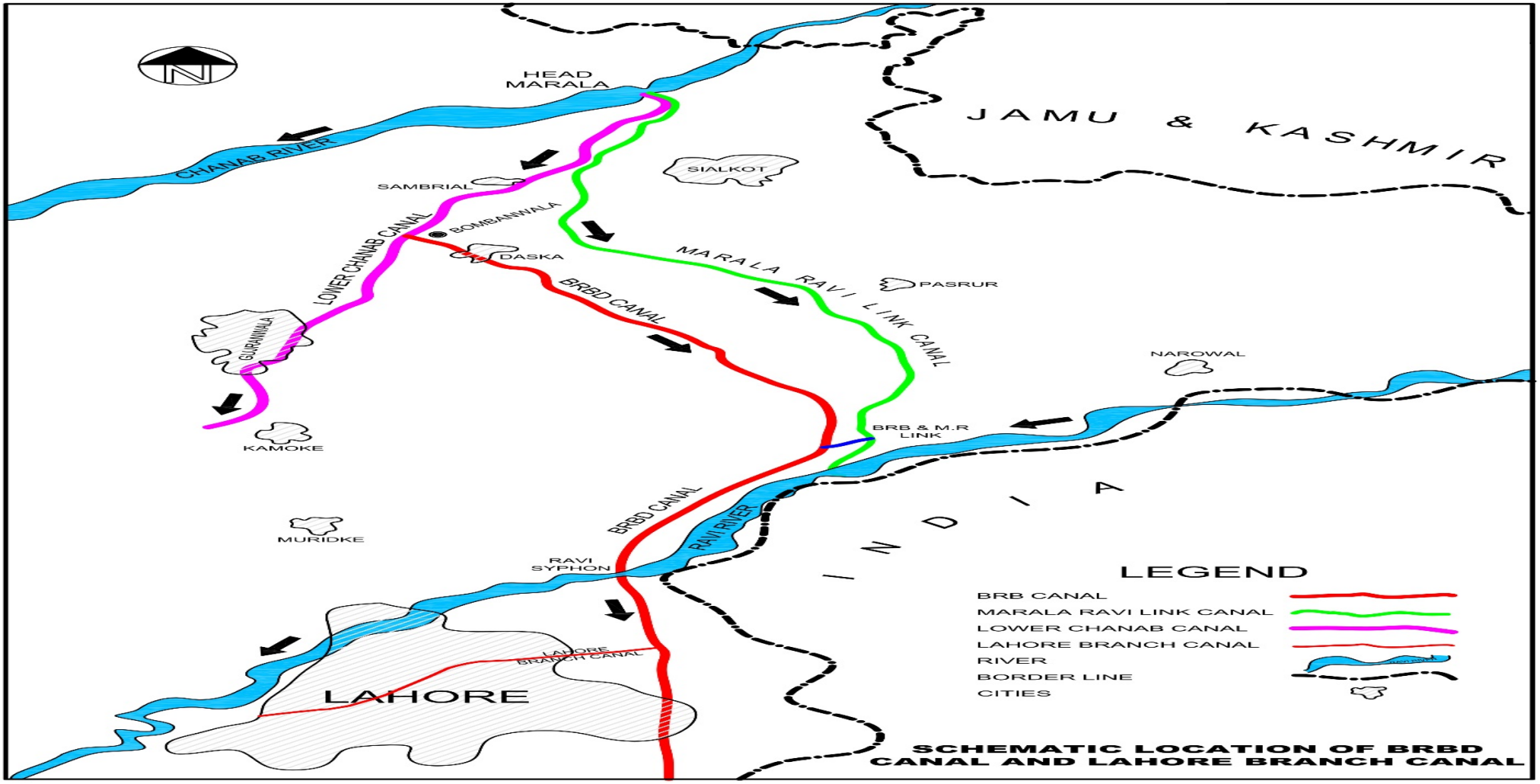


Figure 4.14 Schematic Location of BRBD Canal and Lahore Branch Canal

(Source: Final Feasibility Study Report on Lahore Water and Wastewater Management Project-February, 2019)

4.2.5.2 Ground Water Source

215. Presently main clean water source in Lahore is ground water that meets all the requirements including domestic, industrial and commercial. The River Ravi, that has been the main recharge source to Lahore's shallow aquifer has changed the ground water regime. Due to control of river flow by India, the recharge has decreased and at present, it is of negligible amount[32]. In addition, the decrease in cultivated areas due to urbanization is another reason for decline of aquifer recharge. Current groundwater loss of Lahore is 304 million cubic meters/year, resulting in the lowering of the water table by 01 meters every year. As discussed above, due to population growth and urbanization and excessive pumping, the groundwater balance of the Lahore aquifer is facing increasingly negative trend since the 1970's. The static water level in the majority of wells has been recorded by LWASA for each year since 2000.

216. Uneven groundwater development has resulted in a major groundwater depression, with maximum depth of groundwater up to 47m in areas such as Shadman, Shah Jamal, and Gulberg. Thus, the ground water source does not appear dependable source in future and alternate source from surface water needs to be adopted, to reduce the stress on groundwater[33].

4.2.5.3 Surface water and ground water pattern of Project Area (Package 03 and Package 04)

217. This project lies near River Ravi which was the main source of surface water in past but now it has lost its maximum potential to provide water due to construction of dam on upstream. The Upper Chenab Canal is feeding this area through BRBD canal to meet the agricultural requirements of this area.

218. The project area lies in agricultural land which almost coincides with nearby urban areas of Shalimar town (Shadipura, Baghbanpura, Fatehgarh, Mustafabad etc.). Ground water pattern of this area is controlled by the alluvial deposits of River Ravi including the clay silt, sand and limited amount of gravel at deeper depth. The maximum amount of ground water is available at said site due to alluvial deposits which are considered as good aquifers. The water table generally varies from 15 to 50 meters according to LWASA and Irrigation sources. The maximum depth of water measured by LWASA is 47 meters. The LWASA has installed 60

[32] Kanwal, S., Gabriel, H. F., Mahmood, K., Ali, R., Haidar, A., & Tehseen, T. (2015). Lahore's groundwater depletion-A review of the aquifer susceptibility to degradation and its consequences. *University of Engineering and Technology Taxila. Technical Journal*, *20*(1), 26.

[33] (Section 2.3.1: Final Feasibility Study Report of LWWMP Project-Feb, 2019)

tube wells (including 2 to 4 cusecs) to extract the ground water in order to meet the requirements of local residents of project area.

219. The LWASA is extracting 18038.6 million cubic meter (MCM) per year **Figure 4.14**, but this continuous extraction is putting a lot of pressure on existing aquifers and creating an alarming situation, thus without any surface water alternatives there will be deficiencies of water in near future.

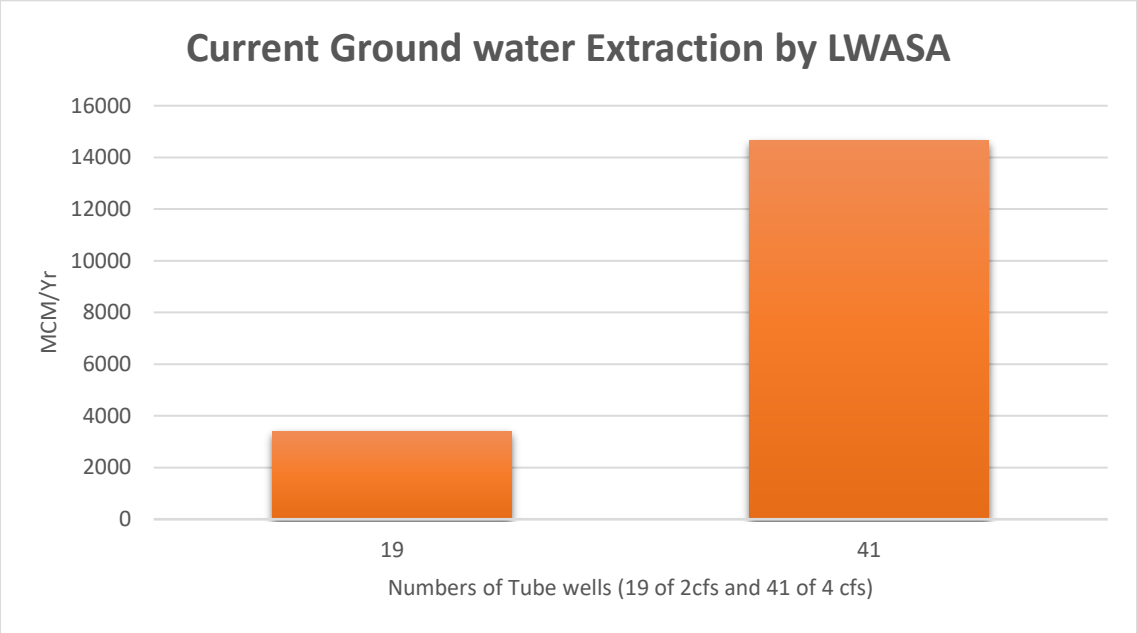


Figure 4.15 Current Groundwater Extraction in Project Area by LWASA

(Source: Hydrological Survey conducted from July to August, 2019)

4.2.5.2 Existing Water Supply Situation

220. The extent of LWASA jurisdiction for water supply has till recently been limited to only 350 square km of the total district area of 1,772 square km. To cover this area, LWASA is maintaining a complex network, with a pipe length of 5,400 km, distributing water abstracted from a battery of over 585 tube wells.

221. Besides Lahore WASA, a number of players, including Tehsil Municipal Authority's (TMAs), the Cantonment Board, Defence Housing Authority (DHA), and a host of private housing schemes are currently managing water and sanitation services in the areas of their respective jurisdictions. These entities will continue to be involved in future as well. Present LWASA share in aquifer withdrawals is shown in the following chart.

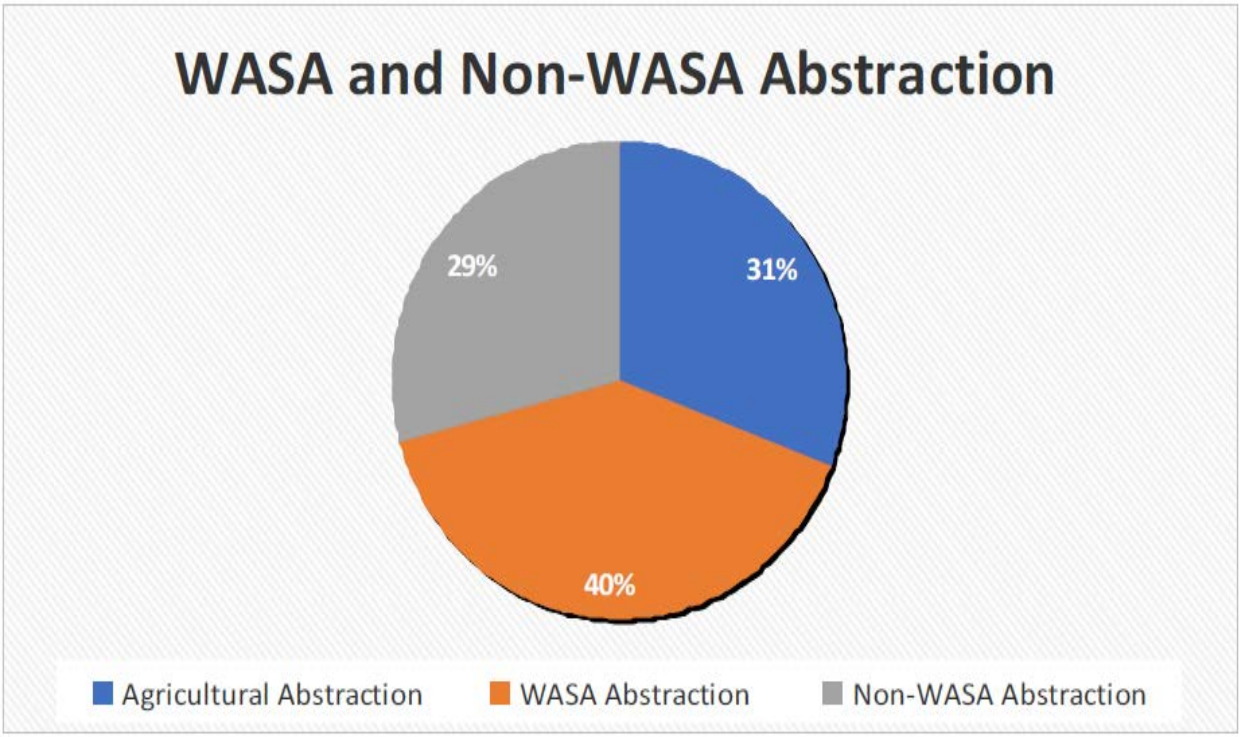


Figure 4.16 Present LWASA share in Aquifer Withdrawals

(Source: Final Feasibility Study Report on LWWMP-February, 2019)

*Note: Exclusive of Industrial and Commercial Withdrawal

222. However, LWASA will play an important role in the entire district, by exercising control on underground water abstraction and by providing a bulk supply of water to agencies responsible for water distribution in peri-urban areas.

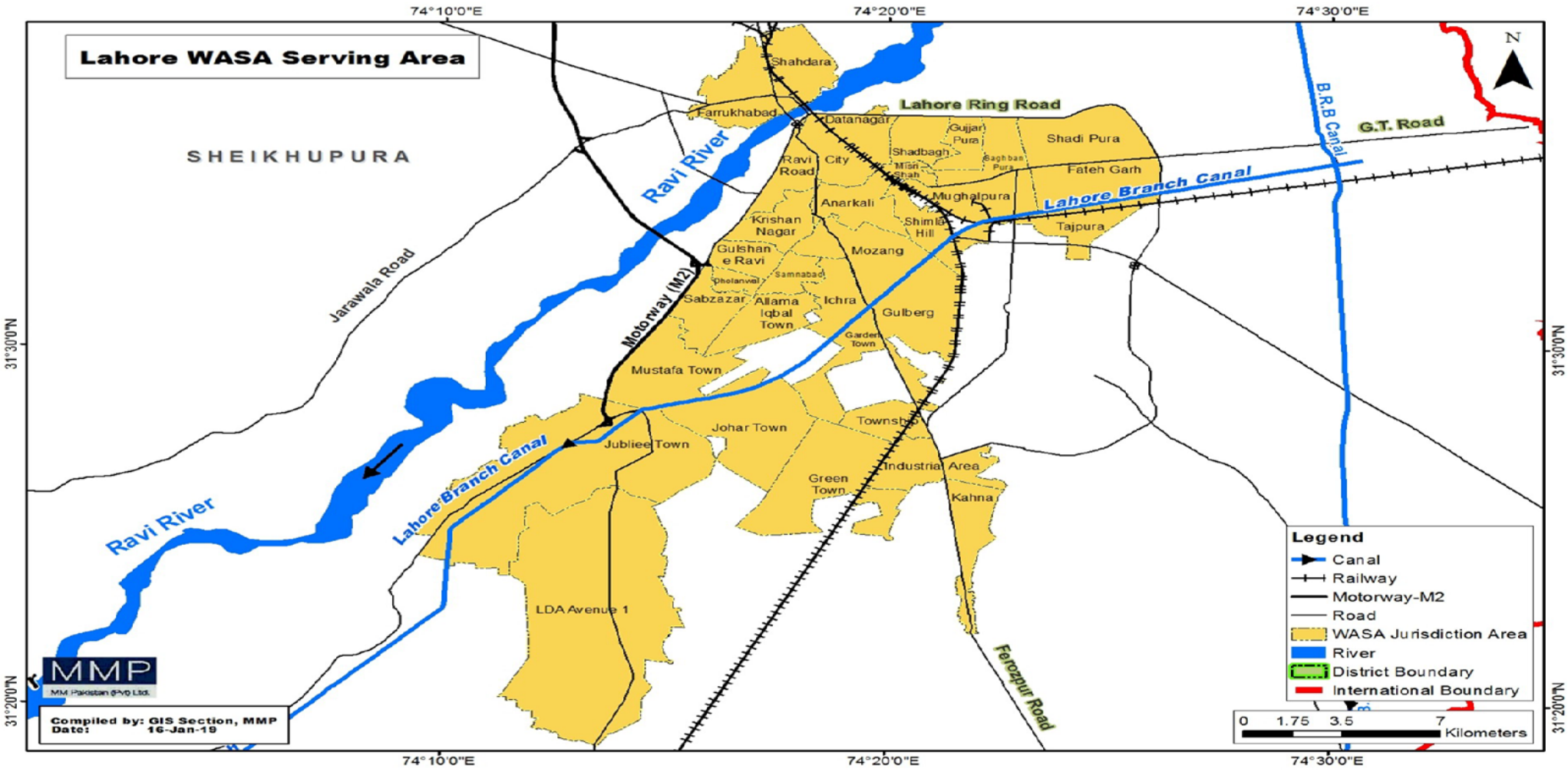


Figure 4.17:Present WASA Service Area

(Final Feasibility Study Report on LWWMP-February, 2019)

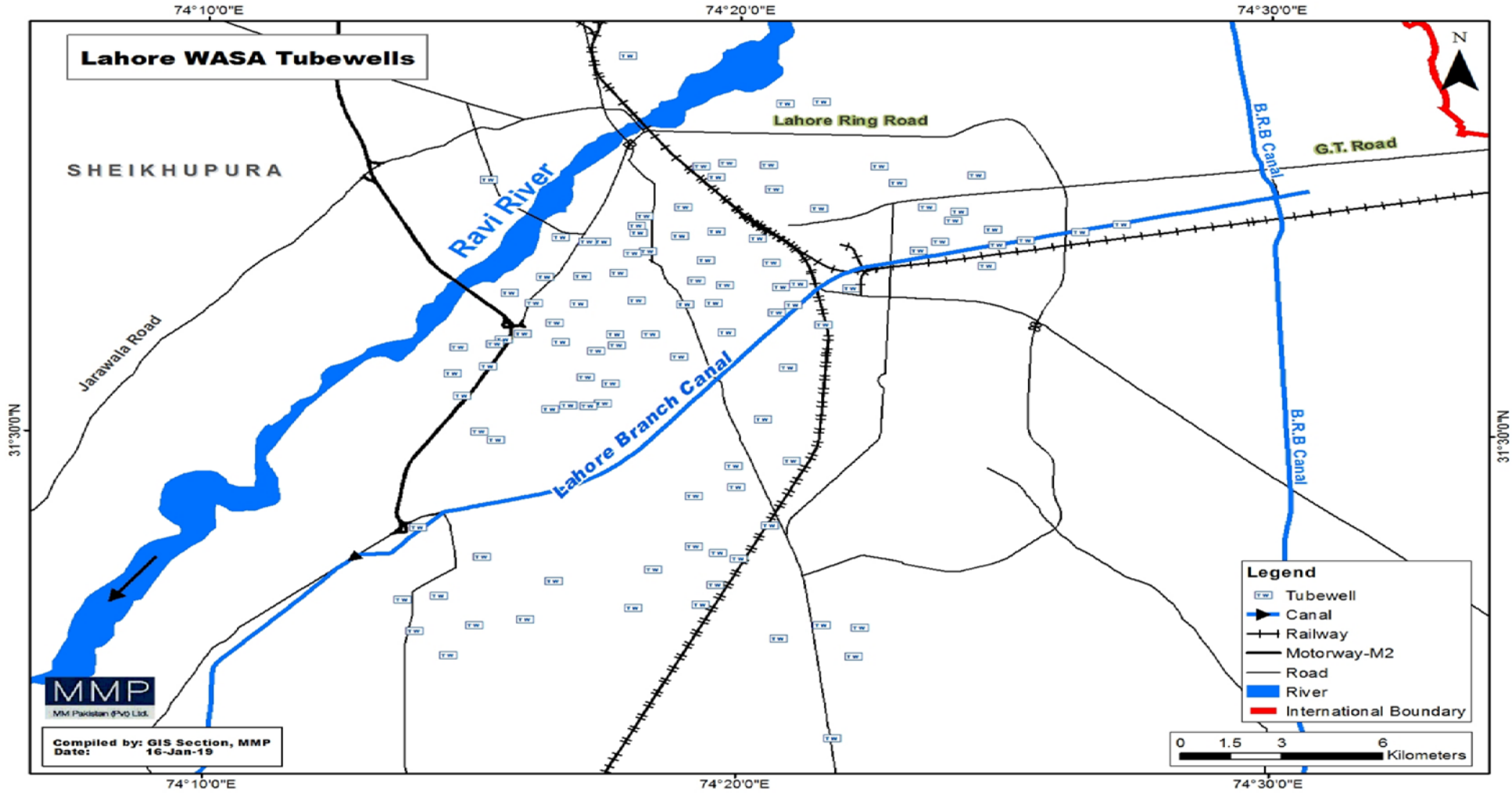


Figure 4.18:Distribution of L-WASA Tube Wells

(Source: Figure 2-3, Final Feasibility Study Report of LWWMP Project-Feb, 2019)

223. Currently, LWASA service area has 34 distribution zones of the variant population and geographic extents. Until recently (the year 2018), the majority of the tube wells did not have bulk flow meters, and most of the existing ones were out of order. This makes it difficult to systematically measure the water at both the production end and the supplies made available to the distribution system in a particular subdivision. Resultantly, a higher proportion of Non-Revenue Water (NRW) currently exists in the system on account of unbilled authorized consumption, water theft, metering inaccuracies, poor network operation i.e. losses from transmission mains, over-consumption of water and lack of water conservation measures. The current level of NRW has been estimated to be around 45% of the water produced. Currently, no proper water metering system is present, so this value cannot be cross checked.

224. In its current operational form, LWASA is unable to prioritize the process of maintenance and hence many components are operated to a dieback stage. Since power and energy costs have increased 137% over the past ten years, the issue of system inefficiencies coupled with lack of preventive maintenance has siphoned off the bulk of LWASA expenditure in payments for the cost of electricity and O&M. At the system level, besides recurrent good rehabilitation and pipe replacement schemes, wellhead efficiencies are less than 80% with a significant loss in pressure heads due to contraflows and inadequate pipe sizing (in the absence of balancing reservoirs, uniformity of pressure cannot be maintained). Owing to poor energy efficiency and lack of preventive maintenance, the bulk of LWASA expenditure is devoted to the cost of electricity and O&M[34].

4.2.6 Environmental Quality

4.2.6.1 Ambient Air Quality (Package 03 and 04):

225. Ambient Air Quality was monitored in the proposed project site.

Package 03 (Water Intake Channel and Surface Water Treatment Plant)

226. Different sites were selected depending upon the highest availability of sensitive receptors, high traffic flow that give an exact scenario of ambient air quality of the project area. The project site of Package 03 is mostly an agricultural area with little population at one side with lower traffic level. At most of the points air quality (majority of the parameters) was within the limits of PEQS with little variations. Lab Reports are attached as **Annexure-G.**

[34] (Section 2.2: Final Feasibility Study Report of LWWMP-Feb, 2019)

Table 4.7 Package 03, Air Quality Monitoring Locations

Location	Code	Date of Sampling
From Where link canal to be extracted from BRB Canal Transmission Main Starting Point	P3#1	30-06-2019
Transmission Main 2nd Point	P3#2	30-06-2019
Transmission Main 3rd Point	P3#3	30-06-2019
Transmission Main End Point Start of Ranger Area within 300 m area	P3#4	30-06-2019
End of Ranger Area, within 300 m area	P3#5	30-06-2019
1 km away from Ranger Area, within 400 m area of Dera Haji Akram	P3#6	30-06-2019
Western Side of the Project-03	P3#7	01-07-2019
Mid-Point Dera Main Yousaf	P3#8	01-07-2019
Northern Side of the Project-03	P3#9	01-07-2019
Project-03 Area towards Gang e Sindhwan	P3#10	01-07-2019
Near Graveyard or School	P3#11	01-07-2019
Boundary Line behind cold storage, Dera Imran Hafeez	P3#12	01-07-2019
Ganj e Sindhwan (residential area)	P3#13	01-07-2019
Ganj e Sindhwan Road	P3#14	01-07-2019
Taj Garh Graveyard	P3#15	02-07-2019
Taj Garh	P3#16	02-07-2019
Shalimar Ring Road Industrial Scheme	P3#17	02-07-2019
Hando Chowk (Industries) Momin Pura Road	P3#18	02-07-2019
Al Rahim Gardens End Point	P3#19	02-07-2019
Momin Pura Grid Station (Back Side) Al Rahim Gardens	P3#20	02-07-2019

Table 4.8 Package 03, Air Quality Monitoring Results

Location	Parameter					
	CO	O_3	SO_2	NO_2	PM_{10}	Noise
Unit	mg/m^3	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	dB(A)
PEQS	10	130	120	80	150	75
P3#1	1.1	14	5.2	56.1	54	56.1
P3#2	BDL	12	2.6	44.8	38	44.8
P3#3	BDL	15	2.6	46.7	40	46.7
P3#4	BDL	11	2.6	41.1	31	41.1

Location	Parameter					
	CO	O_3	SO_2	NO_2	PM_{10}	Noise
P3#5	BDL	16	2.6	48.6	29	48.6
P3#6	BDL	13	2.6	35.5	27	48.2
P3#7	BDL	17	2.6	31.7	36	42.3
P3#8	BDL	14	2.6	41.1	30	43.8
P3#9	BDL	19	2.6	29.9	28	42.1
P3#10	1.1	16	5.2	42	34	43.2
P3#11	BDL	14	2.6	29.9	30	50.3
P3#12	1.1	18	5.2	37.4	36	51.4
P3#13	1.1	22	20.8	74.8	60	61.5
P3#14	1.1	19	23.5	71.0	78	59.4
P3#15	1.1	24	15.6	59.8	69	58.2
P3#16	3.4	28	18.3	74.8	86	62.2
P3#17	5.7	26	28.7	67.3	10	64.3
P3#18	1.1	23	20.8	63.5	60	53.4
P3#19	2.2	29	15.6	67.3	60	58.4
P3#20	4.6	21	31.3	61.7	96	69.8

Source: Global Eco Lab Analysis Report-2019

227. The results shown in **Table 4.8** clearly depict that all studied parameters are well within the normal range. The values of PM10 at P3#14, P3#16 and P3#20 are slightly higher compared to the rest of the points primarily due the flying dust because of agricultural vehicular movement like moving tractor trolleys etc.

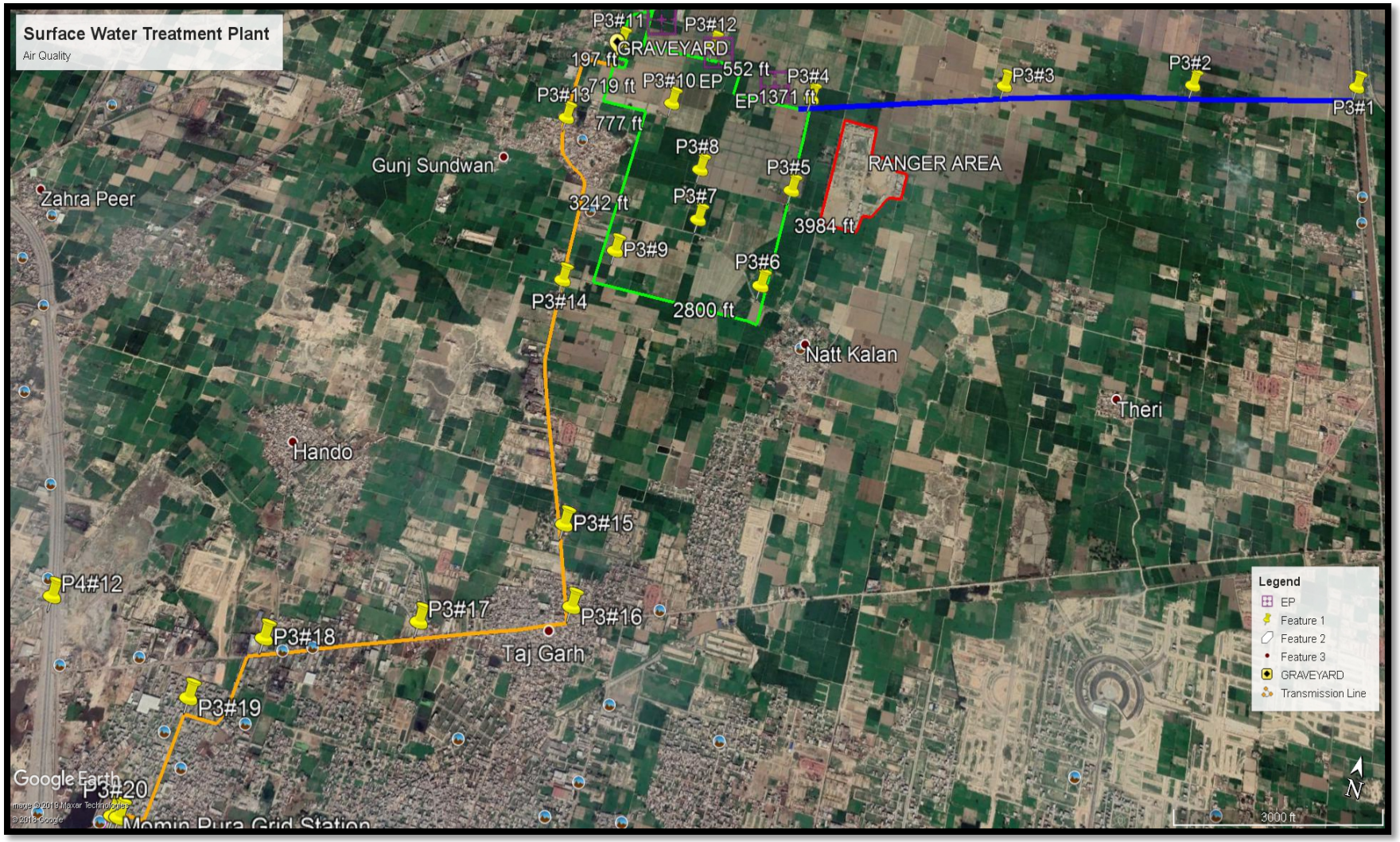


Figure 4.19 Map showing all the points Monitored for Ambient Air Quality of Package 03

(Source: Google Earth Location Map)

Package 04 (Water Distribution Network)

228. Ambient air quality was monitored at 35 locations for Package 04 (Water Distribution Areas) which is a congested area with high population, high traffic volume and little industrial activity. Air quality varied significantly throughout the Package 04. Most of the parameters were within the limits of PEQS at majority of the points. Higher pollution levels were observed near the main roads and industrial units while air quality near residential areas were within the limits of PEQS. The map showing all the points monitored for air quality for Package 04 is given in **Figure 4.20.**

Table 4.9 Package 04 (Water Distribution Network) Air Quality Monitoring Locations

Location	Code	Date of Sampling
Main Canal Road Below Ring Road Bridge	P4#1	03-07-2019
Ring Road, Service Road	P4#2	03-07-2019
Dera Gujran Orange Train Station	P4#3	03-07-2019
Gulshan e Haider Colony, Opposite to Young Scholar School, Backroad of Orange Train	P4#4	03-07-2019
Abdullah Chowk Salamat Pura	P4#5	04-07-2019
WASA Tube well-Takiya Yateem Shah	P4#6	04-07-2019
Fateh Garh	P4#7	04-07-2019
Society Housing Nabi Pura, Railway Workshop Colony	P4#8	04-07-2019
Sukh Nehar	P4#9	04-07-2019
Shalimar Link Road, Near Mosque	P4#10	04-07-2019
Mustafa Abad, Allama Iqbal Road, Dharampura	P4#11	05-07-2019
Mian Mir Road-Sikandar Road	P4#12	05-07-2019
Cantt. Drain Itehad Park	P4#13	05-07-2019
Near Dry Port, Railway Phatak, Shuaib Autos-Mughalpura	P4#14	05-07-2019
Nawan Pull	P4#15	05-07-2019
Harbanspura Road-Jalal Colony	P4#16	02-07-2019
Daragowala Chowk	P4#17	07-07-2019
Baghban Pura Orange Station	P4#18	07-07-2019
Orange Train Station#6 Before UET	P4#19	08-07-2019
National Museum of Science and Technology, UET	P4#20	08-07-2019
Siraj Road, Near Sultan Pura Road	P4#21	08-07-2019
Ghoray Shah Road, Govt. Boys Compary School, Kot Khawaja Road	P4#22	09-07-2019

Location	Code	Date of Sampling
Shahula Chowk	P4#23	09-07-2019
Atif Park, Boghiwal Chowk	P4#24	10-07-2019
Karol Kathi, Ring Road	P4#25	10-07-2019
M A Cold Storage, Ring Road	P4#26	10-07-2019
Boghiwal Road, Near Latif Marriage Hall	P4#27	10-07-2019
Rang Wala Karkhana, Backside of Zuhra Shafi Hospital	P4#28	11-07-2019
Bassi Mour Gol Chakkar, Ringh Road Toll Plaza, Yasin Hospital	P4#29	11-07-2019
Masjid Khoo Jattan	P4#30	11-07-2019
Momin Pura Road Near Hardware Store	P4#31	11-07-2019
Wagha Town, Near Ring Road, Forland Showroom	P4#32	12-07-2019
Ring Road, Zahra Peer/Bhaini Road/Factory Road	P4#33	12-07-2019
Lakhodair, Near Ring Road	P4#34	12-07-2019
Bhaini Road Daragowala, Near English Grammar School/Afzal Marriage Hall	P4#35	12-07-2019

Table 4.10 Ambient Air Quality Monitoring Results (Package 04)

Location	Parameter					
	CO	O_3	SO_2	NO_2	PM_{10}	Noise
Unit	mg/m^3	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	dB(A)
PEQS	10	130	120	80	150	75
P4#1	5.7	28	20.9	59.2	102	72.1
P4#2	2.3	20	10.4	58	87	64.9
P4#3	6.9	24	26.1	76.7	128	82.3
P4#4	1.1	21	13.1	52.4	81	58.4
P4#5	4.6	18	18.3	60.8	102	72.6
P4#6	2.3	24	7.8	62.4	79	63.2
P4#7	4.6	31	13.1	58	91	68.4
P4#8	1.1	22	5.2	50.1	64	55.4
P4#9	2.3	17	10.4	50.4	92	168.6
P4#10	9.1	26	23.5	47.5	136	75.7
P4#11	3.4	21	23.5	53.8	83	72.3
P4#12	2.3	24	18.3	56.4	82	68.2
P4#13	1.1	30	18.3	60.4	67	61.1
P4#14	3.4	19	18.3	54.5	88	78.2

Location	Parameter					
	CO	**O_3**	**SO_2**	**NO_2**	**PM_{10}**	**Noise**
P4#15	2.3	22	13.1	52.2	105	60.3
P4#16	3.4	20	23.5	70.9	121	71.8
P4#17	2.3	26	7.8	46.8	74	73.5
P4#18	2.3	24	15.6	66.5	123	78.3
P4#19	4.6	21	10.4	57.4	105	74.3
P4#20	2.3	26	13.1	54.5	119	74.2
P4#21	2.3	17	7.8	54	130	71.2
P4#22	2.3	19	20.9	98.2	76	73.6
P4#23	9.1	27	15.7	70.5	107	76.4
P4#24	3.4	26	10.4	62.4	93	66.1
P4#25	6.9	26	31.3	42.6	101	66.1
P4#26	2.3	20	18.3	48.1	81	72.5
P4#27	4.4	18	15.7	60.8	84	71.4
P4#28	5.7	20	18.3	62.6	105	72.7
P4#29	2.3	24	20.9	60.8	102	70.2
P4#30	4.6	16	15.7	50.3	97	69.8
P4#31	3.4	19	15.7	54.5	79	73.8
P4#32	1.1	18	7.8	58.3	82	62.5
P4#33	5.7	23	31.3	46.2	89	70.2
P4#34	2.3	21	7.8	54.5	82	65.6
P4#35	6.9	18	10.4	68.5	92	70.6

Source: Global Eco Lab Analysis Report-2019

229. Table represents the detail results of ambient air pollution monitoring at selected environmentally sensitive points of the Package 04. All studied parameters are mostly well within the range in residential areas, however as expected, higher PM_{10} values were observed on and near the main roads as shown in the **Table 4.10** at P4#1, P4#3, P4#10 and P4#21.

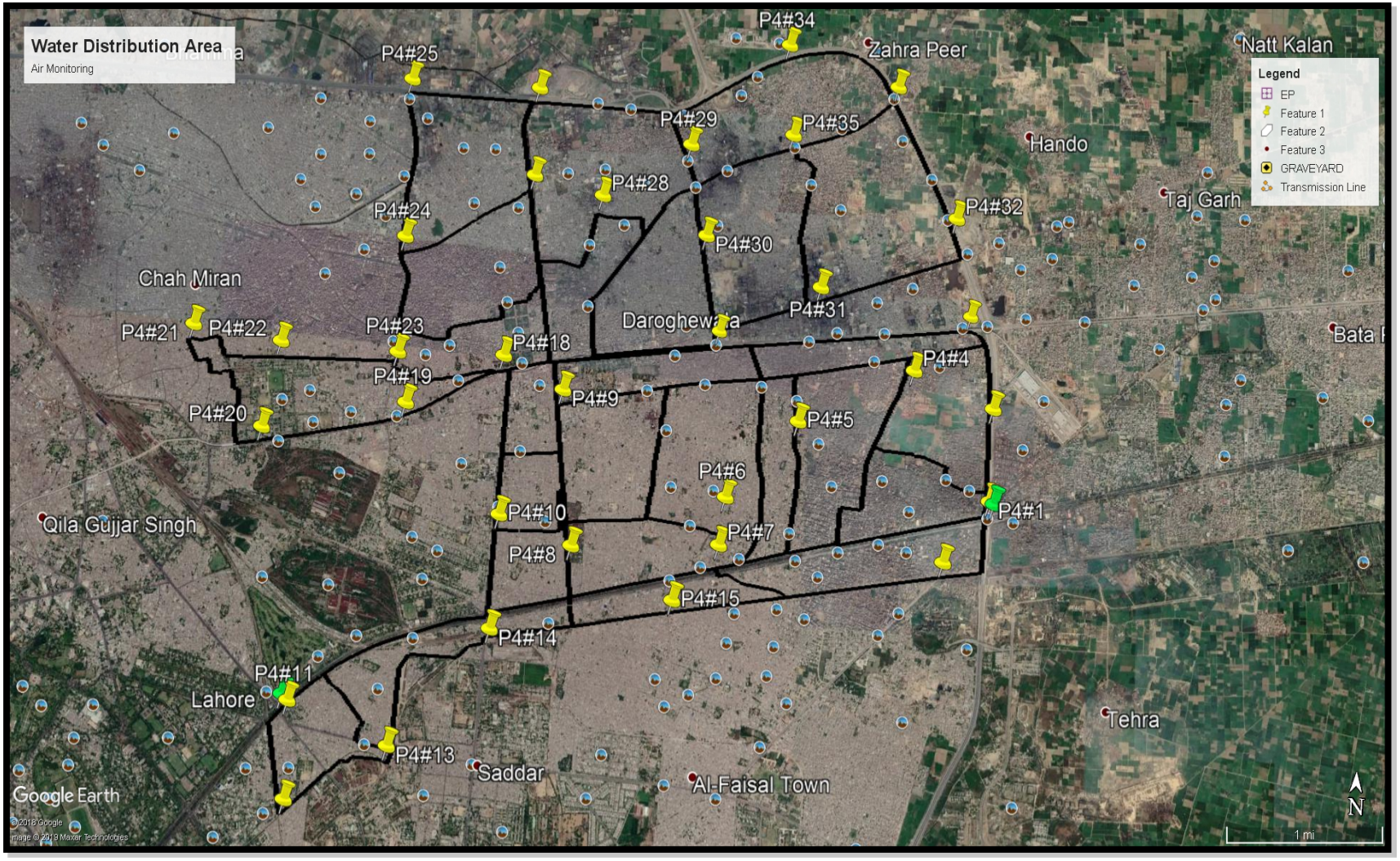


Figure 4.20: Map showing all the points monitored for Air quality of Package-04

Source: Google Earth Location Map

4.2.6.2 Water Quality (Package 03 and 04)

230. Multiple samples were collected from Packages 03 and 04. Both surface water and ground water were examined.

231. In case of Package 03, One (01) sample of surface water was collected by using water sampling device (WinLab) and 5 samples of ground water were collected according to American Public Health Association-APHA Standard method and examined in EPA Certified Lab.

232. In case of Package 04, two (02) samples of surface water were collected by using water sampling device (WinLab) and 09 samples of ground water and one (01) sample of drain water were collected according to American Public Health Association (APHA) Standard method and were examined in EPA certified laboratory.

4.2.6.2.1 Surface Water (Package 03)

233. In case of Package 03 (Surface Water Treatment Plant) one (01) sample of surface water was collected and examined from BRBD canal. BRBD canal is the main source of water for SWTP. Surface water sample was collected through water sampling device (WinLab) and sample was analysed in EPA certified lab. Lab Reports are attached as **Annexure-G.**

Table 4.11Surface Water Sampling (Package 03) Locations

Locations	Code	Date of Sampling
Link of BRBD and Lahore Branch Canal	P3-SW-1	29-06-2019
Mominpura	P3-SW-2	29-06-2019
Sharifpura	P3-SW-3	29-06-2019
Harbanspura	P3-SW-4	29-06-2019
Amir Town	P3-SW-5	29-06-2019
Shama Hospital	P3-SW-6	29-06-2019
Gujar Pura	P3-SW-7	30-06-2019
Singh Pura	P3-SW-8	30-06-2019
Darbar Ghoray Shah	P3-SW-9	30-06-2019
Copper Store	P3-SW-10	30-06-2019

Table 4.12 Analysis Results of Surface Water (Package 03)

Location	Parameter						
	pH Value	TDS	TSS	Total Coliform	Zinc	Lead	Nitrate
Unit	---	mg/l	mg/l	cfu/100ml	mg/l	mg/l	mg/l
PEQS for Drinking Water	6.5 – 8.5	<1000	0	0	5.0	≤0.05	≤50

Location	Parameter						
WHO standards	6.5 – 8.5	<1000	0	0	3.0	0.01	50
P3-SW-1*	7.66	102	80	150	0.058	BDL	0.032
P3-SW-2	7.57	368	0	0	0.032	BDL	-0.018
P3-SW-3	7.04	1308	4	25	0.108	BDL	-0.052
P3-SW-4	7.37	696	2	50	0.074	BDL	-0.026
P3-SW-5	7.67	376	0	0	0.036	BDL	0.018
P3-SW-6	7.27	720	0	0	0.061	BDL	0.020
P3-SW-7	8.02	282	0	0	0.024	BDL	0.014
P3-SW-8	8.03	326	0	0	0.032	BDL	0.016
P3-SW-9	6.81	888	2	30	0.069	BDL	0.022
P3-SW-10	7.82	374	0	0	0.051	BDL	0.024

Source: Global Eco Lab Analysis Report-2019

234. *For canal water sample BOD test was also carried-out to ascertain any organic pollution; the BOD value was 5, which is indicative of presence of some organic load.

235. The laboratory results shown in **Table 4.12** reveal higher values of TDS at P3-SW-3 and P3-SW-9 respectively. The values of pH are mostly well within the recommended limits except at P3-SW-9, where it is below 7. The results shown in **Table 4.12** provide a clear indication that the BRBD canal water is contaminated with biological pollutants due to the possible sewage ingression as the contamination level of Total Coliform, Faecal Coliform and *E.coli* are exceeding the recommended WHO limits as given below in **Table 4.12.**

4.2.6.2.2 Ground Water: Tube Wells (Package 03)

236. For Package 03, five (05) samples of ground water were collected from proposed project site as per American Public Health Association-APHA standards and were analysed in EPA certified lab. Lab Reports are attached as **Annexure-G**. Different samples of groundwater (Tube wells) collected from the site are as follow:

Table 4.13 Ground Water Sampling (Package 03) Locations

Location	Code	Date of Sampling
Bajwa Farms	P3-G/TW-1	29-06-2019
Main Road Near Graveyard/Cold Store (Mosque)	P3-G/TW-2	30-06-2019
Boundary Line behind cold storage, Dera Imran Hafeez	P3-G/TW-3	30-06-2019

Location	Code	Date of Sampling
1 km away from ranger area, 400 meter down eight, Dera Haji Akram	P3-G/TW-4	01-07-2019
Mid-Point Dera Main Yousaf	P3-G/TW-5	02-07-2019

237. Google Earth Location Map showing monitoring points of Water Quality (Surface water and Ground water) is given below as **Figure 4.21**.

Table 4.14 Analysis Results of Ground Water (Package 03)

Location	**Parameter**																	
	As	Cd	Cl	Fe	Mn	Hg	pH	Nitrite	Oil and Greece	Phenolic Compounds	Se	Sulphate	Cr	Colour	Taste	TDS	Turbidity	E. coli
Unit	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	----	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	cu	--	mg/l	NTU	MPN/ 100ml
PEQS	<0.05	0	<250	0.3	<1.5	0.001	6.5-8.5	<0.3	NS	0.002	0.01	NS	<0.05	<15	NO	<1000	<5	0
P3-GW-1	0.028	BDL	42	BDL	0.051	BDL	7.54	0.018	BDL	BDL	BDL	52	BDL	0	NO	342	0.04	0
P3-GW-2	0.024	BDL	38	BDL	0.058	BDL	7.50	0.024	BDL	BDL	BDL	54	BDL	0	NO	349	0.05	0
P3-GW-3	0.027	BDL	32	BDL	0.041	BDL	7.51	0.020	BDL	BDL	BDL	52	BDL	0	NO	348	0.030	0
P3-GW-4	0.035	BDL	64	BDL	0.049	BDL	7.42	0.022	BDL	BDL	BDL	74	BDL	0	NO	481	0.08	0
P3-GW-5	0.028	BDL	55	BDL	0.052	BDL	7.5	0.031	BDL	BDL	BDL	60	BDL	0	NO	384	0.04	0
Source: Global Eco Lab Analysis Report-2019																		

238. The results shown in **Table 4.14** are within the recommended limits, thus, suggesting that quality of the existing ground water is superior compared to the surface water or the water of the BRBD canal.

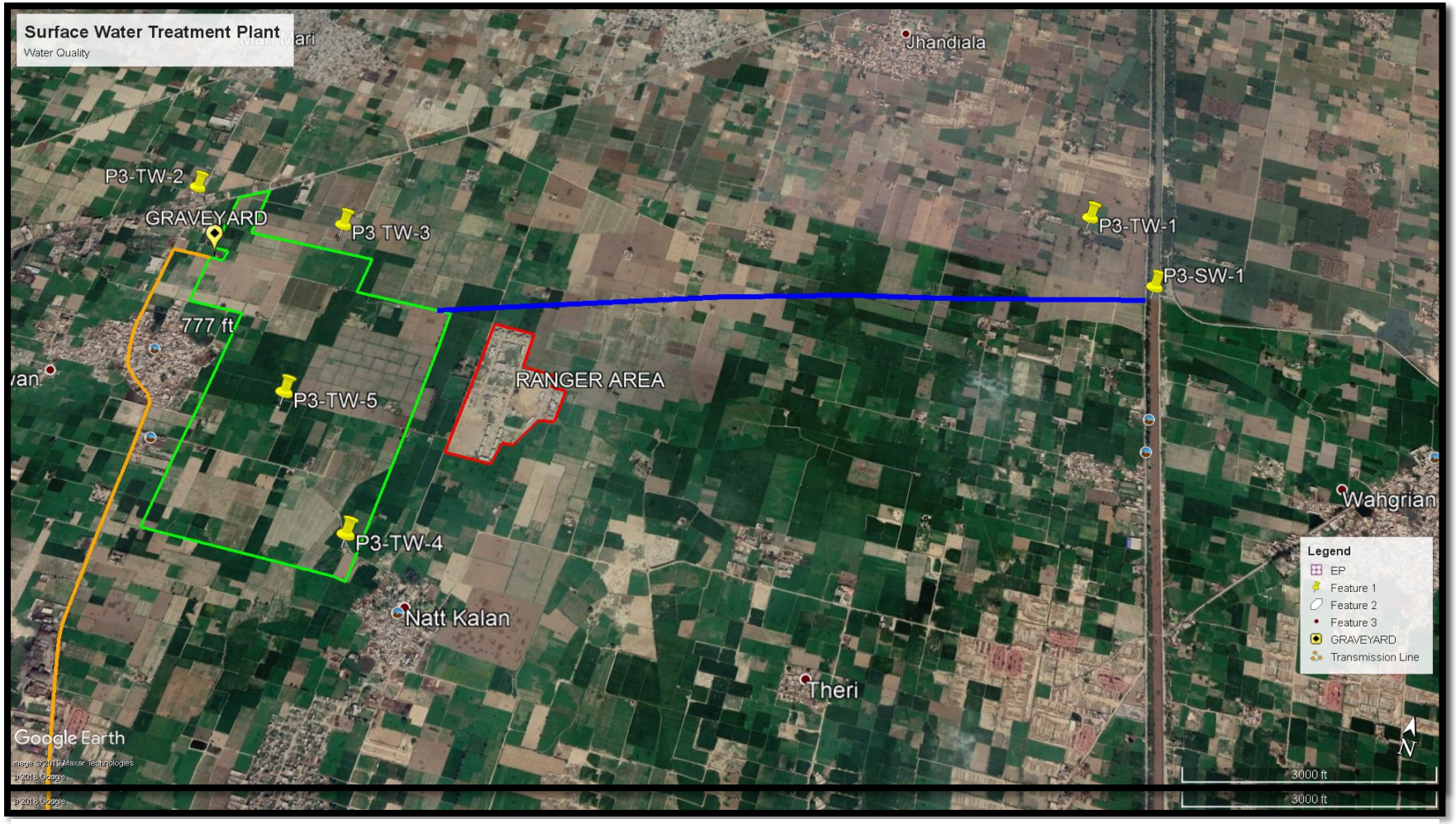


Figure 4.21 : Map showing all the points Monitored for Water Quality (Surface & Ground) of Package 03

(Source: Google Earth Location Map)

4.2.6.2.3 Surface Water (Package 04)

239. Two (02) samples of surface water were collected and examined from Lahore Branch Canal by using water sampling device (WinLab) according to the American Public Health Association-APHA Standard method and samples were analysed in EPA certified laboratory. The results are all within the recommended limits. Lab reports are attached as **Annexure-H.** Different sampling locations of surface water are provided below:

Table 4.15 Package 04 (Water Distribution Network) Surface Water Sampling

Location	Code	Date of Sampling
Lahore Branch Canal Near Ring Road	P4-SW-1	03-07-2019
Mustafa Abad, Allama Iqbal Road, Dharampura and Lahore Canal	P4-SW-2	03-07-2019

Table 4.16 Surface Water Analysis Results (Package 04)

Location	Water Quality Parameters						
	pH Value	TDS	TSS	BOD_5	Zinc	Lead	Nitrate
Unit	---	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
PEQS	6-9	3500	200	80	5.0	0.5	---
P4-SW-1	7.81	103	142	4	0.092	BDL	0.028
P4-SW-2	7.88	114	374	6	0.064	BDL	0.036

Source: Global Eco Lab Analysis Report-2019

4.2.6.2.4 Ground Water (Package 04)

240. A total of nine (09) samples of ground water were collected from proposed project site as per American Public Health Association (APHA) standard method and were analysed in EPA certified lab. Lab Reports are attached as **Annexure-H**. Different samples of groundwater (tube-wells) collected from the site are provided below:

Table 4.17 Package 04 (Water Distribution Network) Ground Water Sampling

Location	Code	Date of Sampling
Package 04- Tube Well Sampling Points		
Infantry Road Tube well	P4-GW-1	05-07-2019
Nadia Ghee Mill, Tohid Park	P4- GW-2	05-07-2019
WASA Tube well, Takiya Yateem Shah	P4- GW-3	06-07-2019
Dilawar Road, Misri Shah, Chah Meeran	P4- GW-4	06-07-2019

Location	Code	Date of Sampling
Salamat Pura, Bari Janazgha Tube Well	P4- GW-5	08-07-2019
Mehar Bashir Colony, Karol Kathi	P4- GW-6	08-07-2019
Faisal Children Park, Mughal Pura	P4- GW-7	09-07-2019
Shah Gohar Tube Well, Eid Gah Mehmood Booti	P4- GW-8	09-07-2019
Package 04- Ground Water Sampling Points		
Wagha Town, Near Ring Road	P4-GW-9	10-07-2019

Table 4.18 Ground Water Analysis Results (Package 04)

Location	Parameter																	
	As	Cd	Cl	Fe	Mn	Hg	pH	Nitrite	Oil and Greece	Phenolic Compounds	Se	Sulphate	Cr	Colour	Taste	TDS	Turbidity	E. coli
Unit	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	----	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	cu	--	mg/l	NTU	MPN/100ml
PEQS	<0.05	0	<250	0.3	<1.5	0.001	6.5 - 8.5	<0.3	NS	0.002	0.01	NS	<0.05	<15	NO	<1000	<5	0
P4-GW-1	0.042	BDL	72	BDL	0.057	BDL	7.75	0.026	BDL	BDL	BDL	80	BDL	0	NO	445	0.06	0
P4-GW-2	0.031	BDL	78	BDL	0.038	BDL	7.64	0.018	BDL	BDL	BDL	90	BDL	0	NO	468	0.04	0
P4-GW-3	0.042	BDL	92	BDL	0.041	BDL	7.55	0.021	BDL	BDL	BDL	105	BDL	0	NO	518	0.05	0
P4-GW-4	0.038	BDL	82	BDL	0.042	BDL	7.78	0.023	BDL	BDL	BDL	100	BDL	0	NO	504	0.07	0
P4-GW-5	0.037	BDL	84	BDL	0.061	BDL	7.49	0.025	BDL	BDL	BDL	110	BDL	0	NO	534	0.08	0
P4-GW-6	0.038	BDL	25	BDL	0.025	BDL	7.6	0.019	BDL	BDL	BDL	31	BDL	0	NO	275	0.02	0

Location	Parameter																	
	As	Cd	Cl	Fe	Mn	Hg	pH	Nitrite	Oil and Greece	Phenolic Compounds	Se	Sulphate	Cr	Colour	Taste	TDS	Turbidity	E. coli
P4-GW-7	0.046	BDL	78	BDL	0.052	BDL	7.4	0.022	BDL	BDL	BDL	95	BDL	0	NO	492	0.04	0
P4-GW-8	0.029	BDL	38	BDL	0.034	BDL	7.54	0.022	BDL	BDL	BDL	45	BDL	0	NO	386	0.03	0
P4-GW-9	0.042	BDL	38	BDL	0.064	BDL	7.10	0.024	BDL	BDL	BDL	38	BDL	0	NO	362	0.02	0

Source: Global Eco Lab Analysis Report-2019

241. The results of ground water sampling are once again fall within the recommended limits similar to the results shown in **Table 4.18**

4.2.6.2.5 Waste Water

242. Wastewater sample was collected from a Drain at Itehad Park, Cantt. Near Railway Track dated 04-07-2019, as per the APHA standard method and was analysed in EPA certified lab. Lab Reports are attached as **Annexure-H.**

Table 4.19 Wastewater Analysis Results (Package 04)

Location	**Parameter**						
	pH Value	TDS	TSS	BOD	Zinc	Lead	Nitrate
Unit	---	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
PEQS	6-9	3500	200	80	5.0	0.5	---
P4-dW-1	7.26	886	374	228	0.160	0.05	0.510

Source: Global Eco Lab Analysis Report-2019

243. The map showing all the monitoring points for water quality (Surface water, Ground water and wastewater) for Package 04 is provided below:

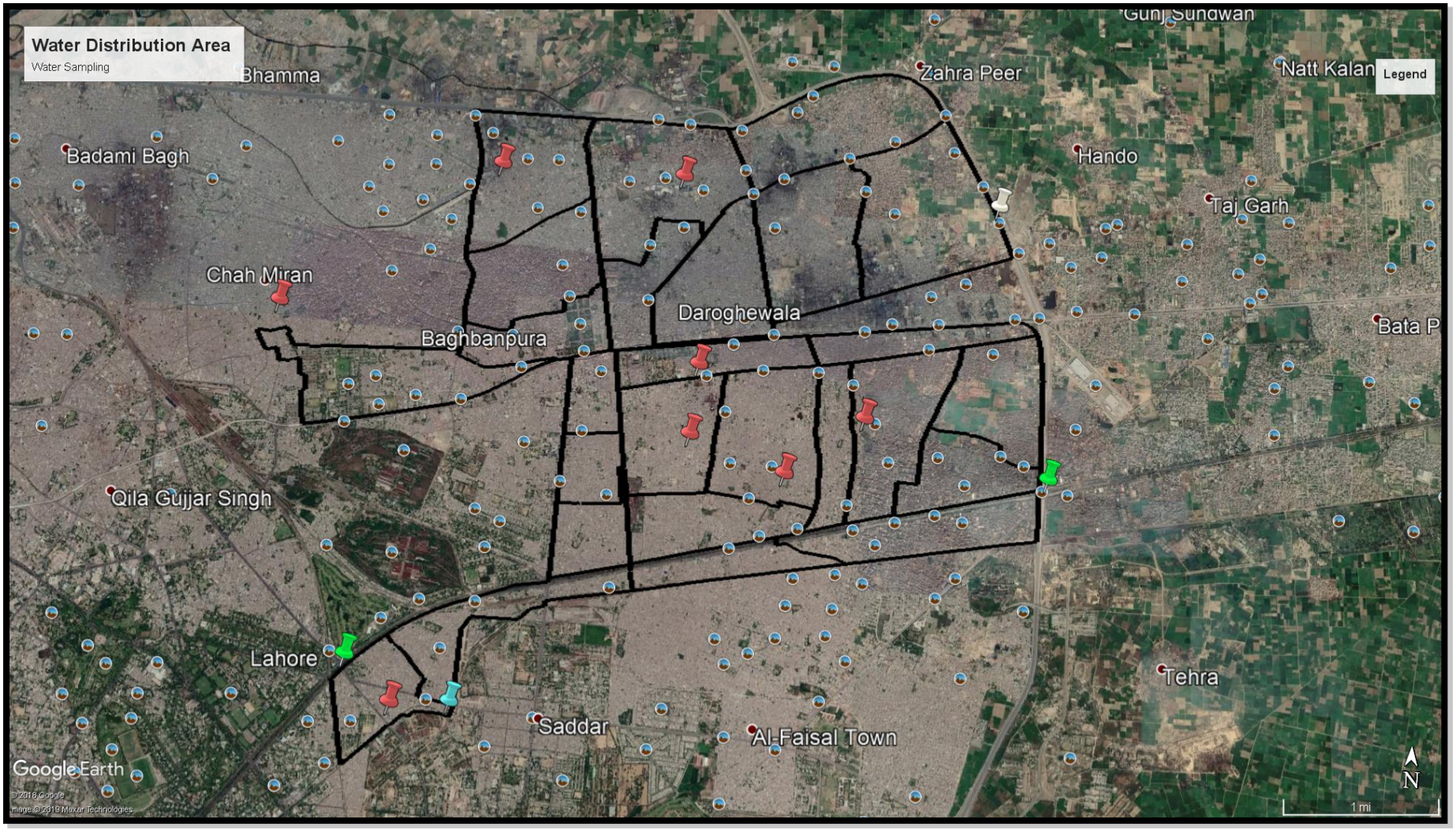


Figure 4.22: Map showing all the points Monitored for Water Quality (Surface, Ground & Wastewater for Package-04

(Source: Google Earth Location Map)

4.2.6.3 Soil Quality

4.2.6.3.1 Package 03

244. A total of five (05) samples of soil were collected from the project site of Package 03 as per the standard protocol and were analysed in EPA certified Lab. Soil analysis report is provided as **Annexure-G.** Different sampling sites are provided below:

Table 4.20 Soil Sampling Locations (Package 03)

Location	Code	Date of Sampling
From Where link canal to be extracted from BRB Canal	P3-SQ-1	29-06-2019
Boundary Line behind cold storage, Dera Imran Hafeez	P3-SQ-2	30-06-2019
Near Graveyard or School	P3-SQ-3	01-07-2019
1 Km away from ranger area, 400 meter down eight, Dera Haji Akram	P3-SQ-4	02-07-2019
Mid-Point Dera Main Yousaf	P3-SQ-5	02-07-2019

Table 4.21 Soil Analysis Results (Package 03)

Location	**Parameter**											
	pH	Sulphate (SO_4^{2-})	Sulphide (S^{2-})	Chloride (Cl-)	Fluoride (F^-)	Sodium (Na)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Iron (Fe)	Barium (Ba)	Zinc (Zn)
Unit	---	mg/kg	mg/kg	mg/kg	mg/kg	mg/ kg	mg/ kg	mg/ kg	mg/ kg	mg/ kg	mg/ kg	mg/ kg
NEQS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
P3-SQ-1	7.84	82	1.5	72	BDL	138	7.2	246	58	0.32	2.5	11.8
P3-SQ-2	7.67	78	1.2	68	BDL	143	5.5	238	62	0.29	1.8	9.5
P3-SQ-3	7.91	86	1.9	102	BDL	156	8.2	310	72	0.41	3.2	14.7
P3-SQ-4	7.86	80	1.5	93	BDL	148	7.5	304	65	0.032	2.8	11.2
P3-SQ-5	7.71	72	1.1	82	BDL	141	6.9	238	42	0.031	2.2	9.6

Source: Global Eco Lab Analysis Report-2019

Figure 4.23: Soil Sampling Points of Package 03

Source: Google Earth Location Map

4.2.6.3.2 Package 04

245. For Package 04, two samples of soil were collected from project site as per standard protocol and were analysed in EPA certified laboratory. Soil analysis report is provided as **Annexure-H.**

246. The map of soil sampling point for Package 04 is given below as **Figure 4.24**

247. **Table 4.22** shows all the soil sampling points for Package 04 and **Table 4.23** shows results of soil analysis.

Table 4.22 Soil Sampling Locations (Package 04)

Location	Code	Date of Sampling
Itehad Park (Cantt. Drain)	P4-SQ-1	12-07-2019
Wagha Town Near Ring Road	P4-SQ-2	12-07-2019

Table 4.23 Soil Analysis Results (Package 04)

Location	Parameter											
	pH	(SO_4^{2-})	(S^{2-})	(Cl-)	(F^-)	Na	K	Ca	Mg	Fe	Ba	Zn
Unit	---	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
P4-SQ-1	8.32	110	9.8	138	BDL	256	15.4	310	98	0.045	5.3	21.8
P4-SQ-2	7.91	76	2.3	74		154	9.3	257	61	0.034	2.2	13.7

Source: Global Eco Lab Analysis Report-2019

248. **Annexure-I** and **Annexure-J** are pictorial presentation of environmental monitoring of Packages 03 and 04 respectively.

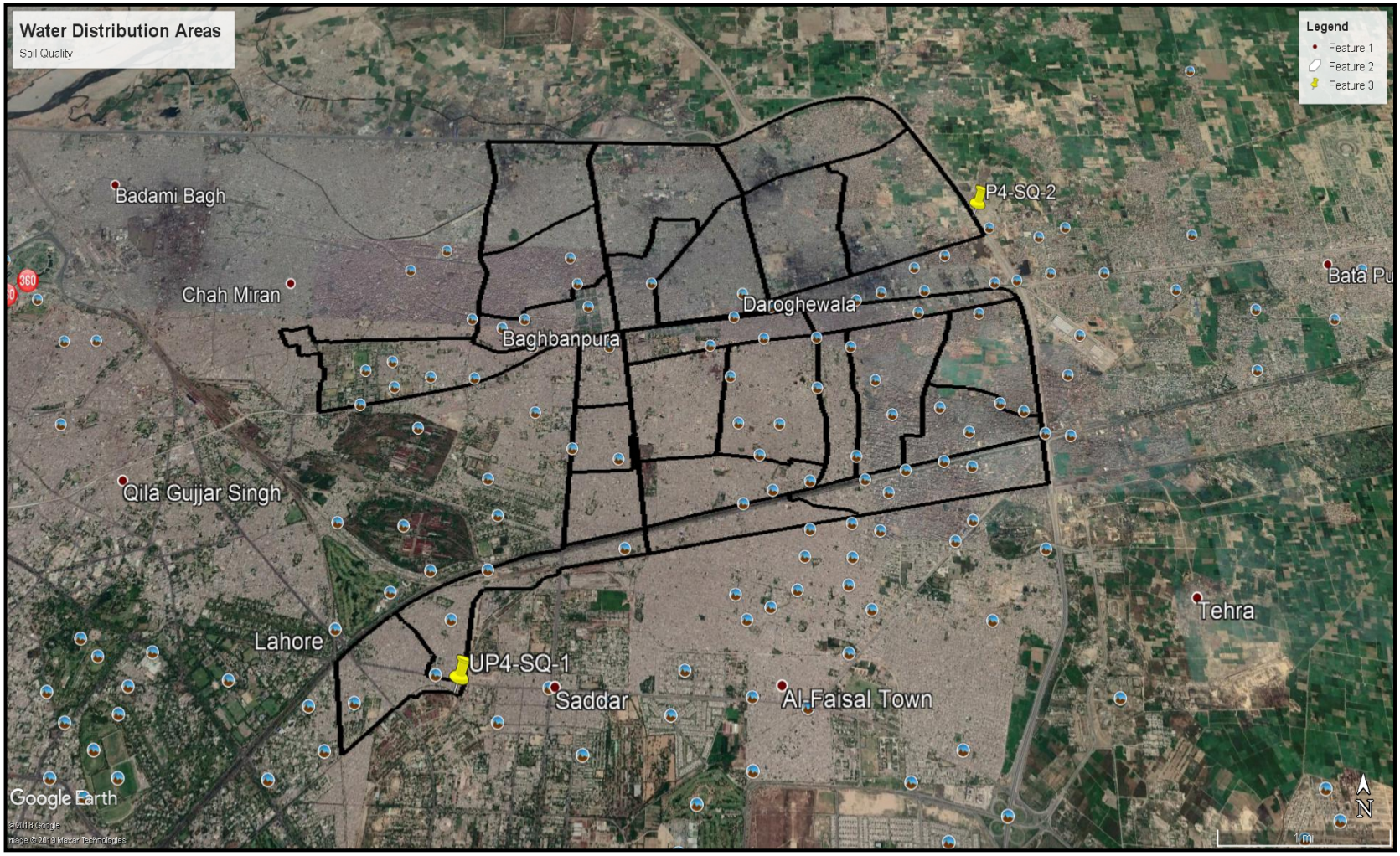


Figure 4.24: Soil Sampling Points of Package-04

Source: Google Earth Location Map

4.3 Biological Environment of Package 03 and Package 04

4.3.1 Introduction

249. An area of 324 acres (131 hectares) of private agriculture land has been earmarked for the establishment of SWTP at moza Ganj Sindhu and Natt and 17 acres (7 hectare) of land for 3 km long raw water intake channel and 5.7 km long electricity transmission line (Package 03 site).

250. The proposed project area for package 03 is under cultivation. Agriculture crops, seasonal grains and vegetables are raised according to season. Canal water irrigation is provided to the crops. There was no complaint regarding the shortage of water.

Water treated at the Surface Water Treatment Plant will be supplied through Transmission Lines which covers the following areas:

i. Mughal Pura Railway crossing (Railway Phatak)
ii. Lal Pull (bridge on the canal)
iii. Fatehgarh
iv. Ring Road Interchange
v. Dera Gujran
vi. Naveed Palace
vii. Lakhodair
viii. Wagha Town
ix. Karool Ghatti
x. Sawiyawala Karkhana
xi. Baghbanpura
xii. University of Technology Gate No. 2
xiii. Shalimar Canal and,
xiv. Graveyard

251. All this area is urban and thickly populated hence devoid of any natural vegetation or wild or semi wild animals (not fully domesticated, having some characteristics of wild animals). The data were however, collected at 14 points along the route of Transmission Lines starting from Mughal Pura Railway Crossing to Shalimar Canal and graveyard, regarding the presence/occurrence of vegetation and animal species.

252. Ecological data including flora and fauna for Package 03 and Package 04 were collected employing standard techniques. Pictorial presentation of data collection is provided as **Annexure – K.**

4.3.1.1 Flora

253. Various kinds of trees were found haphazardly planted all along the unpaved roads and water channels (khals), including some fruit trees, amenity trees and commercial timber trees. Along agricultural fields and the water channels, rather thick rank growth of small shrubs, herbs and grasses is present that could harbour pests and could endanger the crops. No effort on the part of growers was however seen to have been adopted to control weeds e.g. herbicide or physical removal of plants. Pesticide use was also not reported.

Flora of Package 03 includes:

a) Trees
b) Herbs
c) Shrubs
d) Grasses
e) Agriculture Crops

Flora of the Package 04 site includes:

a) Trees
b) Ornamental Plants
c) Grasses

4.3.1.2 Fauna

254. Faunal species occurring in the study area were identified while walking along the Transect i.e. along the kacha (unpaved or dirt) roads and water channels (khals) almost throughout the length and breadth of the area.

Fauna of Package 03 includes:

a) Birds
b) Mammals
c) Reptiles
d) Amphibians
e) Fish
f) Insects
g) Invertebrates

Fauna of Package 04 site includes:

a) Birds
b) Mammals
c) Reptiles

d) Amphibians

4.3.1.3 Birds

255. Different birds' species were observed while flying in the area, on the trees, bushes on electricity lines. Standard field guides were used to identify birds. Binocular 10x40mm was used to confirm the identification

4.3.1.4 Mammals

256. Large mammals are not present in the area. Burroughs and signs for the presence of small mammals were searched.

4.3.1.5 Reptiles and Amphibians

257. Vegetation in the area was searched for the presence of Reptiles and Amphibians. During the initial surveys, it became apparent that there was little presence, and even the use of pitfall traps would be fruitless. The emphasis therefore was on the search of vegetation.

4.3.1.6 Fishes

258. The fish species found in BRBD canal and reported in the baseline study of the project are: ***Labeo rohita* (Rohu), *Catla catla* (Thaila), *Wallago attu* (Mullee)**

- ***Labeo rohita* (Rohu):** Rohu is an omnivore fish and usually takes increasing quantities of decayed vegetation matter including higher plants, which might form more than half the bulk of its food. The fry usually feed on unicellular algae and zooplankton. Its spawning period extends from April to late July. In captivity, it cannot be bred except through induced spawning. Pairing occur during the period of spawning. There is external fertilization and no parental care. The spawning temperature is 20-26^{o} C. Fecundity rate is about 100,000 eggs per kilogram body weight. It is very popular and considered an excellent food. Due to high demand and price in the market, it is commonly cultured in the province of Punjab along with other species.
- ***Catla catla* (Thaila):** It is surface-feeder. Adult usually feeds on phytoplankton, zooplankton, small insects and crustacean. During fingerling stage, it feeds mostly on crustaceans and algae. Its spawning period extends from April to late July. In captivity, it cannot be bred except through induced spawning. Pairing occur during the period of spawning. There is external fertilization and no parental care. The temperature required for reproduction is 20-26 ^{o}C. Fecundity rate is about 100,000 eggs per kg body weight. Eggs are hatched within 8-12 hours. It is of reasonable price in the market in Punjab Province.
- ***Wallago attu* (Mullee):** It is extremely carnivorous and feeds on all types of aquatic animals as well as on dead bodies. As such, it is also called "Freshwater Shark". It breeds

during July and August. The eggs are yellowish with a diameter ranging from 1.2 -1.5 mm. It grows to about 2m and weighs more than 40 kg. Although it is included in the game fishes of Pakistan, its taste and meat is not liked very much due to its feeding on dead bodies. Moreover, due to its carnivorous habits and low market value it is not used in aquaculture practices.

259. All florral and faunal species are "Least Concern" species according to the International Union of Conservation of Nature (IUCN) Red List of Threatened species[35]. The following lists of flora and fauna species present at the sites of Package 3 and 4 do not contain endangered species from the IUCN red list.

260. No endemic species was recorded from the area. All the floral data collected on Package 03 is presented in the following **Table 4.24.**

Table 4.24 Flora Present on Site of Package 03

Sr. No.	Scientific Name	Common / Local Name
TREES		
1.	*Acacia nilotica*	Kikar, Babool
2.	*Bombax ceiba*	Semal, Cotton tree, red cotton tree, silk tree
3.	*Conocarpus lancifolius*	Cono, damas
4.	*Dalbergia sissoo*	Shisham, Tahli, North Indian Rosewood
5.	*Eucalyptus camaldulensis*	Safaida, River red gum
6.	*Ficus benghalensis*	Banyan tree, Bohr
7.	*Ficus elastica*	Rubber plant, Indian rubber tree,
8.	*Ficus religiosa*	Peepul Tree
9.	*Ficus retusa*	Ficus
10.	*Melia azedarach*	China berry tree, Persian lilac, Indian lilac, English bakkain, Dharaik
11.	*Morus alba*	White mulberry, Toot
12.	*Syzygium cumini*	Jamun, Malabar plum, java plum, black plum
13.	*Psidium guajava*	Guava
SHRUBS		
1.	*Calotropis procera*	Aak, Apple of Sodom, King's Crown, rubber bush
2.	*Cannabis sativa*	Bhang

[35] (IUCN Red List of Threatened species, 2019)

3.	*Parthenium hysterophorus*	White top weed and famine weed, Gajar booti (Invasive species)
HERBS		
1.	*Achranthes aspera*	Prickly chaff flower
2.	*Amaranthus viridis*	Green amaranth.
3.	*Carthamus oxyacantha*	Distaff thistles
4.	*Trichoderma indicum*	Distaff thistles
Many members of different families like Acanthaceae, Amaranthaceae, Apocyanaceae, Asclepiadaceae, Asteraceae, Boraginaceae, Cannabinaceae, Chenopodiaceae, Convolvulaceae, Cruciferaceae, Euphorbiaceae and Malvaceae		
GRASSES		
1.	*Aristida adscensionis*	Lambh
2.	*Bothriochloa pertusa*	Indian couch grass
3.	*Cenchrus setigerus*	Dhaman, buffel grass
4.	*Cynodon dactylon*	Bermuda grass, Khabbal
5.	*Panicum antidotale*	Blue panic grass
6.	*Saccharum bengalense*	Kanna, Sarkanda
AGRICULTURAL CROPS		
1.	*Capsicum annum*	Chilli pepper, Mirch
2.	*Oryza sativa*	Rice
3.	*Sorghum bicolor*	Jowari/millet/milo, Chari
4.	*Saccharum species*	Sugar cane
5.	*Triticum aestivum*	Wheat
6.	*Zea may*	Maize fodder
7.	All different kinds of vegetables	

261. All the fauna observed on Package 03 is presented in **Table 4.25**.

Table 4.25 Fauna Present on Site of Package 03

Sr. No.	Scientific Name	Common / Local Name
BIRDS		
1.	*Acridothere stristis*	Lali. Myna, Shark
2.	*Acridothere ginginianus*	Bank myna
3.	*Ardeola grayii*	Paddybird, Bagla, Indian Pond Heron
4.	*Argya striata*	Sohrran, 7 Sisters, Jungle Babblar
5.	*Corvus splendens*	Crow, kawa, kann

Sr. No.	Scientific Name	Common / Local Name
6.	*Coracius benghalensis*	Neel kanth, Indian Roller
7.	*Dicrurus macrocerus*	King crow, Jhanple, Black Drongo
8.	*Elanus caeruleus*	Black -shouldered kite
9.	*Lanius excibutor*	Grey shrike
10.	*Lanius schach*	Rufous-backed shtike
11.	*Merops orientalis*	Green bee-eater
12.	*Milvus migrans*	Black kite
13.	*Passer domesticus*	House sparrow
14.	*Ploceus philippinus*	Baya weaver
15.	*Pycnonotus cafer*	Red-vented bulbul
16.	*Vanellus indicus*	Tatiri, Red-wattled Lapwing
MAMMALS		
1.	*Canis aureus*	Geedar, Golden or Indian Jackal
2.	*Canis species*	Stray dog, free-ranging urban dog
3.	*Felis catus*	Domestic cat
4.	*Funambulus pennantii*	Five striped palm squirrel, northern palm squirrel
5.	*Mus musculus*	Field mouse, house mouse
6.	*Rattus norwegicus*	Black rat, chooha
7.	*Chiroptera*	Bat
FARM ANIMALS		
1.	*Bos Taurus*	Cow, cattle, domestic cat
2.	*Bubalus bubalis*	Buffalo, water buffalo, domestic water buffalo
3.	*Capra aegagrus hircus*	Domestic goat, goat
FISH		
1.	*Labeo rohita*	Rahu Fish
2.	*Labeo catla*	Thela Fish
3.	*Wallago attu*	Mullee
REPTILES		
1.	*Calotes versicolor*	Oriental garden lizard
2.	*Hemidactylus frenatus*	Oriental house lizard
3.	*Mabuya dissimilis*	Striped grass skink
4.	*Varanus bengalensis*	Bengal monitor
AMPHIBIANS		

Sr. No.	Scientific Name	Common / Local Name
1.	*Hoplobatrachus tigerinu*	Indus valley bullfrog
2.	*Bufo*	Common toad
INSECTS		
1.	*Colias croceus*	Pili Titly, Clouded yellow butterfly
2.	*Tineola bisseltiella*	Patanga, Clothes Moth
INVERTEBRATES		
1.	*Chilopoda*	Centipede
2.	*Diplopoda*	Millipede

262. All the floral data collected on Package 04 on different 14 points are presented in **Table 4.26.**

Table 4.26 Flora Present on Site of Package 04

Sr. No.	Scientific Name	Common / Local Name
TREES		
1.	*Bombax ceiba*	Semal, Cotton tree, red cotton tree, silk tree
2.	*Conocarpus lancifolius*	Cono, damas
3.	*Dalbergia sissoo*	Shisham, Tahli, North Indian Rosewood
4.	*Eucalyptus camaldulensis*	Sufaida, River red gum
5.	*Ficus benjamina*	Ficus, weeping fig
6.	*Ficus benghalensis*	Banyan tree, Bohr
7.	*Ficus elastica*	Rubber plant, Indian rubber tree,
8.	*Ficus religiosa*	Peepul Tree
9.	*Melia azedarach*	China berry tree, Persian lilac, Indian lilac, English bakkain, Dharaik
10.	*Morus alba*	White mulberry, Toot
11.	*Phoenix dactylifera*	Khajoor, Date palm
12.	*Syzygium cumini*	Jamun, Malabar plum, java plum, black plum
ORNAMENTAL SHRUBS		
1.	*Catharanthus roseus, Vinca rosea*	Sada bahar
2.	*Hibiscus rosa-sinensis*	Hibiscus
3.	*Murraya exotica*	Marwa
4.	*Thuja orientalis*	Mor pankh
FLOWERING ANNUALS AND SMALL SHRUBS		

Sr. No.	Scientific Name	Common / Local Name
1.	*Parthenium hysterophorus*	White top weed and famine weed, Gajar booti (Invasive species, weed)
GRASSES		
1.	*Cynodon dactylon*	Bermuda grass, Khabbal

263. All the fauna observed on Package 04 on different 14 points are presented in **Table 4.27.**

Table 4.27 Fauna Present on Site of Package 04

Sr. No.	Scientific Name	Common / Local Name
BIRDS		
1.	*Acridothere ginginianus*	Bank myna
2.	*Acridothere stristis*	Lali. Myna, Shark
3.	*Corvus splendens*	Crow, kawwa, kann
4.	*Milvus migrans*	Black kite, cheel
5.	*Ploceus philippinus*	Baya weaver
6.	*Passer domesticus*	House sparrow
7.	*Pycnonotus cafer*	Red-vented bulbul
MAMMALS		
1.	*Canis species*	Stray dog, free-ranging urban dog
2.	*Felis catus*	Domestic cat
3.	*Funambulus pennantii*	Five striped palm squirrel, northern palm squirrel
4.	*Mus musculus*	Field mouse, house mouse
5.	*Rattus norwegicus*	Black rat, chooha
REPTILES		
1.	*Hemidactylus frenatus*	Oriental house lizard
2.	*Mabuya dissimilis*	Striped grass skink
AMPHIBIANS		
1.	*Bufo*	Common toad
2.	*Hoplobatrachus tigerinu*	Indus valley bullfrog
INSECTS		
1.	*Colias croceus*	Pili Titly, Clouded yellow butterfly
2.	*Tineola bisseltiella*	Patanga, Clothes Moth
INVERTEBRATES		

Sr. No.	Scientific Name	Common / Local Name
1.	*Chilopoda*	Centipede
2.	*Diplopoda*	Millipede

4.5 Socioeconomic Aspects

264. The Environment and development move parallel and cannot be separated. Environment involves not only the biophysical aspects but also the socioeconomic dimension of any proposed developmental activity. People are part of the environment and are often victims of adverse effects of such developments and related activities. The major impacts associated with certain proposed developmental activities are evident by changes in socio-economic factors in the project as well as surrounding areas. Emphasis on this dimension of the environment is a newer thing than focusing on the physical, chemical, biological and cultural environment. It has resulted from the realization that the environment cannot be dealt in isolation it must include the factors associated with human concerns[36].

265. The socio-economic impacts of a proposed development on a community begin the day the project is proposed. Changes in social structure and interactions among the community members are obvious in the scenario, which may not be measurable directly. In fact, real measurable and often significant effects on the human environment can begin to take place as soon as there are changes in social and economic conditions.

266. The assessment of socioeconomic status of workers and people living nearby areas was based on general observations to collect baseline information, and interview method-using questionnaire.

4.3.2 Socio-economic Aspect Summary

267. The major local communities surrounding proposed project area are Ganj Sindhu, Natt, Jandiala, Bhaseen, Jandiala Road, Taj Garh, Shalimar Ring Road Industrial Scheme , Hando Chowk , Al Rahim Gardens , Momin Pura Grid Station, Momin Pura, Baghban Pura, Sukh Nehar, Mughal Pura, Dharam Pura, Fateh Garh, Daragowala, Karool Ghatti, Dera Gujran, Itehad Park (Cantt,) Lakhodair, Bassi Mor, Atif Park (Boghewal Chowk), Shahula Chowk, Shalimar Link Road, Society Hospital Nabi Pura, Abdullah Chowk Salamat Pura, Gulshan e Haider Colony, Rang Wala Karkhana, Bhaini Road and Harbanspura etc. There is an increasing trend of housing societies being under construction as people are converting agricultural land into residential area. All the spheres near proposed project area have primary schools, mosque, health care center, veterinary clinic and small markets. For drinking purpose, people use water from hand pumps and motor operated pumps and some of the tube

[36] Wildman, P. (1990). Methodological and social policy issues in social impact assessment. *Environmental Impact Assessment Review*, *10*(1-2), 69-79.

well installed by WASA. Health and sanitation situation were not satisfactory as discussed ahead under the heading “Health Facilities” of this section. Some part of the area was also covered with cultivated land and small farms having goats, sheep and other domestic animals. Along the Momin Pura road many industries are also present. Their housing and health situation were not very good too. There was no proper sewage system. Hand pumps and motor drawn water is used for drinking purpose. Vegetables, wheat and grains are the common crops in this area.

4.3.2.1 Administrative Set-up

268. The project site is well established administrative setup. The study area Assistant Commissioner. There is also public representative like Member of National Assembly (MNA), Member of Provincial Assembly (MPA), Chairman and Councillors etc.

4.3.2.2 Religion

269. The Project area is mainly a Muslim populated area with small percentage of Hindu and Christian minorities. After completing the social survey and analysing the data, survey team concluded that majority of the people interviewed (98%) were Muslim and only 2% belong to other religions like, Christian, Hindu and Qadiani etc.

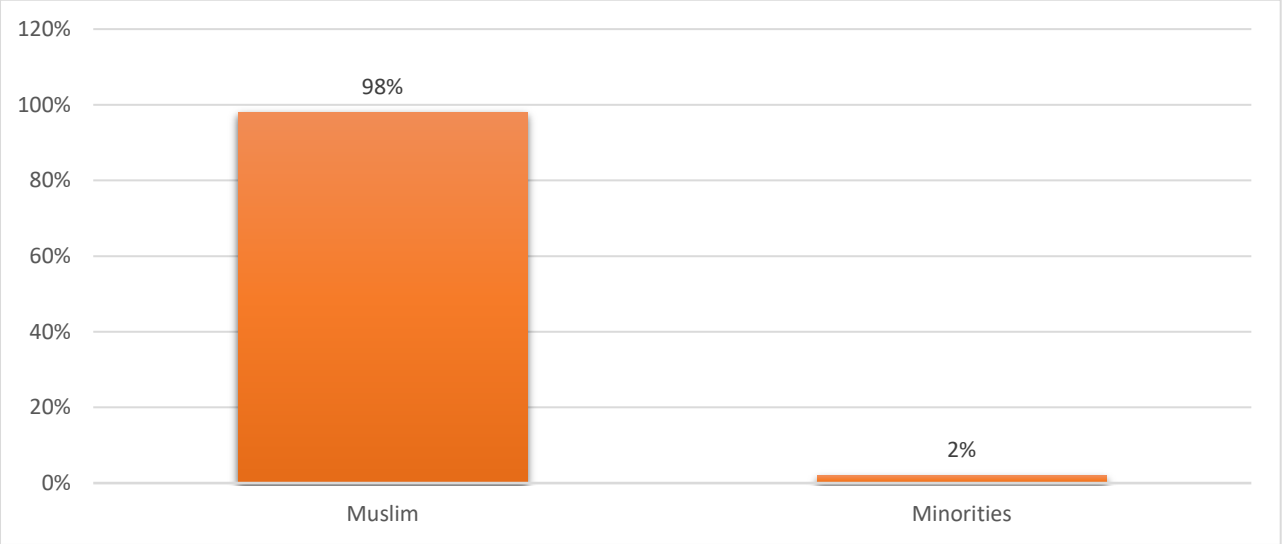


Figure 4.25 Religion Dominance in the Area

4.3.2.3 Customs, Dress and Language

270. The proposed project area like remaining Pakistan is generally a conservative society (rural setting and urban suburbs) and people observe and follow customs strictly. Mostly Hijab is observed among women all over the project area. The People are very much concerned about castes and beliefs, visiting shrines is very common among them. The mother tongue of the proposed project area is Punjabi. Urdu is rarely spoken in the villages. Majority of the

people wear Qamiz and Shalwar, but pant shirt and trousers are also seen in the area among the people who are doing jobs in offices, marketing etc.

4.3.2.4 Interviews and Observations

271. Most of the population of the study area belongs to low socioeconomic group. Housing conditions are poor. There is no proper drainage system and hence stagnant water ponds forms at many places during rainy season. These ponds badly affect community aesthetics and are potential source for the spread of many infectious diseases. Communities lack adequate infrastructure for solid waste disposal, with very poor waste collection system. Heaps of solid wastes are seen at different places presenting an unsightly scene and provide breeding places for rodents, mosquitoes and many disease-causing agents.

4.3.2.5 Occupation / Employment Status

272. People were interviewed about their employment status. After completing the social survey and analysing the data, survey team concluded that 38% people interviewed were daily wagers (labour), working in different factories, 32.55% people interviewed were having their own shops, 6.66% people interviewed were involved in marketing jobs, 8.88% people interviewed were associated with different occupations (teacher, opticians, housewife etc.). Only 6% people interviewed were involved in business activities. The low proportion of people doing business indicates that majority of the people in the area are poor and having low /weak financial status.

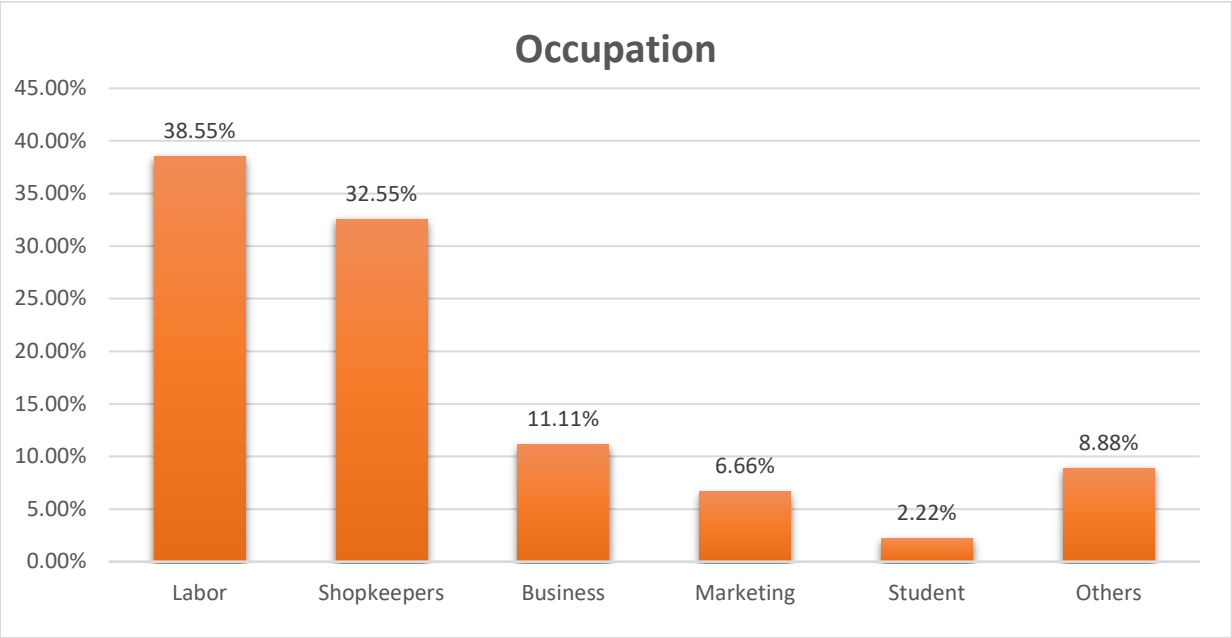


Figure 4.26 Major Occupations in the Area

273. After completing the social survey and analysing the data, survey team concluded that majority of the people interviewed (92%) were employed in different sectors etc. while 8% were unemployed or retired.

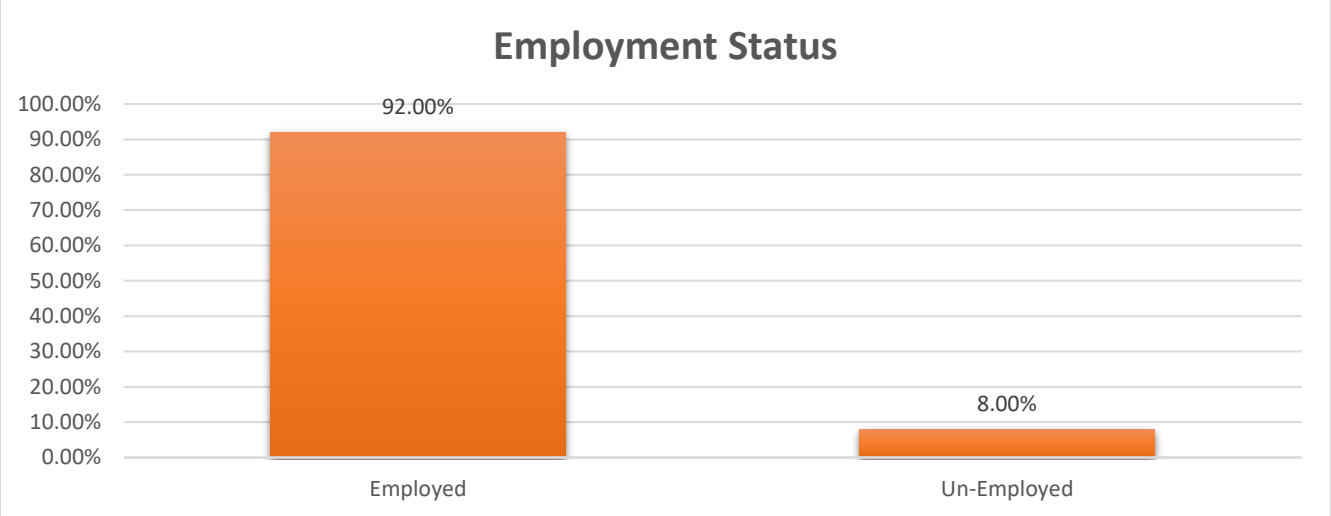


Figure 4.27 Employment in Area

4.3.2.6 Income Level

274. People were interviewed about their income. Most of the people were reluctant to tell their exact income due to several reasons; tax problem, fear of unknown, fear of disclosure. After completing the social survey and analysing the data, survey team concluded that majority of the people (45%) were earning within the range of 16000 to 45000 that is far below the poverty line and it is very less to fulfil basic needs, 26% people interviewed were earning within the range of 16,000-25,000 which is also below the poverty line. 17% people interviewed were earning within the range of 26,000-35,000, 9% people interviewed were earning within the range of 36,000-50,000 while only 2% people interviewed were earning more than 50 thousand. Almost 45% people who got interviewed were below the per capita national income which is 1580 USD[37], and 55% people were earning up to per capita national income.

[37] https://data.worldbank.org/country/pakistan

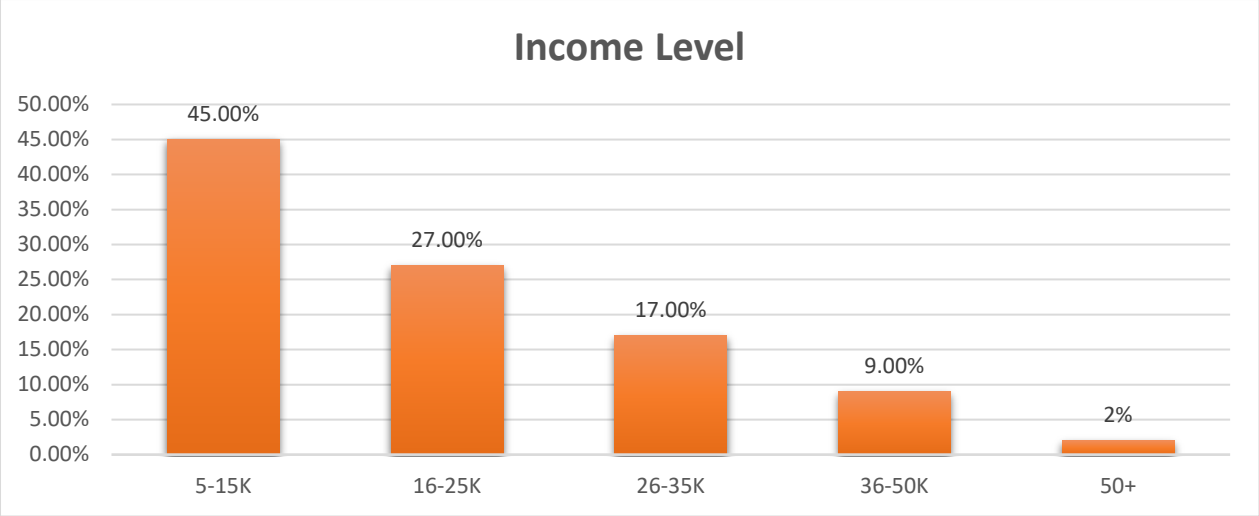


Figure 4.28 Income Level of inhabitants of Area

4.3.2.7 Age

275. People were interviewed about their age group. Most of the people were reluctant to tell their exact age. After completing the social survey and analysing the data, survey team concluded that majority of the people (40%) were of or below 30 years, 31% were between 30- 40 years, 19% were below 50 years, 9% were up to 60 years and 1% were more than 60 years.

276. The existence of youth shows growth potential, thus creating opportunities for the area to develop in future. Appropriate reforms will enhance the overall productivity of the area; better health, education and training, job opportunities. The current project will alleviate the burden of health issues in the area (generating from the water intake of deteriorating quality), thus providing more opportunities to explore livelihoods. The project will also provide job opportunities.

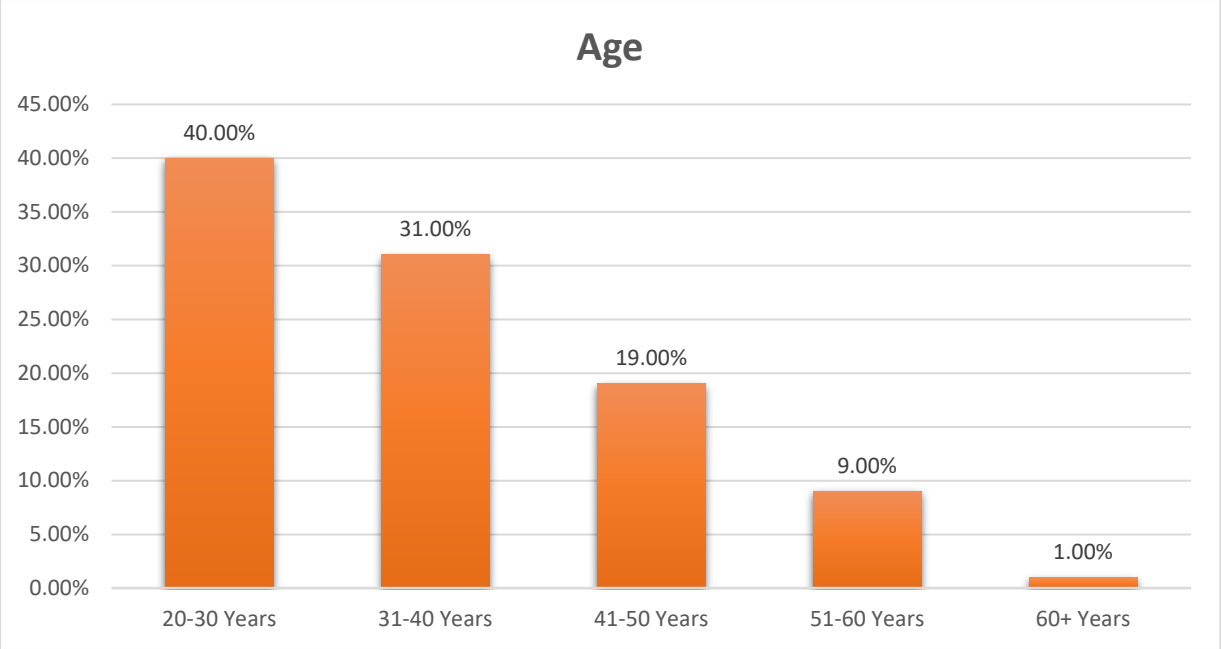


Figure 4.29 Age of the Respondents in Area

4.3.2.8 Gender

277. Social survey was conducted to collect information of gender in the project area. After completing the social survey and analysing the data, survey team concluded that majority of the people interviewed (90%) were male and only 10% were females. The result was based upon the conducted social survey, but it may be misleading, as majority of the women were not willing to give/share their feedback.

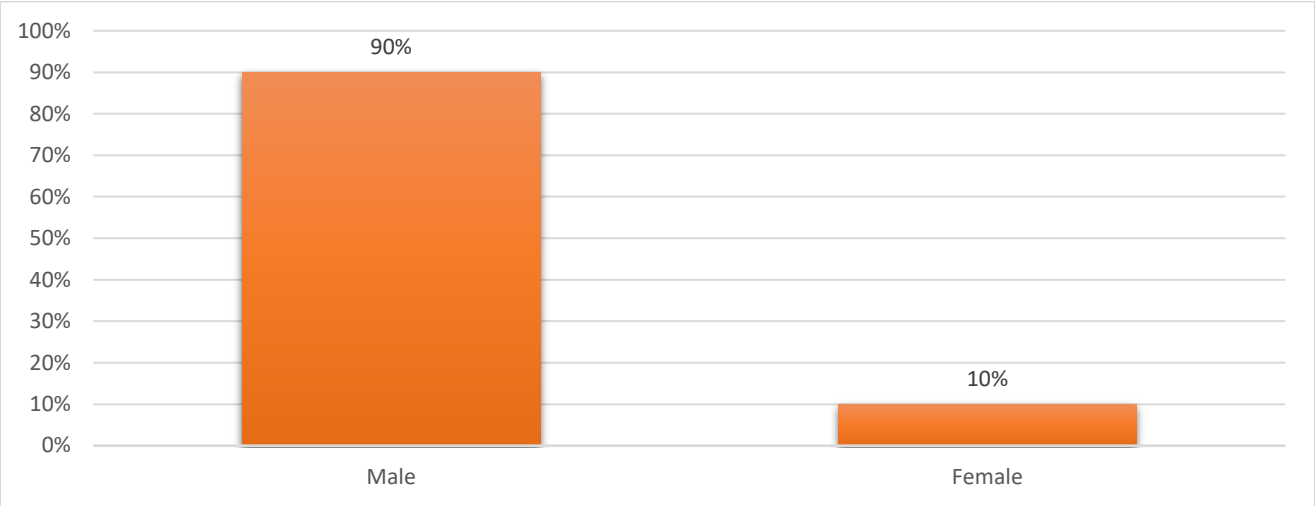


Figure 4.30 Gender of the Respondents of Proposed Project Area

4.3.2.9 Education

278. People were interviewed about their qualification. After completing the social survey and analysing the data, survey team concluded that 27% of interviewed people were illiterate because of higher educational cost and low socio-economic status. Survey results showed

that 63% community members are literate (can read or write) out of which 5% were having education only up to primary level (having 5 year of education), 15% were up to middle level (having 8 year of education), 29% were matric pass (having 10 year of education), 14% had qualification up till intermediate (having 12 years of education) level and 10% were graduated (having 16 year of education). Some Government and private schools are present in the nearby area. Schooling facilities (mostly government; approximately 200 in numbers) are not as per the need of the day; due to the poor and ineffective teaching system, government has initiated the restructuring of the whole educational system especially at primary and secondary level. Many technical and vocational training centres are also available in the area. College and university facilities are also available in the area.

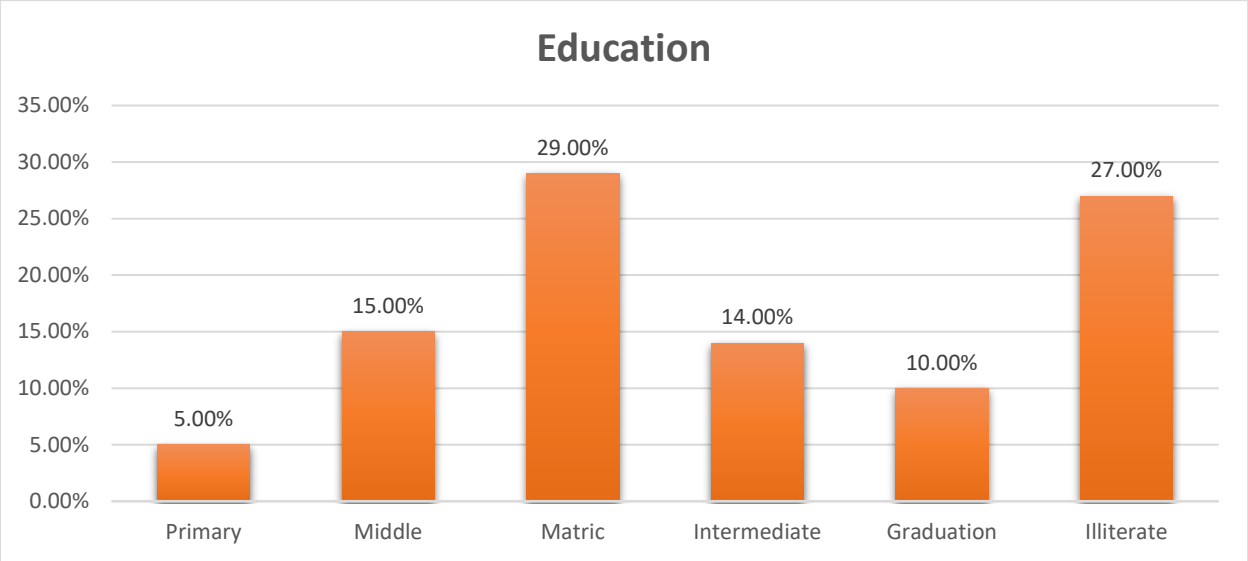


Figure 4.31 Education of the Respondents

4.3.2.10 Educational Facilities

279. A field survey was conducted to collect data about educational facilities and infrastructure in the area. Multiple schools, colleges and universities were found in the area. During survey, more than 290 schools were seen in the area. Some of the significant schools are mentioned as follow:

- Abexsun Grammar School
- Ahmad Grammar High School
- AL Khalid Foundation School
- Al-Hadi Foundation School
- Al-Jadeed Academy
- Al-Qalam High School
- Asad Grammar School
- Curious Learners School System Shalimar Campus Lahore

- Eagles Model School
- Government Higher Secondary School for Girls
- Govt. Model Girls High School, Qalandar Pura
- Haward Grammar High School
- Islamia Model School
- KIPS SCHOOL
- Laurel bank Public School (Daragowala Campus)
- Mumtaz Public School
- SILK School Model Campus
- The Educators, Sahar Campus IV
- Young's Scholar School

280. About 40 colleges (private/government) were seen in the project area. These colleges taught sciences, computer, Information Technology, Business etc. Some of them are as follow:

- Al-Raheem Academy and Computer College
- Aspire Group of Colleges, Harbanspura (Boys Campus)
- Government College for Women
- Government Vocational Training Institute, Baghbanpura, Lahore. (TEVTA)
- Shalimar Medical and Dental College
- Superior College Shalimar Campus
- VU New Kashmir College Campus
- Government College for Women China Scheme
- ILM College Harbanspura Lahore
- Ripha International College Fateh Garh
- Noor College of Business and Sciences
- Lahore Medical and Dental College
- Govt Shalimar Degree College for Boys Shalimar Garden

4.3.2.11 Nature of Houses

281. People were interviewed about nature of their houses, weather they live in Cemented Houses, Semi Cemented Houses, and Muddy Houses etc. After completing the social survey and analysing the data, survey team concluded that majority of the people interviewed (98.5%) were living in Pacca (Cemented Houses) while only 1.5% respondents lived in Semi-Pacca houses (Half Cemented/Half Muddy/Mud Houses).

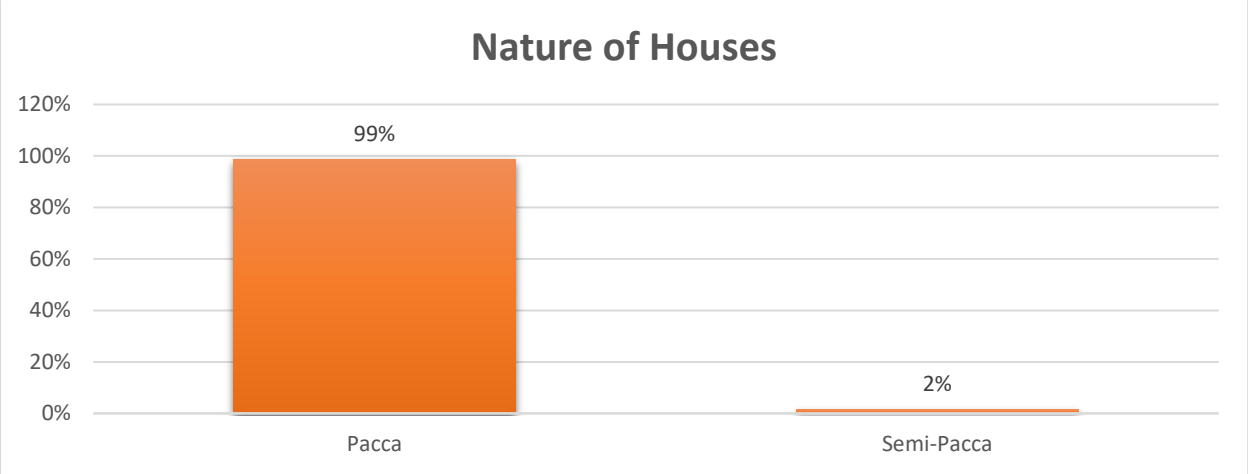


Figure 4.32 Nature of Houses in the Area

4.3.2.12 Family System

282. Questions regarding family system i.e., joint family or separate family/independent were asked. After completing the social survey and analysing the data, survey team concluded that majority of the people (63%) were living in Joint Family System, as it is the culture of area. Approximately 37% interviewed persons were living in separate family system. There are many reasons for living in family system like family clashes and income problems etc. Majority of the separate living individuals were young. It was also concluded that joints family system induces social pressures on spouses and lessens financial burden on the families. Individual families have specific dynamics and may act accordingly. People living in joint family system believe that it implicates more financial stability due to sharing of resources and more family security.

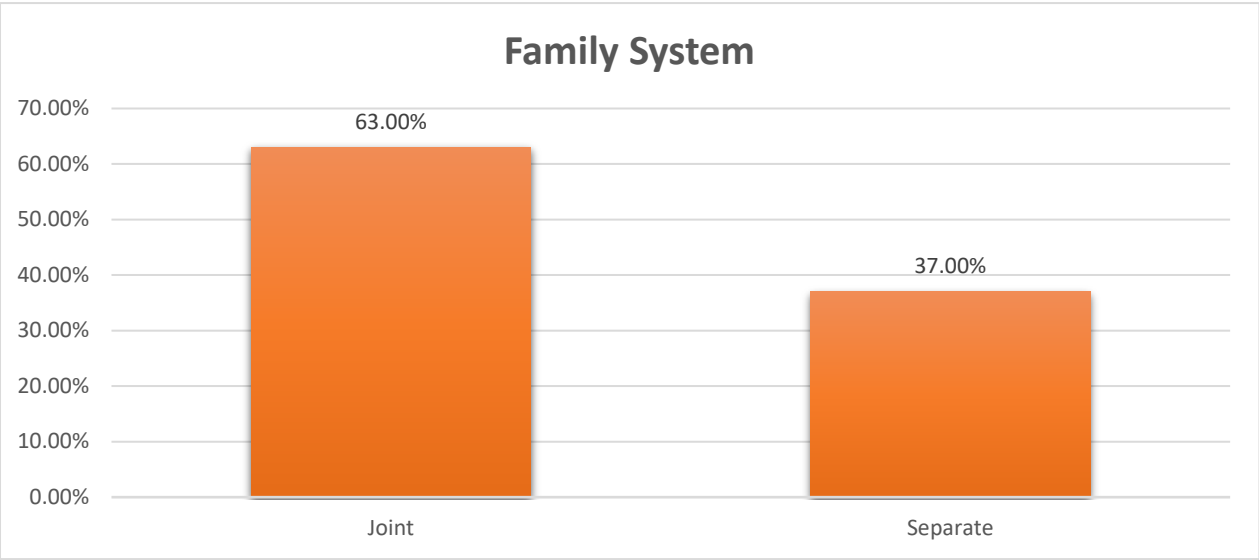


Figure 4.33 Family System in Area

4.3.2.13 Caste

283. People were interviewed regarding their caste (Biradari). After completing the social survey and analysing the data, survey team concluded that variety of castes are residing in the project area. Most common castes were including Rajpoot, Arain, Sheikh, Jutt, Pathan, Rehmani, Qureshi, Malik, Syed, Butt, Bhatti, Gujjar, Ansari, Kambo, Mehar etc. According to the results of social survey and people interviewed, Rajput caste was leading in the area and counted for 23%, 10% Arain, 7% Shiekh, 7% Mughal, 8% Mughal, 5% Pathan, 5% Syed, 6% Jutt and other caste account for total 29%.

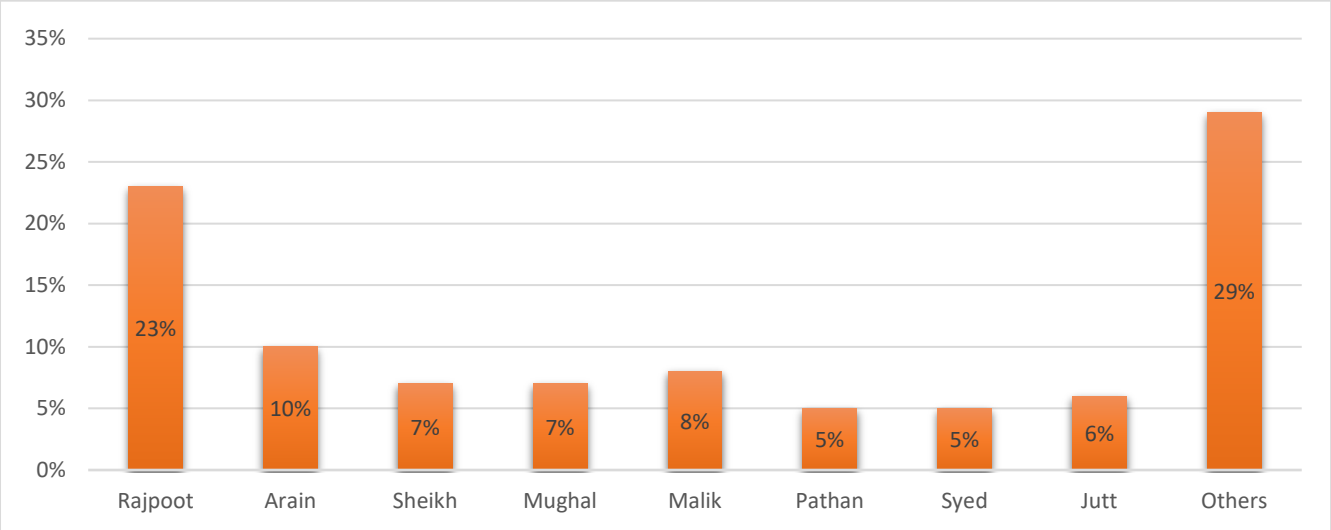


Figure 4.34 Major Castes in Area

4.3.2.14 Health Facilities

284. A field survey of the proposed project area was conducted to collect information about health facilities and infrastructure. More than 90 health facilities including private clinics, government hospitals, private hospitals, dispensaries, were observed during survey. Some of them are equipped with all required machinery but they are overloaded with patients and majority of these facilities do not have basic life support machinery. Major diseases such as; Tuberculosis, Asthma and Cardiovascular were most common among the patients of these health facilities. Overall health facilities in the area are not well-equipped. Some of them are as follow:

- Shalimar Hospital
- Abdul Lateef Tahir Hospital (Muslim Charity UK)
- Ahmad Hospital
- Al Aziz Clinic
- Al-Shaad Surgical Center
- Azra Maternity Home

- Faisal Medical and Neuro Center
- Kishwar Fazal Hospital
- Miraj Din Welfare Hospital
- Mussarat Razzaq Hospital
- Public Welfare Hospital
- Zahid Homeo Care and Clinic
- Zohra Shafi Free (Trust) Hospital
- Shiekh Karam Allahi Dispensary

285. The data collected from hospitals during survey showed that the most common water borne illnesses were diarrhea and vomiting. Almost 62.67% people were suffering from them. The second most common was dermatological diseases, having a prevalence rate of 21 %. Few people suffered from prolonged fever (8%), malaria (5%), yellow coloration of eyes (1.67%) and other problems (1.67%) respectively. Surveys results indicated that water-borne diseases were mostly prevalent in monsoon and summer season (May to September) showing a percentage of 44.67% and 39.33%, respectively. About 82% of the people interviewed admitted that they did not treat (boiled or filtered) water before drinking. Bacteriological examination of water samples collected from the target households in the area of study showed contaminated and found unfit for drinking according to WHO standards. The proposed project of clean drinking water supply will help in reducing prevalence of water borne diseases and improving people health in the area.

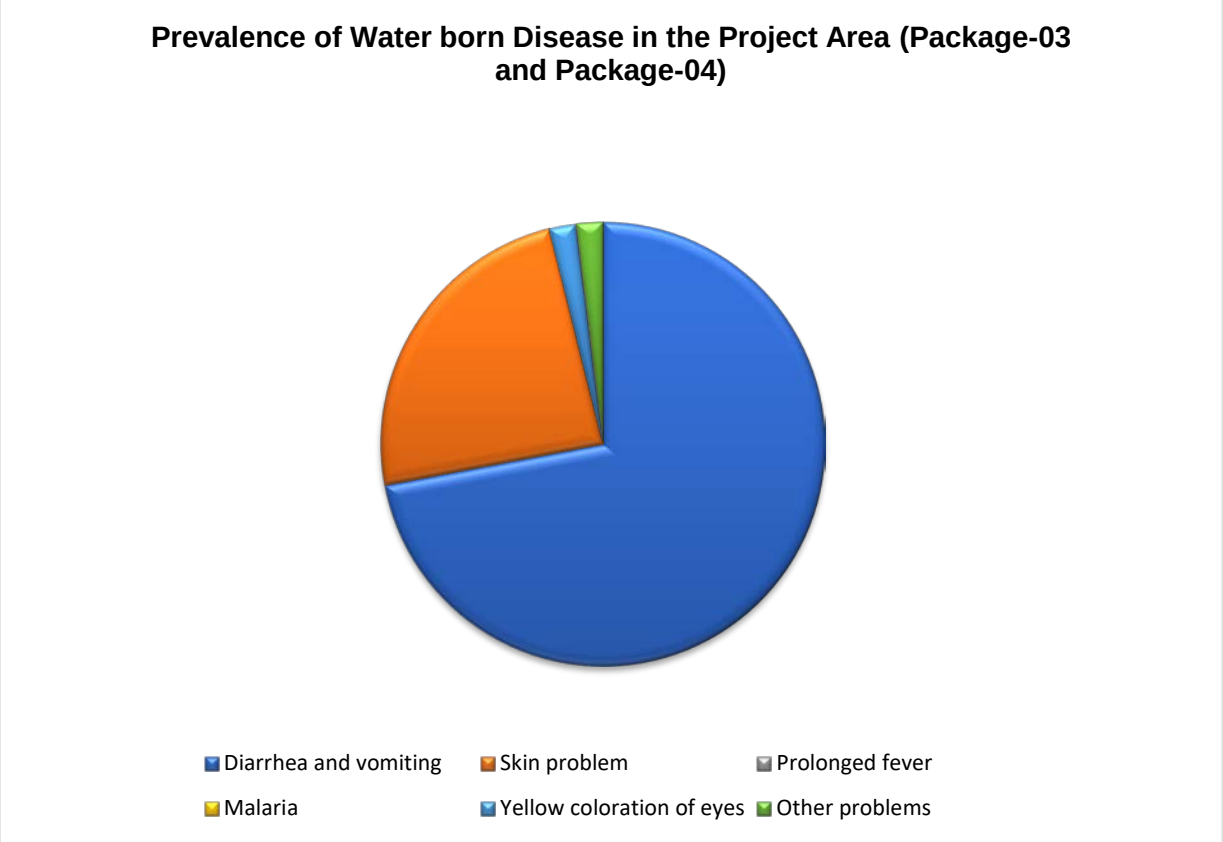


Figure 4.35 Prevalence of Water born Disease in the Project Area (Package 03 and Package 04)

4.3.2.15 Mosques, Tombs and Graveyards

286. A field survey was conducted to get idea about Mosques, Tombs and Graveyards located in the area. Approximately 100 mosques were observed in the area that indicates that majority of the population in that area is Muslim. Some of the mosques are as follow:

- Abu Hanifa Mosque
- Bilal Masjid
- Jamea Masjid Betul Hudaa
- Jamia Masjid Al Mustafa
- Jamia Masjid Anwar Muhammadia
- Jamia masjid Haji Muhammad Sharif Noor Bagam
- Jamia Masjid Hanfia Ghosia
- Jamia Masjid Naqshbadi
- Jamia Masjid Taqwa Ahle Hadith
- Jamiya Masjid Hafiz Taj Din Sahib
- Jamiya Masjid Muhammadiya
- Masjid Haji Mehar Deen Barelvi
- Sheikh Muhammad Hussain Masjid

- Takiya Wali Masjid Mehmood Booti

287. Multiple graveyards were found in the area. Some of them are as follow:

- Bhogiwal Graveyard
- Christan Cemetery Fateh Garh
- Christian Graveyard
- Graveyard of Lakhodair
- Handoo Gujjar Graveyard
- Harbanspura Cemetery
- Mian Family's Graveyard
- Nafeerabad Graveyard
- Old graveyard Fatehgarh
- Shah Abdul Ghani Graveyard
- Shalimar Housing Scheme Salamat Pura Graveyard
- Wapda Graveyard

4.3.2.16 Cultural/Historical Sites

288. Tomb of Takiya Yateem Shah and Tomb of Dai Anga/Gulabi Bagh were also found in the area along with other tombs. Another important historical site found in the project area is Shalimar Garden.

4.3.2.17 Industries

289. Industrial survey was conducted for the proposed project. Complete survey was conducted in two weeks and the entire study area has been purposefully covered to collect primary information regarding total and types all industries using questionnaire survey and waste water sampling. Approximately 2000 different industries were found in the area. Most of the industries are steel processing industries however there are some other types of industries like wood industries, pharmaceutical industries, plastic bag industries, flour mills etc. also exist. Pictorial presentation of industrial survey is provided as **Annexure-L.** Area wise type and approximate number of industries are as follow:

Table 4.28 Industries located in the Project Area

Sr. No.	Area	Number of Industries	Types of Industries	Coordinate Range
1	Gujjar Pura	50>	Metal Industry Wood Industries/differed types Various small-scale industries	31.355944 74.212785
2	Shalimar Town	500>	Wood Industry	31.5861303 74.3848611
			Steel Industry Cold storage	31.5857490 74.3848611
			Recycling Industries	31.5963838 74.3897454
3	Begum Kot	200>	Plastic Bag Industry	31.615482 74.268014
				31.620634 74.265491
			Spare Part Industry	31.616412 74.263120
			Bottle Caps Industry	31.616017 74.263999
			Metal/Teen Industry	31.615213 74.261996
			Pharmaceuticals ASCO	31.625474

Sr. No.	Area	Number of Industries	Types of Industries	Coordinate Range
				74.263409
			Flour Mill	31.633695 74.271410
			Samad Pipes Industry	31.640359 74.279717
4	Shad Bagh	200>	Steel Industries and Tanneries Suppliers	31.601539 74.333507
				31.601503 74.333462
				31.602544 74.333339
				31.605313 74.334665
				31.609464 74.338775
				31.609137 74.346557
				31.608948 74.352897
5	Karool Ghatti	500> industries	Steel Processing Industries	

Sr. No.	Area	Number of Industries	Types of Industries	Coordinate Range
6	Bhini	200> industries	Steel Processing Industries	
7	Daragowala	100> industries	Steel Processing Industries	

4.3.2.18 Transportation

290. Lahore is the provincial capital of Punjab and has higher and better transportation facilities as compared to other area of Punjab. Different modes of transportation are available in the area and being used by the local residents e.g. Metro Bus, Feeder Busses, Lahore Transport Company, internal city route wagons, Uber, Careem, SWWL Wagon service, Private Cars, Bike, Cycles, Hans driven carts and animal driven carts were also observed. Orange Line Metro Train is also under construction, this will also improve the transportation facilities of the area.

4.3.2.19 Sewerage, Drainage and Waste Collection

291. A field survey was conducted to collect information about sewerage, drainage and waste collection scenario in the area. There was a full fledge operational sewerage system in some areas and was in good working condition. Some areas faced defected sewerage system and situation was also very bad in some areas. Similarly, waste collection was found very poor as heaps of waste were there at multiple locations. According to field visit it was evident that waste collection authorities are not doing their work properly and they need improvement in their strategy. Improper waste handling and poor collection system is dangerous for human health and causes multiple disease and putting life on risk. Proper waste handling and collection is required.

4.3.2.20 Project Response

292. After completing the social survey and analysing the data, survey team concluded that majority of the people interviewed (97%) were in the favour of the project and endorsed such developmental and public utility programs. There were also some people (3%) who were not certain about the benefits of the project and expressed their concerns such as:

- The land that is to be acquired will be bought on rates cheaper than the market value
- They will be forced to sell their land. Some were of the view that there are not willing to sell their ancestor's land because of emotional attachment.

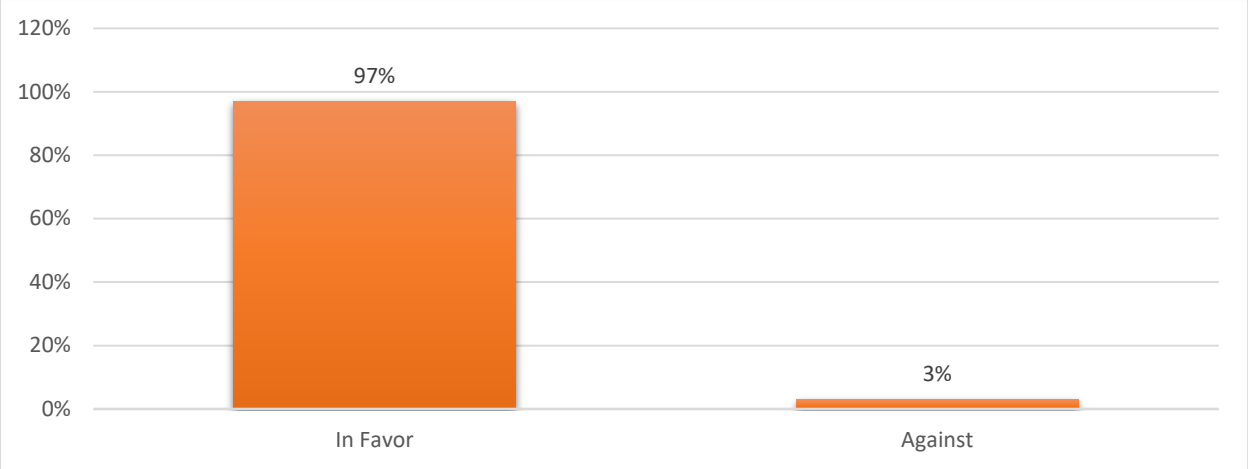


Figure 4.36 Project Response

CHAPTER 05

5 ASSESSMENT OF ALTERNATIVES

293. The project (Package 03 and Package 04) have been considered and investigated for several alternatives to reduce the environment, social and resettlement impacts. The alternatives assessed were not limited to environment and social aspects, but assessment also included the technical and financial impacts of different options. The conclusions have been incorporated into the project design and implementation arrangements.

5.1 No Project Option

294. Lahore is provincial capital of Province of Punjab and the second largest city of Pakistan. Lahore city depends entirely on groundwater to meet the water requirement of its 11.1 million populations (Census, 2017). For a longer period of time, ground water extraction is much more than the ground water recharge that has led to groundwater level recession.

295. Lahore aquifer is contaminating due to improper disposal of industrial and sewerage wastewater and use of fertilizers. River Ravi is among the main recharge sources of the Lahore aquifer and it remains almost dry except in monsoon season and average precipitation is not adequate to compensate for the decline in groundwater levels. Rapid increase in population, urban migration and industrialization has increased the load on groundwater supply manifold times.

296. The current decline rate is observed to be 0.76 meter per annum. With the ongoing declining of groundwater level, the City has started to face severe water shortages. Thus, the groundwater source alone does not seem to be a dependable/reliable source in future. Keeping in view the expected population (1,389,799) of the area (04 areas to be served) by the year 2030 (with the growth rate of 2.41% till the year 2020 and for the remaining 10 years, the estimated growth rate is 1.92%), the required water demand would be approximately 55 MGD. It would be difficult to attain water demand through groundwater extraction. The proposed SWTP having the capacity of 54 MGD would eventually suffice this requirement.

297. In addition, the water being supplied in Lahore city is not as per Punjab standards for drinking water quality and is not considered as safe mainly because of biological contamination and sometimes also because of chemical characteristics (different tube wells have very high TDS which tends to grow higher with the passage of time and utilization), therefore there is a strong need of supplying safe drinkable water.

298. The proposed project area has the following problems:

- There is no water metering system in the project area.
- The supplied water is wasted due to the rusted and broken joints and pipes.
- The water theft by illegal water connections.

- Moreover, due to absence of water metering system and deteriorated quality of pipe, the water is over consumed and water leakages occur while distribution.

299. The amount of water wasted while distribution and not reaching to the end user is known as Unaccounted-for Water (UFW). In the project area pipelines are about 30 years old. The rusted broken pipes of about 161.66 km length are loosed from many places and need to be replaced. The current situation is creating many problems such as loss of drinking water by leakages, drinking water contamination, increase in the water borne diseases, extra pumping and use of extra disinfectant to meet the water demand and water quality requirements of the community.

300. Some portion of water is wasted during transmission, is Non-Revenue Water (NRW) and the other portion that is delivered to the consumers is not charged according to their water consumption. The existing NRW is assumed to be around 45 percent. Unbilled authorized consumption is causing the less money collection as compared to the actual water consumption by the users. In short, the present conditions of pipes are not favourable to supply safe water to community and must be replaced with new high-quality material pipes.

301. It is anticipated that "No Project Scenario" will further exacerbate the situation in Lahore City. Therefore, there is an urgent and emergent need to solve the considerable water issues in Lahore.

302. With this project, better quality of potable water will be supplied, which will improve the health of people living in the project area while ensuring sufficient water supply for the sustainable development of the city. Furthermore, installation of metering system will bring the value of NRW to 25% or even lower than this after addressing the leakages in the system. This value of NRW will be achieved by taking the following steps:

a) Plugging all the water leakages through replacing the old pipes, which are not only causing water losses but also allowing ingress of wastewaters causing waterborne diseases;

b) Controlling overconsumption of water because of 90 percent unmetered connections, through metering 100 per cent of connection;

c) Avoiding water theft, through bulk meters installations, and ensuring 100% billing and at least 90% collection.

5.2 Infrastructure Siting (Package 03 and Package 04)

5.2.1 Analysis of Water Treatment Plant Site

303. Three (03) options have been considered and are discussed as under:

i. **Option-1:** The SWTP is proposed next to BRBD canal along Bhaini Road. The total land required will be about 341 Acres. Land in excess to 300 Acres required for SWTP is available at this location.

ii. **Option-2:** The SWTP is proposed at a distance of 4.5 km from BRBD canal towards Ring Road along Bhaini Road. Land in excess to 324 Acres required for SWTP is available at this location.

iii. **Option-3:** In this option, the SWTP is located near Natt kalah village

Table 5.1 Merits and Demerits of Assessed Options

Option 1	Option 2	Option 3
• Few commercial buildings exist, which shall be acquired from private owners. • After Treatment the water would have to travel a long distance due to which an underground tank (UGT) would be required for the purpose of second phase chlorination and pumping • The underground tank will have a capacity of 13.5 million gallon. Thus, incurring additional CAPEX and OPEX cost. • The proposed land is right next to bunkers of Pakistan Army (Defence Authority) making it more vulnerable. • The raw water will be drawn under gravity from the Intake point (RD 315+040) of BRBD canal and will be treated for pre-sedimentation, coagulation / flocculation, clarifiers, filtration and disinfection. • The treated water will be pumped to UGT through the transmission main. The water will be distributed through independent distribution network (DMA's) to the consumers. The disinfection would further be done at UGT.	• The area is currently being used for cultivation purpose and no residential or commercial buildings are currently present. • Due to less traveling time of treated water the proposed UGT will not be required and single stage pumping will be used. • This option may be most feasible as it does not require additional land for UGT and laying of Transmission-Main, meaning it will have least issues related to operations and construction of the project, thus having least adverse impacts	• The proposed area has residential and commercial buildings, including Mosques and graveyards • The land acquisition would have more social issues and would require high resettlement cost. • In addition, private land would be required to be purchased for laying of Transmission Main having additional financial impact. • Due to this location the underground tank, which was required in the first option, will not be required in this option.

304. In the light of above, the option-2 is found most feasible as compared to option-1 and 3. The option-1 involves two stage pumping and construction of additional underground tank for second stage chlorination. Option-3 involves resettling of local people and acquisition of additional land for laying of transmission main. Thus, option-2 is the recommended option, being most feasible and cost effective as shown below in **Table 5.2.**

Table 5.2 Cost Analysis - Surface Water Treatment Plant Options

Sr. No.	Option	Description of SWTP	Capital Cost of SWTP (Rs. in Million)	Remarks
1	I	SWTP near BRBD canal	9,948	Have considerable ESIA issues due to construction of Underground tank and Commercial building.
2	II	The SWTP is proposed at a distance of 4.5 km from BRBD canal towards Ring Road along Bhaini Road	8,298	Minimum ESIA impact and underground is eliminated.
3	III	SWTP is located near Natt Kalah village	11,313	Highest ESIA impact as the site is already occupied by local peoples.

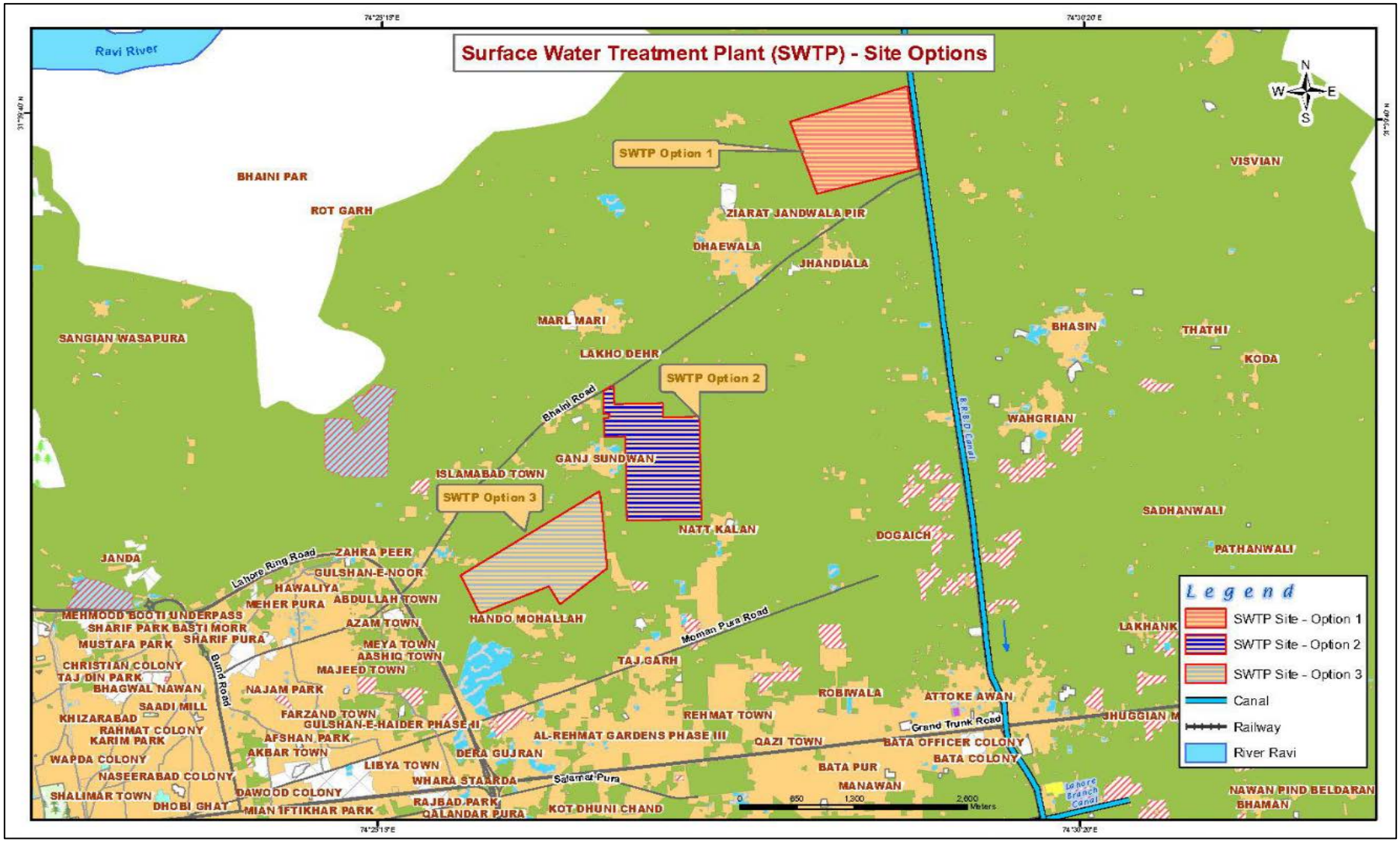


Figure 5.1 Surface Water Treatment Plant (SWTP) Site Options

5.2.2 Option Analysis of Transmission Main

305. Three (03) possible options have been considered and are discussed as under:

i. **Option-1:** Parallel to Bhaini Road towards Hando Mohallah. The total length of this proposed option is 3.1 km length up to the terminal point near Meya Town.

ii. **Option-2:** Along Bhaini Road having a total length of 3.4 km length up to the terminal point at serving area of Fateh Garh.

iii. **Option-3:** Parallel to Bhaini Road towards Zahra Peer.

Table 5.3 Merits and Demerits of Assessed Options

Option 1	Option 2	Option 3
This is the shortest route, having no involvement of R.O.W. and will pass through the private agriculture land, for which land needs to be acquired.	Although this route is approximately 300 meters longer than Option-1 but is financially more viable as compared to option-1 as no land will be required to be purchased by LWASA. Similarly, as the pipe is being laid along the Bhaini Road so it will have least environmental and social impacts. However, approval of R.O.W will be required before laying of pipe for transmission main.	This option is the least feasible as it has the longest length of 3.9 km. After crossing Bhaini Road, this alignment will be laid through the open fields (cultivated land). This is the longest route and will require R.O.W for crossing Bhaini Road. After crossing of Bhaini Road the transmission main will pass through the private agriculture land, for which land needs to be acquired and will include resettlement.

306. In the light of above, the option-2 is the recommended option, being most feasible and cost-effective option, as compared to option-1 and 3. The cost comparison of each route is shown at the below Cost Analysis - Transmission Main Routes Land acquisition cost.

Table 5.4 Cost Analysis - Transmission Main Routes Land Acquisition Cost

Sr. No.	Option	Length (km)	Capital Cost of Transmission Main (Rs. in Million)	Remarks
1	I	3.1	1115	This is the shortest route with high capital cost as this option involves land acquisition.
2	II	3.5	1095	Financially and Economically most feasible option, having least ESIA impact.
3	III	3.9	1401	Longest route involving land acquisition, NOC from concerned department and has most ESIA impact.

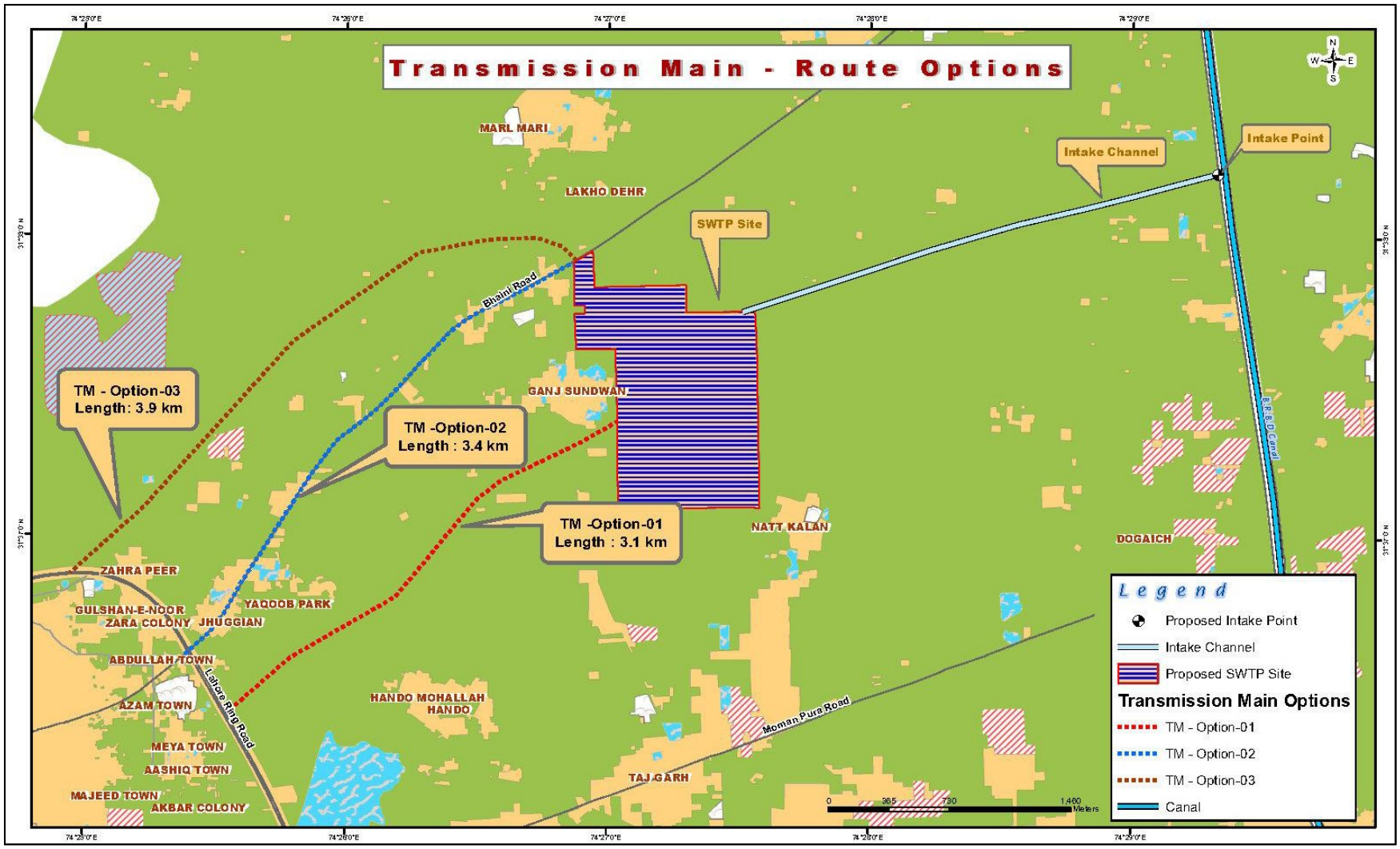


Figure 5.2 Transmission Main-Route Options

5.3 Technology Alternatives

5.3.1 Option Analysis of Water Treatment Processes

307. Samples from BRBD canal were collected and tested for different parameters in the laboratory. Results showed that the raw water quality varies considerably. The test results indicate that in the raw water, turbidity, total organic carbon and coliform exceed the limits set forth in Punjab Standards for Drinking Water and WHO Guideline values. The proposed treatment process should be able to remove biological contaminants and suspended solids, considering economic viability. In this regard, two options, ultra-filtration (membrane technology) and conventional treatment (Rapid Sand Filter and Slow Sand Filter) are considered. The description of these two is given below:

5.3.2 Option I-Membrane Filtration

308. Membrane filtration, microfiltration and ultra-filtration are used for the removal of turbidity / particulates, bacteria, virus, cyst etc. The filtration through membrane takes place by separation of particulate from water while raw water passes through membranes under pressure. Most of the membranes are operated at pressure differential less than 15 psi (35ft). The removal efficiency depends upon pore size. The former has larger pore size than the later one and consequently has less removal 5-3 efficiency. Therefore, ultra-filtration is used to meet the drinking water requirement. However, it has certain benefits over the conventional treatment, although there are some demerits in this technology. Option II-Conventional Water Treatment

309. Conventional water treatment comprises coagulation, flocculation and clarification followed by filtration and disinfection. Since turbidity is caused by very fine particulate matter, these have inherited low settling velocity that takes a long time to settle down. This requires very large size settling tanks. In order to enhance the settling velocity and reduction of sizes of sedimentation basin, chemical (coagulant) are added in the raw water. Thus turbidity, bacteria and viruses are removed through sedimentation followed by filtration and disinfection. The merits and demerits of this option are described below:

Table 5.5 Merits and Demerits of Assessed Options

Option 1	Option 2
Merits	
i. The removal of small particles is independent of pre-treatment conditions and water turbidity. The pores in the membranes are smaller than Giardia cysts and	**i.** The conventional water treatment plants are comparatively easy to operate than Membrane systems. **ii.** The system involves more civil work construction; therefore, local

Option 1	Option 2
cryptosporidium oocytes and are generally uniform in size. Therefore, UF membranes provide a predictable physical barrier to the cyst-sized particles, when the membranes are intact. **ii.** The membrane system can produce low turbidity water, generally less than 0.1 NTU. **iii.** There are no turbidity variations or particle break through, as long as there are no breaks in the membrane or seals. **iv.** The water quality is uniform, unlike conventional filtration, where the turbidity is different at the beginning of run and at the end of run. **v.** Since in the membrane system, coagulants are rarely used, its residuals are less problematic than the residuals of Conventional Water Treatment.	construction material is used to a greater extent. This provides job opportunities. **iii.** The flocculation and coagulation system remove some heavy metals (if present in water). **iv.** The flocculation and coagulation followed by sedimentation reduce total organic carbon.
Demerits	
i. Although small particle removal through membrane system is independent of raw water quality and pre-treatment, the operator may need to reduce the membrane flux rate or decrease the time interval between backwashing, when the turbidity level increases, thus the operator will have to be careful in this regard. **ii.** As an alternate to membrane flux, the pre-treatment such as	**i.** The land area requirement is more than membrane system. **ii.** Filtrate quality varies at the start and end of filter run. **iii.** Due to use of chemicals as coagulant, the residuals disposal is problematic because of environmental issues

Option 1	Option 2
coagulation and sedimentation will be required as UF membranes best perform for the turbidity of around 10 NTU. **iii.** A lower temperature requires higher operating pressure to maintain same filtered water flow rate. Thus, an understanding of the automatic control system is necessary for the operators. **iv.** UF productivity is more sensitive to precise operation of the instrumentation; it requires chemical cleaning for the removal of material from the surface of membranes, which are not removed by backwashing. **v.** The UF membrane system does not remove heavy metals, if present in raw water. Pre-treatment with coagulation and settling will be required for the removal of high turbidity and total organic carbon.	

310. The above-mentioned merits and demerits indicate that UF membranes are more complex in operation and maintenance, and the productivity is depending on automation.

311. The experience of existing water treatment plants shows that automation is difficult to keep for a long time, without skilled maintenance. Further to this, the turbidity level in treated water, as per Pakistan National Standards for drinking water is <5.0 NTU, which is achievable through conventional water treatment plant. Also, since raw water may contain TOC, which can be removed with conventional treatment, whereas ultra-filtration cannot remove TOC.

312. Cost Analysis for both the techniques i.e. Membrane Filtration and Conventional Filtration has been carried out and is shown in **Table 5.6**.

Table 5.6 Cost Analysis of Techniques

Sr. No.	Description	Amount PKR Million
1	Cost of Membrane Filtration	10,066
2	Cost of Rapid Gravity Filtration	1,025

313. Under the above scenario, conventional water treatment plant has been proposed and recommended. Conventional water treatment done will be using two types of filter media.

- Slow Sand Filters
- Rapid Sand Filters

314. Due to very low Surface overflow rate, slow sand filter is not a feasible option for the described project, as it requires 40 times filtration area as compares to rapid sand filter. A detailed comparison of Rapid and Slow Sand Filter is given below in **Table 5.7.**

Table 5.7 Comparison of Rapid Sand Filters and Slow Sand Filters

Factors	Slow Sand Filters	Rapid Sand Filters
Nominal rate of filtration	2 gallons/ sft/ hr.	2 gallons/ sft/ min
Raw water turbidity	Perform well at 10 – 50 NTU	Perform at higher turbidity, preceded by flocculation and coagulation
Size of bed	Large, ½ acres	Small, 1/100 to 1/10 acre
Depth of bed	12 in. of gravel, 42 in. of sand	18 in. of gravel, 30 in. of sand
Size of sand	0.25 to 0.3 to 0.35 mm effective size, 2 to 2.5 to 3 coefficients of non-uniformity	0.45 mm and higher effective size, 1.5 and lower coefficient of non-uniformity
Under drainage system	Split tile laterals laid in coarse stone and discharging into tile or concrete main drains	Filter nozzles installed in RCC slab
Loss of head	0.2 ft initial to 4 ft final	1 ft initial to 8 or 9 ft final
Length of run between Cleanings	20 to 30 to 60 days	12 to 24 to 72 hrs.
Penetration of suspended Matter	Superficial	Deep
Method of cleaning	Scrapping, washing and replacing	Backwashing
Supplementary treatment of water	Chlorination	Chlorination
Cost of construction	20 times of Rapid gravity filters	20 times less than slow sand Filters

315. The above merits and demerits indicate that slow sand filters perform well at turbidity 10 to 50 NTU, otherwise coagulation and clarification will be required, whereas rapid sand

filters perform well at high turbidity level; preceded by coagulation and clarification. In addition, the capital cost of slow sand filters is much higher than rapid gravity filters. Moreover, slow sand filters are outdated, due to higher capital cost and land area requirement. The existing water treatment plants in Rawalpindi-Islamabad and under construction water treatment in Faisalabad of (10 MGD) are based on rapid gravity filtration. Therefore, the most feasible solution is Rapid Sand Filter, which is recommended for the project.

Table 5.8 Technical Performance and Score Card Analysis

Factors	Slow Sand Filters	Rapid Sand Filters
Nominal rate of filtration	Low (1)	Good (4)
Raw water turbidity	Good (4)	Very Good (5)
Size of bed	Low (1)	Good (4)
Depth of bed	Low (1)	Good (4)
Size of sand	Good (4)	Good (4)
Under drainage system	Medium (3)	Good (4)
Loss of head	Good (4)	Medium (3)
Length of run between Cleanings	Good (4)	Low (1)
Penetration of suspended Matter	Good (4)	Medium (3)
Method of cleaning	Low (1)	Good (4)
Supplementary treatment of water	Good (4)	Good (4)
Cost of construction	Low (1)	Good (4)
Scoring	32	44
Ranking	2nd	1st

CHAPTER 06

6 STAKEHOLDER CONSULTATIONS AND ESIA DISCLOSURE

316. The LWASA, GoPb endorsed and AIIB approved ESIA will be disclosed at LWASA and AIIB websites in accordance with paragraph 57 of ESP of AIIB. The final version of the full ESIA will be made available at key publicly accessible and convenient locations such as the offices of P&DD, HUD and PHED, LWASA, EPA, district and tehsil administration, and EPC Contractor's camp office. An Information Booklet consists of summary of ESIA in Urdu will be distributed to affected persons committees in the villages. The important aspects of the ESIA will be further disclosed to the primary stakeholders and other stakeholders by organizing workshop and face-to-face orientation sessions for identified male and female APs, by the ESS of PMU and Contractor through location specific workshops.

6.1 Requirements for Stakeholder Participation, Consultation and Information Disclosure

317. Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2002, sub section (6) of section 10 "Public Participation" of deals with involvement of locals, relevant government departments and environmental experts for their concerns regarding proposed activity. Sub section 3 (i) of section 12 "Initial Environmental Examination and Environmental Impact Assessment" of Pakistan Environmental Protection Act, 1997 (XXXIV of 1997) Amended 2012 deals with importance of public participation in environmental assessment and approval. The Right to Information Act of GoPb 2013 also deals with disclosure of information from any government record except matter of country's sovereignty.

318. AIIB Policy ESP and standards deals with public involvement and information disclosure regarding proposed project and its associated impacts on environment and social conditions of the affected persons, their mitigation measures, and grievance redress mechanism to redress and issues related to the Project's environment and social performance.

6.2 Methodology/Consultation and Information Disclosure

319. The potential affected persons, neighbours of the project site, responsible authority e.g. District Office Environment/Environmental Protection Agency (primary stakeholders) and Environmental Experts from different universities and business groups (secondary stakeholders) were consulted and informed about the proposed project. The responses from the stakeholders were gathered through focus group discussion, interviews, meetings and stakeholder questionnaire and all the points discussed were recorded. Written feedbacks and pictorial profile of all consulted locals, stakeholders and Environmental Experts are attached in annexures.

6.3 Objective of the Stakeholder Consultation

320. The objectives of stakeholder (primary/secondary) participation in an EIA are to:

- Provide sufficient and accessible information to all the stakeholders in an objective manner to assist them to identify issues of concern and provide suggestions for enhanced benefits and alternatives.
- Inform and educate general public, project affectees, government officials, environmental experts and all the other stakeholders to avoid misunderstandings and conflicts about the proposed developmental project
- Identify problems, concerns (regarding project and associated impacts) of all the stakeholders through feedback and consultation
- Dissemination of information on the project in order to promote ownership and enhance social acceptability
- Get expert opinion, alternative or/ and recommendations on environmental problems and their solutions

6.4 Key Consulted Stakeholders/Identification of Stakeholder

321. As previous experience shows that certain potentially contentious issues never get to the public domain if the correct consultation process is not maintained from the conceptual stage of any development. For this project, proponent and the consultant have maintained a steady consultation process with all the primary and secondary stakeholders to ensure that all issues of concern are rationalized and sorted out prior to the implementation of the proposed project. The key consulted stakeholders and consultation methodology is given in the **Table 6.1**.

Table 6.1 Key Consulted Stakeholders and Consultation Methodology

Category of Stakeholder	Type of Stakeholder	Consultation Methodology
Primary Stakeholders		
Project Affected Persons	The project affected persons are the primary stakeholders of the Project. These include the affected persons due to acquisition of private agriculture land at village Ganja Sindhu, Natt, Jandiala and Bhaseen for package 3 and road users, commuters, pedestrians, user of public and private social services, students and staff of schools and colleges and business community operating	Consultations through individual meetings, focus groups discussion and workshop.

	businesses along the alignments of water transmission, feeding mains and distribution system.	
General Public (Citizens)	Local residents of the proposed project areas and nearby villages, project effectives	Focus Group Discussion Interviews
Government Officials and Responsible Authority	• Forest Department, Lahore • Fisheries Department, Lahore • Punjab Irrigation Department • Director, Pakistan Metrological Department • Geological Survey of Pakistan, Lahore • Pakistan Council of Research in Water Resources, Lahore • Archaeological Department, Lahore • Punjab Wildlife and Parks Department • Punjab Industries • District Wildlife Office, Lahore	Focus Group Discussion Interviews Meetings
Secondary Stakeholders		
Private Community Stakeholders and Environmental Experts	Civil society organisations (CSOs), Environmental Experts from Academia, Consultancy Services, Environmental Labs, Business Groups Treatment Technologists etc.	Focus Group Discussion Interviews Meetings

6.5 Stakeholder Engagement Plan (SEP)

322. A stakeholder engagement plan (SEP) has been developed as a standalone document, as a part of the ESIA and RP, for SWTP and associated infrastructure by following AIIB ES standards and international best practices. The SEP will act as a guideline to enable the Lahore Water and Sanitation Agency (LWASA), the Executing Agency of the LW&WMP, and other involved parties, to systematically carry out socially and gender inclusive consultations with the stakeholders, to record their views and concerns and implement mitigation measures. The plan is aimed at enabling active and meaningful engagement of the stakeholder groups, especially the affected persons and venerable groups of APs, and assures disclosure of information in a timely manner. The effective implementation of the SEP will mitigate the risks of poor stakeholder relations, particularly with affected people throughout

the project lifecycle. The SEP will be disclosed to the affected persons and other stakeholders in the same manner as the RP. The SEP is also attached as annex to the RP and ESIA.

323. The SEP is a "living" document which will be regularly updated to include and enable documentation of all consultation activities undertaken and adaptation of stakeholder engagement approach and methodology in the light of results of monitoring and reviews to ensure appropriateness and effectiveness approach and methods used in engaging stakeholders (evaluation).

324. The key features of the SEP are (i) identification and analysis of primary and other key stakeholders; (ii) principles and key considerations for stakeholder engagement; (iii) stakeholder engagement approach; (iv) detail of GRM in the legal framework of GoPb and project specific GRM; (v) SEP implementation methodology; (vi) a plan for stakeholder engagement activities throughout the project lifecycle; (vii) SEP monitoring, reviews and reporting (viii) key issues identified through stakeholder holder engagement activities during preparation of ESIA and RP and their addressal.

6.6 Challenges Faced in Consultations

325. The consultation process with the potential APs of agriculture land underwent many ups and downs largely because titleholders of the affected land did not want their lands to be acquired for the construction of SWTP and later their strong demand for the replacement cost of their lands should equal to the prevailing market value. After a long process of consultations, ES consultants were able to carry out surveys and studies of affected persons. The consultations with the tenants of agriculture lands, permanent and seasonal agriculture laborers, in comparison were smoother and shorter.

326. Most of the titleholders of affected land did not accurately reveal information about their other sources of income particularly the non-residents and better off residents, who do not fall under the category of low-income group. In the first round of surveys, most of the APs did not provide accurate information about their socio-economic conditions, but after the trust building activities, another round of surveys and studies was conducted to validate the data. The triangulation of data was done through qualitative poverty, social and gender assessment tools. The vulnerable AHs took interest and participated actively in analysing their social and economic status and showed APs of small land holding and non-titleholder took keen interest in on farm livelihood improvement and alterative non-farm livelihood restoration opportunities including establishing micro enterprises and skilled and unskilled labour in construction related activities.

6.7 Information Dissemination

327. The APs and other key stakeholders were informed about the aims and objectives of the Project, the socio-economic and environmental impacts due to siting and construction of SWTP and water Intake Channel, and provision of surface water to four most deserving target areas. The purpose of the process was to gather APs and other stakeholder views and concerns on several aspects of ES issues that need addressal for developing mitigation measures and Project implementation mechanisms. Several tools were used for this purpose such as meetings, semi-structured interviews, wayside stand-up meetings, key informant interviews, in-depth interviews, focus group discussions, a formal structured workshop and use of questionnaires and checklists. The following aspects were covered during the consultations:

(i) project introduction,
(ii) discussion on potential environment and social impacts and their mitigation measures
(iii) discussion on concerns and issues of APs on land acquisition and resettlement;
(iv) options for resettlement assistance;
(v) assistance for relocation and rehabilitation; and
(vi) livelihood restoration and improvement support for vulnerable affected livelihoods.

328. Meetings with other stakeholders were held throughout the period of the ESIA and RP preparation. The Individuals representing institutional stakeholders and APs were informed about the Project in general, siting and construction of SWTP and raw water Intake Channel in specific and subsequent negative impacts. The other stakeholders represent a broad cross section of informed people living and having micro businesses and small industries in surrounding area of SWTP water intake channel, educational and health institutions, government departments, academia, CSOs, environment and social development professionals and public representatives. These stakeholders have different types of stakes according to their interests, professions, impacts and involvements in various aspects of the Project. All the stakeholders were given an opportunity to share their views and concerns regarding the siting of SWTP, its design, its environment and social impacts and implementation of the Project including poverty, gender and broader social and environment aspects. The summary of consultations is given in **Table 5.1.**

6.8 Consultation with Civil Society Organizations (CSOs) and Academia

329. The Civil Society Organizations (CSOs) that showed interest in the project were involved in consultations, as they advocate for the sustainable management of environment and social performance including improving people's lives and conserving the natural

resources. They work for the creation of a society based on principles of social justice and gender equality. The key CSOs interested in the SWTP are:

- Lahore Conservation Society/Lahore Bachao Tehreek
- World Wide Fund for Nature
- Punjab Urban Resource Centre (PURC)
- MUAWON (Movement for Urban Area Wellbeing through Information and Networking)
- SCOPE (Society for Conservation and Protection of Environment)

330. The CSOs are concerned about rapid depletion of groundwater table and its contamination and are in favour of the provision of surface water to the population of Lahore However, they demanded that concerns and suggestions of affected persons should be taken into account at the stage of the Project planning particularly the siting of SWTP and Intake Channel, efforts should be made to avoid or minimize the adverse social and economic impacts, and in case of non-avoidance, sufficient and timely payment of compensation and resettlement assistance, full mitigation of social and environmental impacts, effective consultations and participation of stakeholder particularly affected persons in resettlement and environment concerns of the Project should be ensured.

6.9 Consultations with Vulnerable Groups

331. Separate consultations were conducted with Changarh (socially excluded group), ethnic minority (Christian) and with women by the field staff. The Changarh and Christians are among the low-income groups of the affected people, mostly poor and extreme poor. The women were keen to have consultations and provided useful information. These included female of AHs, teachers and other working women of SWTP affected villages (Ganja Sindhu and Natt). A majority of the women belonged to poor affected households, whilst interviews were also carried out with women from better off and middle-income households in the area. The female agriculture labourer in the area raised following key issues:

- The women from the AHs of titleholder of small landholding showed concerns that they would lose their permanent source of income from the affected land, while culturally it will not be possible for them to work on the others' lands. They demanded for culturally and socially appropriate alternate source of income within their household or villages;
- Women from landless AHs who contribute to their family income through seasonal agriculture labour showed serious concerns on the adverse impact on their source of income and strongly emphasized on providing alternative means of income through support under the Project;
- Women showed serious concern about the sever impact on their household food security as they would lose their source of wheat, rice and vegetables due to loss of productive lands;

- Loss of land by titleholders and non-titleholders will cause loss of means of fodder for their animals;
- Women from all income groups strongly emphasized on compensation of affected land and other assets on replacement cost, at the prevalent market rate;
- Provision of safe drinking water services in the affected villages;
- Most of the women from AHs demanded sufficient resettlement and rehabilitation assistance and restoration of household income and livelihoods due to loss of agriculture land;
- Risk of their safety and security would increase many folds, especially for their male and female children due to presence of outsiders for the construction works. Adequate measures should be taken in this regard by LWASA and the location of construction camps should be a minimum half of a KM away from the village settlement;
- Construction of boundary walls of SWTP and water intake channel before construction starts to avoid impact on women's and children safety and security when they will be working in the agriculture fields as most of the women from poor families are involved in agriculture labor along with their young girls and boys, and small children.
- There should be a separate shopping area for the construction workers to purchase the daily use items and WASA should not let them enter in the villages to shop;
- The male affected persons should be supported to open small shops for the construction workers daily use items, small eateries, team stalls, etc.

332. When women were consulted about labour opportunities at the STP, they showed their unwillingness to work with the outsiders/strangers. They recommended that the male members of their families including male youth should be given the labour and employment opportunities in the construction related works.

6.10 Consultations with Affected Persons

333. The APs were concerned of acquisition of their lands for siting of SWTP; severance impact on their agriculture lands particularly due to construction of raw water intake channel; shared their fear that WASA is intended to acquire excessive land for SWTP site more than actual requirements; loss of income and livelihoods; fear of not getting replacement cost of their lands and other lost assets; safety and security of children and women during construction phase, lack of opportunities for men and women in SWTP related jobs; increased pollution etc. APs showed their concerns that there is no provision in the Project design for the provision of clean water facility to the affected population. The APs showed the risk of breeding of mosquitoes and dengue mosquitoes due to the storage of water in the pond.

334. The APs particularly the agriculture workers and seasonal agriculture daily wage laborers strongly emphasized the provision for non-farm and off-farm livelihood restoration activities under the Project to the poor and extreme poor affected households. They strongly demanded for providing opportunities to the poor AHs in the project related work. They showed interest in skilled, semi-skilled and un-skilled labour during the construction of SWTP and associated infrastructure.

335. The PMU will share information about the requirements of skilled, semi-skilled and skilled labour opportunities with clearly defined criteria including other employment opportunities before start of construction of the STP and associated infrastructure. The lists of jobs will be displayed in the Village Information Centres and provided to APCs with procedures for the recruitment.

336. Men showed concerns about loss of livelihoods and loss of their heritage, severe impact on their identify and social status, adverse impact on their social network and associations with the area for generations, loss of year-round food sufficiency, loss of source of animal fodder, impact on privacy of women, air pollution and noise, the risk of accidents due to increased vehicular traffic, increase in crime rate, loss of vegetation in the area, the change in the physical environment of the area, risk of mosquitoes and dengue mosquitoes in the SWTP water storage pone.

6.11 Consultations with others Stakeholders

337. Community perception of the proposed project opinions gathered through interaction with stakeholders within the project area indicates that the people are well disposed to the project. Most of the stakeholders consulted at the project site have no objection with the establishment of the proposed project. They stated that the proposed project will not generate any adverse environmental impacts and will provide them with an easy access of clean drinking water supply which is presently their basic need. However, a very few settlements expressed uncertainties in connection with the project.

6.11.1 Tabulated Summary of General Public (Citizens) Consultation

Table 6.2 Summary of General Public (Citizens) Consultation

Date/Location/Timing	Summary of Discussion	Feedback
29-07-2019 Ganj-e-Sindhwan 10:00 AM to 11:00 AM	• A detailed public consultation was organized with the potential project effected people, local representative, shopkeepers, businessmen etc. • The community members stressed that the Executing Agency should give incentive to project effectives. • Cost of the water and connection should be declared and must be subsidized for locals. People were also concerned that what will be the water quality. Consensus • The local community members are of the view that the proposed water project is desirable. • However, they are apprehensive about the water quality, price of metered water and billing system.	• All the structural design and layout will be carries out in accordance with engineering parameters. • Cost of the water connection will be affordable, and billing will be according to the usage of water. • Low cost and good quality drinking water will be provided to the local community. • Timing of the water availability will be improved.
29-07-2019 Natt Kalan 11:20 AM to 12:30 PM	• Most of the people were of the view that water supply is available in some areas, but the quality of water is very poor. Also, the supply timings need to be improved • People were apprehensive about the quality and quantity of water. All participants were concerned about the billing system and asked for concession on billing of water for poor families	• Existing water supply system (pipelines) will be improved and newer pipeline will be laid down. • Low cost and good quality drinking water will be provided to the local community.

Date/Location/Timing	Summary of Discussion	Feedback
	Consensus • The local community members are apprehensive about the water quality, price of metered water and billing system. • A subsidized water supply will be considered in near future.	• Timing of the water availability will be improved. • Cost of the water connection will be affordable, and billing will be according to the usage of water.
29-07-2019 Momin Pura, Handu Chowk 01:00 PM to 02:30 PM	• The community members are of the opinion that with improved water supply facilities, there would be enhancement in the quality of life. • The decision on the billing system should be taken considering all financial categories of people. • The community members stressed that the period of construction needs to be reduced to avoid nuisance due to prolonged construction period. • People were also concerned about the adverse environmental impacts associated with the project.	• The water supply is expected to commence within two to three years, but effort will be made to reduce the construction time. • All the adverse environmental impacts associated with project have been addressed in ESIA report and detailed Environmental Management Plan- EMP has been designed to mitigate environmental impacts from the construction activity. • The EMP will be incorporated into the bid document for implementation by the contractor.
	Consensus • The local community members favoured the project and were apprehensive about the water quality, price of metered water and billing system. • A subsidized water supply will be considered in near future.	

Date/Location/Timing	Summary of Discussion	Feedback
29-07-2019 Mughal Pura, Harbans Pura 03:00 PM to 04:00 PM	• The community members asked for incentive to project effectives and inquired about the cost of the water and connection. • People were also concerned that what will be the water quality, timing of water availability. • The community members are of the opinion that with improved water supply facilities, there would be enhancement in the quality of life. • The community members stressed that proper mitigation measures should be identified and implemented to reduce environmental impacts during the construction phase Consensus • The local community members favoured the project and were apprehensive about the water quality, price of metered water and billing system.	• Low cost and good quality drinking water will be provided to the local community. • Job quota will be established for project effectives and locals. • All the adverse environmental impacts associated with project have been addressed in ESIA report and detailed Environmental Management Plan has been designed to mitigate environmental impacts from the construction activity. • The EMP will be incorporated into the bid document for implementation by the contractor.
29-07-2019 Baghbanpura, Shalimar, Nabi Pura, Begum Pura 05:00 PM to 06:30 PM	• Majority of the people were in the favour of the proposed project. Some have issues regarding land acquisition, lower payments as compared to market price. • People also showed concern regarding unemployment in the area and job quota in proposed project.	• Land will be acquired at market rate. • All the concerns and issues will be resolved at first instance.

Date/Location/Timing	Summary of Discussion	Feedback
	• Some also appreciated as this project will provide cleaner drinking water and will reduce disease burden.	• Locals will be given job quota. • Low cost and good quality drinking water will be provided to the local community.
	Consensus • The local community members favoured the project and were apprehensive about the water quality, price of metered water and billing system.	

338. Pictorial Profile of Public Consultation (citizens) and Feedback forms are attached as **Annexure-M** and **Annexure-N** respectively.

6.11.2 Comments and Response from Government Officials and Responsible Authorities Consultation

339. There are many important reasons to establish and maintain good working relationships with governmental authorities at different levels, and to keep them informed of the project's activities and anticipated impacts. Government support can be critical to the success of any project, and routine engagement with various regulatory and public service authorities is often required as part of doing business. On a practical level, local government authorities may have long-established relationships with project-affected communities and other local and national stakeholder groups, and as such can play a role in convening and facilitating discussions between the project and stakeholder representatives. Local government can also partner with private companies in many respects, for example, in providing services, communicating information to the local population, or integrating local development plans with the operational needs of the project. Most of the stakeholders consulted have no objection with the establishment of the proposed project and stated that the proposed project will not generate any adverse environmental impacts. Following comments were recorded from contacted Government officers of various Departments.

Table 6.3 List of Government Officials Contacted

Sr. No.	Officials Contacted	Designation/Department
1	Mr. Tariq Naseem	Deputy Secretary (Planning), Forest Department
2	Dr. Sikandar Hayat	Director General, Fisheries Department
3	Dr. Nauman Mushtaq	Deputy Secretary (Operations), Punjab Irrigation Department
4	Mr. Nauman Baig	XEN (operations), Lahore Zone, Punjab Irrigation Department
5	Muhammad Ajmal Shad	Director, Pakistan Metrological Department
6	Muhammad Nadeem Anjum	Deputy Director, Geological Survey of Pakistan, Lahore
7	Zamir Ahmad Somro	Regional Director, Pakistan Council of Research in Water Resources, Lahore
8	Muhammad Afzal Khan	Deputy Director (South), Archaeological Department, Lahore

Sr. No.	Officials Contacted	Designation/Department
9	Maqsood Ahmad Khan	Deputy Director (North), Archaeological Department, Lahore
10	Mohammad Naeem Bhatti	Director Headquarter (HQ), Punjab Wildlife and Parks Department
11	Muhammad Zahid	Deputy Director (Planning) at Punjab Industries
12	Tanvir Ahmad Janjua	District Wildlife Office, Lahore

6.11.2.1 Tabulated Summary of Consultation with Government Officials and Responsible Authorities

Table 6.4 Summary of Consultation with Government Officials and Responsible Authorities

Name/Date/Location/Timing	Summary of Discussion	Feedback
Muhammad Tariq Naseem 24-07-2019 Forest, Wildlife and Fisheries Department, Lahore	• ECO team visited Punjab forest office. And informed officials about project titled "Lahore Water and Waste Water Treatment Project" located at Mouza Ganj Sindhwan and Natt. • It consists of surface water treatment plant, transmission mains, feeding mains and distribution system. The Surface Water Treatment Plant shall cover more than 300 acres of Agriculture land with trees at random. • Mr. Tariq said that the construction of surface treatment plant will disturb bio-diversity of the area. • The flora and fauna associated with this ecosystem will be disturbed at the time of construction of surface water treatment plant, transmission mains, feeding mains and distribution system. Consensus	• It is the duty of the consultant Firm to propose steps which will be helpful to save or rehabilitate original flora and fauna. • It is proposed that construction of infrastructure may be carried out in such a way that original flora i.e. trees and shrubs can be saved. • Moreover, after completion of the project about 25-30% area may be declared as Green Area where ever green indigenous tree species with maximum foliage like Pipal, Arujan, Ficus spp. and Pelkin may be planted which will helpful to save bio-diversity of the area • In addition, Punjab Forest Department has issued a Notification with the approval of Chief Minister, Punjab regarding deposit of "Replenishment Cost". According to the subject Notification, Client Department has to deposit Replenishment Cost equal to Rs.157525/acre for the land which will be used for development project.

Name/Date/Location/Timing	Summary of Discussion	Feedback
	• ESIA would be shared with the Department. The ESMP would be available in public domain and all the information would be available to examine the project and its suitability except confidential information.	
Dr. Sikander Hayat 24-07-2019 Fisheries Department, Lahore	• Dr. Sikandar Hayat, Director General at Fisheries Department, Lahore shared information regarding fish species present in the BRBD Canal and showed concerns about negative impacts associated with this project. • He was much concerned about production of Dengue Larvae and its sprawl.	• He suggested natural prey and predator phenomenon for dengue larvae. Tilapia fish is found effective in case of wastewater treatment, similar species can also be used in case to avoid dengue production and sprawl.
	Consensus • ESIA would be shared with the Department. The ESMP would be available in public domain and all the information would be available to examine the project and its suitability except confidential information.	
Muhammad Naeem Bhatti	• Consultation team visited Mr. Nadeem at his office and shared details regarding proposed	• Mr. Nadeem showed concerns regarding wildlife, flora and fauna of the project area. He asked for

Name/Date/Location/Timing	Summary of Discussion	Feedback
24-07-2019 Punjab Wildlife Department	project, its implementation and associated concerns. • Discussion was based on wildlife of the area and impacts on wildlife due to the proposed activity. Consensus • ESIA would be shared with the Department. The ESMP would be available in public domain and all the information would be available to examine the project and its suitability except confidential information.	wildlife protection plan, No Hunting Policies and strict instructions for workers to avoid any damage to wildlife. • Details regarding No Hunting Policy, Wildlife management plan, flora and fauna protection plan were shared with Mr. Nadeem and he was found satisfied.
Nauman Baig (XEN Irrigation Department) **Muhammad Nauman Mushtaq** 24-07-2019 Irrigation Department, Lahore	• Mr. Nouman Baig, XEN (operation) and Mr. Nouman Mushtaq, Deputy Secretary (Operations), Punjab Irrigation Department, Lahore shared information regarding water aquifer level of the project area and overall city • They also discussed depletion in water level for overall city and specific to the project area. • They discussed Inflows and outflow of BRBD and impacts of 100 Cusic water extractions from BRBD for the existing project on aquatic life.	• They were in the favour of the proposed project as it will pose no negative impacts on the aquatic life of BRBD and irrigation patterns of the proposed project area. • They asked for slight modifications in project design and also asked for proper management of project throughout its construction and operational phase.

Name/Date/Location/Timing	Summary of Discussion	Feedback
	Consensus • ESIA would be shared with the Department. The ESMP would be available in public domain and all the information would be available to examine the project and its suitability except confidential information.	
Muhammad Ajmal Sahd 26-07-2019 Pakistan Meteorological Department, Jail Road, Lahore	• Mr. Ajmal Shad, Director Pakistan Metrological Department, Lahore shared useful data on metrological conditions of Lahore and the proposed project site. • He said that climate is a diverse field and changes occur on daily basis. Weather forecasting is very difficult and a technical practice as meteorological changes occurs/changes day to day or even within hours.	• He emphasized on the importance of Tress and encouraged to plant more and more trees in an effort to tackle climate change and bring a cooler future. • Mr. Ajmal showed his full support for the proposed project. He was of the view that such projects will decrease the disease burden by provision of safe drinking water to a wider community
	Consensus • ESIA would be shared with the Department. The ESMP would be available in public domain and all the information	

Name/Date/Location/Timing	Summary of Discussion	Feedback
	would be available to examine the project and its suitability except confidential information.	
Tanvir Ahmad Janjua 26-07-2019 District Wildlife Office, Lahore	• Mr. Tanvir Ahmad Janjua, District Wildlife Office, Lahore shared information regarding wildlife species present in the proposed project area. • He also discussed breeding patterns and habit of local, native and indigenous species in area and their suitability in the area.	• He showed concerns regarding illegal hunting of the wildlife, if the contract goes to foreigners as they have track record of killing dogs etc. After assurance from the proponent, that there will be no illegal hunting he agreed and favoured this project. • No hunting policy and other relevant measures for the proposed project were also discussed with him.
	Consensus • ESIA would be shared with the Department. The ESMP would be available in public domain and all the information would be available to examine the project and its suitability except confidential information.	
Muhammad Zahid 26-07-2019 Deputy Director (Planning) at Punjab Industries	• Mr. Muhammad Zahid, Deputy Director (Planning) at Punjab Industries shared information regarding industries present in the proposed and adjacent area. He also showed concern about the pollution being caused by industries and its associated impacts.	• He favoured the project as this project will provide safe and clean drinking water to local public at cheaper rates and will have a positive impact in case of ground water recharge.

Name/Date/Location/Timing	Summary of Discussion	Feedback
	Consensus • ESIA would be shared with the Department. The ESMP would be available in public domain and all the information would be available to examine the project and its suitability except confidential information.	
Muhammad Nadeem Anjum 31-07-2019 Geological Survey of Pakistan, Lahore	• Mr. Nadeem Anjum, Deputy Director Pakistan Geological Survey, Lahore shared all the relevant data regarding geological formation of Lahore and project site. He also explained briefly the faults of Lahore, Hafiz Abad and Kasur. • He further added that Geological Survey of Pakistan is helping university student to work with them and to have an idea that how things are going on.	• He said that selected area is safe from major earth quacks and the site is suitable. Disaster like earth quacks will put minimum damage to the infrastructure being proposed. • He also emphasized that all the measures should be adopted to tackle any disaster
	Consensus • ESIA would be shared with the Department. The ESMP would be available in public domain and all the information would be available to examine	

Name/Date/Location/Timing	Summary of Discussion	Feedback
	the project and its suitability except confidential information.	
Zamir Ahmad Somroo 31-07-2019 PCRWR Regional Office, Raiwind Road, Lahore	• Mr. Zamir Ahmad Somroo, Regional Director Pakistan Council of Research in Water Resources, Lahore shared information regarding water quality and quantity in Lahore. • He referenced the Water analysis conducted by PCRWR Water Testing Laboratory. Consensus • ESIA would be shared with the Department. The ESMP would be available in public domain and all the information would be available to examine the project and its suitability except confidential information.	• He further added that water quality is not so much satisfying and causing multiple diseases and deaths. • He showed his full support for the proposed project. He further added that such projects will bring prosperity and must be dealt on priority basis.
Muhammad Afzal Khan **Maqsood Ahmad** 31-07-2019 Archaeological Department, Shahi Qilla, Lahore	• Mr. Maqsood Ahmad, Deputy Director (North) Punjab Archaeology Department, Old Fort Lahore shared information regarding cultural and heritage site of Punjab, Lahore, and project site. • He informed us regarding their rehabilitation project. Consensus	• He asked to bring Layout map of the Existing and Proposed WASA Distribution Network. So, that he can share his expert opinion regarding impacts on heritage site • He was informed that clean Water will be distributed in the existing WASA network with some little repair and replace of old pipes. He was in the favour of this

Name/Date/Location/Timing	Summary of Discussion	Feedback
	• ESIA would be shared with the Department. The ESMP would be available in public domain and all the information would be available to examine the project and its suitability excepts confidential information.	project if all the precautionary measures are taken regarding protection of cultural sites • He showed his full support regarding the proposed project of clean water supply to the local community. This will reduce disease burden and will bring prosperity in area.

340. Pictorial Profile of Consultation with Government Officials and Responsible Authorities and Feedback forms are attached as **Annexure-O** and **Annexure-P** respectively.

Table 6.5: Summary of Public Consultations

Date	Location	Participants		Key Concerns
		Male	Female	
14/07/2019	Mauza Ganjay Bakhsh Sindhu Dera Sardar Liaqat Ali Dogar	180	29	• Look into the matter of site selection and find alternative land • In case no alternatives can be found; the government should compensate land at market rate.
18/07/2019	Dera Haji Arshad Maqbool (Landowner)	12	7	• SWTP should be built on non-productive land as the land selected is fertile and is also being used for high value cropping
23/07/2019	Dera Mian Fawad Shafee (Landowner)	20	7	• Livelihood of the people is dependent on the land to be acquired and construction of SWTP would cause huge land and livelihood losses for the people of the area. • Land being used for both agriculture and commercial farming activities.

Date	Location	Participants		Key Concerns
		Male	Female	
02/08/2019	Mauza Natt Dera Ch. Bilal Abbas (Landowner)	20	8	• Strong opposition from the affected persons against the land acquisition. • In case there are no other viable land options, land prices should be set at the market rate to compensate for the loss of land and livelihoods.
05/08/2019	Mouza Ganja Sidhu Dera Awan Dahi Wala	06	07	• Explore alternative livelihood opportunities for male and female agriculture laborers • Create opportunities for both men and women to acquire new skills to enable them to find alternative sources of employment. v.
05/08/2019	Dera Rana Maqbool	0	28	• Livelihood of the families working on the project proposed land is dependent on land itself and the construction of the SWTP would t cause loss of their livelihoods. • Alternative livelihood options should be provided by the government to the agriculture laborers.
06/08/2019	Moujza Ganja Sindhu Dera Rana Arshad Maqbool	0	25	• To be able to find an alternative, culturally acceptable, source of income for women should be explored. • As food needs being fulfilled with the land being acquired, the AP's food security should be ensured. • Land acquired for the project should only be used for the SWTP purpose. • Land loss would be both emotional and physical; it would be difficult to compensate such losses. • Measures need to in place to ensure that environmental concerns are addressed. • Support economically vulnerable people for the losses of their incomes by providing training in alternative income generating skills • The hiring of local people in the Project related works should be guaranteed, a contract agreement should be signed between affected people and the contractors for this purpose. • Ensure village pathways and safe passages of crossing and traveling are provided to the local population during the construction of the project. • Clean drinking water supply should be provided to the affected and other communities residing in surroundings of SWTP, once the project is operational.

Date	Location	Participants		Key Concerns
		Male	Female	
06/08/2019	Moza Ganja Sindhu Dera Rana Arshad Maqbool	06	0	• Alternative livelihood and employment opportunities should be provided during and after plant construction.
06/08/2019	Moza Ganja Sidhu Akhter Public School	07	15	• Provision of alternative livelihood opportunities • Community consultations deemed necessary to satisfy the communities with regards to land acquisition, compensation and other assistance, and livelihood restoration.
06/08/2019	Mouza Ganja Sindhu Dera Haji Rafaqat	05	0	• The resettlement issue needs to be handled carefully and diligently; the affected persons need to keep in the loop to understand their apprehensions
07/08/2019	Akhtar Public School	0	13	• Loss of livelihood as no such other source of income generation in the area. • The government needs to provide alternate sources of income, especially to the farm laborers.
08/08/2019	Stakeholders Workshop at LWASA Training Center, Gulshan-e-Ravi, Lahore	71	28	• LWASA did not conduct consultations prior to the planning of the project, as to take willingness of land holders to give their land to LWASA. • The notification of Section 4 was backdated to avoid any objections being raised by affected people. No communication of the intention to acquire the land was made, notifications were not delivered to land holders and no public advertisements were made. • LWASA is acquiring land for some other purpose under the guise of the SWTP and thus is planning to deprive the owners of their valuable land for a fraction of the market value. • The land selected is semi-urban land and is just off the Ring Road and is rapidly developing and therefore, the water SWTP should be taken away further in rural area, further away from the city. • The construction of SWTP in village Gnaja Sindhu would thus radically change the nature of the land use and would change the face of the area. • The acquisition of land would deprive the landholders of their livelihoods and inheritance. There are residential schemes a few hundred meters away from the SWTP proposed site and a number of industries also situated there. A large Rangers Complex has also been completed near the site and it houses hundreds of people. Therefore, the land acquisition cost as per market rate would be very high.

Date	Location	Participants		Key Concerns
		Male	Female	
				• It was suggested that the project should acquire land that was proposed for "River Ravi Front Urban Development Project" (a project proposed in 2014 for building a 36 Km long, 1 Km wide, and 15 m deep concrete channel, run from the siphon of the Ravi River from BRBD canal to Maraca area to develop a new city on its banks that would have green belts, parks and recreational area • The government owned land should be used for the construction of SWTP, such as dry bed of River Ravi or Jallo Park. • Highly excessive land acquisition of over 300 acres for the SWTP is being acquired whilst the project currently only requires 30 acres of land to begin with. • The landless agriculture laborers both permanent and seasonal would lose their livelihood. How would they be compensated? • On the basis of the PC 1 project cost estimation, land cost had not been included in the total cost as the total cost of land acquisition as per market rate which would be much higher. • The severance impact would be great as there are a number of people whose land would be divided into parts and would not be viable for farming. Particularly, the new raw water channel would destroy the integrity of land holdings and mutilate khasras, rendering a lot of land useless for future use • Has the no project option been considered and what were the project findings. • What alternative options were considered for the SWTP sites? • Huge quantities of sludge would be generated. Will LWASA treat it and here would the treatment be done? • Water metering should be considered by LWASA to curb water losses. • An open channel would be receptor of water borne diseases, especially dengue in the area. • The project design needs to be reconsidered as the stakeholders advised that the project design should look into developing an underground water channel for convenience of raw water from BRBD canal to SWTP site rather than acquiring prime agriculture land and causing huge severance impact for the cultivators and their labour force.
09/08/2019	Mouza Ganja Sindhu Factory	05	0	• Need to provide alternate income opportunities for women where they can work without any cultural and social limitations.

Date	Location	Participants		Key Concerns
		Male	Female	
09/08/2019	Mouza Ganja Sindhu Akhtar Public School	06	0	• The concerns of the local people need to be addressed and alternative sources of income, as per existing knowledge and skills need to be provided.
09/08/2019	Mouza Ganja Sindhu Christian Mohallah (neighborhood)	0	04	• Livelihoods of affected religious minority should be kept in mind whilst planning the livelihood restoration program under the project
09/08/2019	Akhtar Public School	5	0	• Extremely opposed to the construction of treatment plant in the area. • Affected households would be deemed landless after the construction of SWTP.
09/08/2019	Dera Haji Rafaqat	6	0	• Extremely opposed to the development of the treatment plant in the area. • They will resist the treatment plant with every possible influence.
09/08/2019	Factory	5	-	• The factories should be saved from demolition as more than 100 workers will lose their source of income, which will have a huge impact on income and livelihoods of the families of factory workers.
10/08/2019	Akhtar Public School	4	0	• Loss of livelihood due to loss of land. • Alternative sources of income should be introduced by the government, as to enable the local population especially poor to be able to earn the same level of income.
10/08/2019	Christian Town	0	3	• Livelihood dependent on land use, alternative sources of income need to be provided.
16/08/2019	Mouza Ganja Sindhu Dera Haji Saleem	06	13	• The project should find an alternative construction site. • Keep the affected people in the loop and updated about final decisions of the government to acquire their land.

Date	Location	Participants		Key Concerns
		Male	Female	
16/08/2019	Ganja Sindhu	05	02	• Loss of livelihood would be a major impact; the government should provide alternate income sources to the poor.
29-09-2019	Jhandialya (House of M. Ramzan) Baseen Dera Haji	4	18	• Land owner ladies work in their own fields and also joined by female workers from other villages. They are happy about the project as this will be beneficial for them. • Only a primary school is there and kids need to go to Jallo More after primary. • No medical facility available and people need to go Ghurki or Baseen in case of any illness. • The ladies travel for work will get affected. • Some concerned if they can get the same size land with the money they are getting from govt. for their existing land. • The land is only way of their earning.
29-09-2019	Baseen Dera Haji Nazeer	3	5	• Their land can be divided across the canal • People from outside can come to take a bath in canal on which they don't have any control, which will be an issue for ladies to go out in fields for work • In current situation kids can play outside without any issue but after the project there may be security risks due to outside people visiting the
29-09-2019	Liaquat Dogar House, Ganjay Sindhu	5	2	• Construction work will increase air pollution, which will be very dangerous for the health of villagers, and lungs problems are already common in the area due to existing chemical factory, and it is neglected by the people of the village because they do not know the reasons and they are not aware about air pollution.
29-09-2019	Dera Liaquat Dogar, Ganjay Sindhu	3	2	• Women who are working as laborer do not have other skills to work somewhere else they can just work in the field for vegetable picking and other farming related tasks. • It will be very difficult women of the area to move outside the village or far from their houses to work. • Old and poor women also work on this land they can't do any other work and move outside the village. • It will be costly for them to shift outside the village.

Date	Location	Participants		Key Concerns
		Male	Female	
				• Govt. should provide them enough money so they can shift to other reasonable place to work or any other opportunities to earn money.
29-09-2019	Affected land of Arshad Maqbool Natt	2	2	• Women and men get good wages by working on the affected land. • Their land owners give them money in advance whenever they need and they take care of their worker's needs. • Poor people will suffer if the land will be acquired from their owners. • They get free vegetables from their land owners which is money saving for food expenses. • Construction work will also disturb privacy of the female, now they have trust on their community, and they can let their girls move in the village easily. • Labour for the construction work will not be trust worthy and labour crimes will be occurred. • It will be safer if they hire labour from the village.
29-09-2019	Chaand ka Dera, Jandiala	3	2	• Affected women work on their own land and other women come from outside. • Women who earns from affected land were worried that they will lose their source of income. • Their lands will be severed, water channels will cut off from severed part of the lands • The mobility of villagers will be affected due to severance impact • Government should build the bridges to mitigate the impacts on access
29-09-2019	Baseen Village	1	4	• Privacy will be disturbed when construction work will be started, and it will be threatening for their children because they will not be safe if they go outside the house during this construction work. • Women privacy will also be affected because of movement of outsiders. • The village land will be divided into two parts

6.12 Consultations with Secondary Stakeholders

341. Secondary stakeholders include Private Community, businessmen and Environmental Experts from different sectors.

6.12.1 Comments and Responses from Consultation with Private Community Stakeholders and Environmental Experts

342. There are many important reasons to establish and maintain good working relationships with Private Community, businessmen and environmental experts at different levels, and to keep them informed of the project's activities and get their expert opinion about the anticipated impacts of the project and their solutions. Environmental Experts from different universities and other sectors were briefed about the project and interviewed to get their expert opinion. Following experts were interviewed for the expert opinion regarding proposed project.

Table 6.6 List of Experts Interviewed for Expert Opinion

Name	Expertise
Dr. Kausar Jamal Cheema	Senior Environmentalist
Dr. Asim Mahmood	Waste water Expert
Dr. Aleem Chaudhary	Biological/Ecological Expert
Dr. Ali Kamran	Solid Waste Expert
Mr. Masood Ahmad	OHS Expert
Mr. Waqar Ahmad	Hydrologist
Dr. Fareeha Arooj	Waste Water Expert

6.12.1.1 Tabulated Summary of Comments and Responses from Consultation with Private Community Stakeholders and Environmental Experts

Table 6.7 Summary of Consultation with Private Community Stakeholders and Environmental Experts

Name/Date /Location/Timing	Summary of Discussion	Input/ Recommendation
Dr. Kausar Jamal Cheema 25-07-2019 Global ECO Labs, Lahore	• Dr. Cheema, shared information and strategies regarding Environmental and Social Impact Assessment of the proposed project. • She discussed and gave expert opinion for Site Suitability and Site Alternatives, Environmental Monitoring Parameter, monitoring frequency, Expert Opinion in Social Economic Surveys, Safety Parameters and Protocols, Biodiversity of the Area and Advance treatment technologies. Consensus • ESIA would be shared with the her. The ESIA would be available in public domain and all the information would be available to examine the project and its suitability expects confidential information. Project alternatives will be considered, and impact would be minimized.	• Dr. Cheema was much concerned about detailed impact assessment of the project, covering each and every aspect. • She emphasized on selection of best suitable site, having minimum environmental and social impacts. She was of the view that biodiversity of the area should not be damaged and proper management should be done. • She proposed that environmental monitoring (air, water, soil etc.) should be done on regular basis. • She said that SOP's for each and every practice should be designed and implemented throughout the project phase. And also said that proper environmental and safety audits should be conducted

Name/Date /Location/Timing	Summary of Discussion	Input/ Recommendation
		• She said that latest technologies with better result should be used in the project, environmental and safety trainings should be arranged for the workers to avoid any mishap.
Dr. Asim Mahmood 25-07-2019 Global ECO Labs, Lahore	• Dr. Asim Mahmood shared information regarding Environmental Impacts of the proposed project and also discussed Mitigation measures of expected impacts. • He also discussed and share guidance on Cumulative Environmental Impact Assessment of the project. Consensus • ESIA would be shared with him. The ESIA would be available in public domain. Project alternatives will be considered, and impact would be minimized. Latest technology will be preferred for water treatment and throughout the project.	• He proposed latest Water and Wastewater treatment methodologies for the proposed project. • He suggested that environmental monitoring of the proposed project area should be done regularly, and all parameters must be covered to avoid any negative impacts on human health.
Dr. Aleem Chaudhary 25-07-2019 Senior Environmentalist and Biodiversity Expert	• Dr. Aleem Chaudhary, shared information regarding biodiversity of the area. • He also joined us in field visit and assessed the project area. He discussed and shared information regarding local, native and migratory bird species, animals present in the area and also discussed their breeding season and patterns.	• He favours this project due to provision of cleaner and cheaper drinking water to the residents of the area and also because this will help in recharging depleting ground water.

Name/Date /Location/Timing	Summary of Discussion	Input/ Recommendation
	• He also shared information regarding agricultural activities of the area and major crops present in the area and expected damage to these crops and other biodiversity in case of this project. Consensus • ESIA would be shared with the him. The ESIA would be available in public domain. Project alternatives will be considered, and impact would be minimized. No hunting policy and wildlife protection mechanism will be adopted.	• He suggested/recommended that policy and rules must be established to avoid any damage to the local environment. • He also endorsed that No Hunting Policy should be enforced to avoid any damage to animals/wildlife. • He also recommended that minimum area should be used, and maximum area should be available as Green Areas.
Dr. Ali Kamran 25-07-2019 Global ECO Labs, Lahore	• Dr. Ali Kamran, shared information regarding nature of industries in project area, their waste, disposal pattern and related pollution. He shared information regarding sustainable solution of managing waste. • He further added that such projects of public welfare should be installed and managed in effective ways. Consensus • The ESIA would be shared with him and will be available in public domain. PA detailed EMP will be established and implemented to minimize the negative impacts. Advanced waste management practices would be used.	• He shared ideas how to manage solid waste generated from the proposed activity in construction phase as well as operational phase

Name/Date /Location/Timing	Summary of Discussion	Input/ Recommendation
Muhammad Waqar 25-07-2019 College of Earth and Environmental Sciences, University of The Punjab, Lahore	• Mr. Waqar Ahmad, shared information regarding depleting water level of Lahore, water inflows and outflows of BRBD canal, flood probability in River Ravi and its adjacent areas. Consensus • The ESIA would be shared with him and will be available in public domain. Project alternatives will be considered, and impact would be minimized. A detailed EMP will be established and implemented throughout the project construction and operation. Latest technology will be preferred for water treatment and throughout the project.	• He strongly endorsed development of large-scale clean water drinking supply project and said this will help a lot in controlling outbreak of disease. • He further added that, renewable and environmental measures should be taken to preserve the environment and sustainable development should be our core value.
Dr. Fareeha Arooj 08-08-2019 Department of Environmental Sciences, UVAS, Lahore	• Dr. Fareeha Arooj, shared information regarding treatment technologies, alternative sites and best suitable and available treatment technology • She also discussed about the associated and expected impacts and said that mitigation measures and management plans should be there. Consensus • The ESIA would be shared with her and will be available in public domain. Project alternatives will be considered, and latest technologies will be	• She suggested that Ozonation should be preferred over chlorination due to the production of by-products. • She suggested that membrane technology should be used to provide safer and cleaner drinking water to the residents of Lahore. • She also suggested that water quality of the BRBD canal should be monitored on regular basis and detailed assessment should be

Name/Date /Location/Timing	Summary of Discussion	Input/ Recommendation
	used. Detailed environmental management plan will be established and implemented.	done to get idea about the most suitable treatment option

343. Pictorial Profile of Consultation with Environmental Experts and Feedback forms are attached as **Annexure-Q** and **Annexure-R** respectively.

6.12.2 Tabulated Summary of Comments and Responses from Stakeholder Engagement Workshop

Table 6.8 Summary of Comments and Responses from Stakeholder Engagement Workshop

Name/Date /Location/Timing	Summary of Discussion	Input/ Recommendation
Rao Zakariya 08-08-2019 WASA Training Center, Lahore 10:00AM to 02:30 PM	• A detailed discussion regarding the proposed project was conducted at workshop arrange by LWASA to inform the local community and to get opinion and recommendations from different departments, sectors, educational institutions, academic experts, environmental experts etc. • One member from engineering team shared the technical information, one member from environmental team shared information regarding expected impacts of the proposed project and mitigation measures to deal with impacts. • One member of social team shared all the information regarding social economic conditions of the area, concerns of the effected people.	• He suggested and recommended alternate site • He opposed the current selected site • Discussed expected disasters and life risk to the locals
Dr. Sajad 08-08-2019 WASA Training Center, Lahore 10:00AM to 02:30 PM		• Expected risk of dengue • Dengue Controlee measures
Mr. Mansoor 08-08-2019	Consensus: • After a long discussion and answering all the answers and valid objection, it was concluded that proposed project will improve the quality of life of the area.	• Excessive Land Requirement and purchasing • Site/Land Alternative • Requested realistic picture/current situation of the site • Technical aspects of the project

WASA Training Center, Lahore 10:00AM to 02:30 PM	• Genuine concerns of the effected communities and recommendations from the environmental experts were noted and it was assured that all these concerns will be observed, and efforts will be made to minimize any possible impacts.	
Khalid Usman 08-08-2019 WASA Training Center, Lahore 10:00AM to 02:30 PM		• Quoted Karachi Surface Water Treatment Plant and its quality • And shared information regarding water related diseases • Management Plan
Muhammad Ashfaq Sandhu 08-08-2019 WASA Training Center, Lahore 10:00AM to 02:30 PM		• Mr. Ashfaq is land effete and requested for reconsideration project site
Mansoor Ul Haq 08-08-2019		• He said that Child Labour should be strictly banned • Locals should be preferred for jobs

WASA Training Center, Lahore 10:00AM to 02:30 PM		
Fawad Shafeeq 08-08-2019 WASA Training Center, Lahore 10:00AM to 02:30 PM		• He is a land effete and said that government land available in nearby areas should be used instead of clearing agricultural and private land

6.13 Addressal of Stakeholder Concerns

344. The issues and concerns of the APs and other stakeholders were documented and shared with LWASA for follow up actions. The LWASA has developed a set of actions to address the concerns of affected persons.

345. The addressal of APs and stakeholder concerns and suggestions has been incorporated in the ESMP, RP and GAP to the extent possible, and will be implemented as an integral part of the LW&WM Project activities. The concerns and issues raised by women and other stakeholders have been adequately considered in the provision of resettlement and rehabilitation packages for the male and female APs and about safety and security of women and children in ESMP. RP has been prepared to compensate APs sufficiently and promptly.

346. The ES staff of PMU, PMC and EPC Contractor will consult APs and other relevant stakeholders at the stage of detailed design during the process of updating the RP, and develop mitigation measures against identified impacts and corrective actions to address concerns of APs and other stakeholders.

347. The SEP will be updated at the stage of the detailed design to include and enable documentation of all consultation activities undertaken and proposed (Monitoring), and reviews of appropriateness and effectiveness of methods used in engaging stakeholders (Evaluation).

6.14 Continued Stakeholders Consultation and Participation During Implementation Stage

348. A continued process of consultation and participation of stakeholders particularly with AP will be followed to ensure transparency in implementation of RP and to keep the stakeholders informed, will continue receiving and incorporating their feedback at various stages of the Project implementation. It will provide a good measure to improve the social acceptability of the project and ensure effective participation of the stakeholders especially APs in the process of RP implementation, and the Project. Public consultation will assist obtaining cooperation from informed APs and other stakeholders, to avoid cost and time in dealing with complaints/grievances. As per the requirement of the AIIB ES Policy, a strategy for public consultation during implementation of the Project works is delineated. Table 5.2 provides a consultation plan to be implemented by the LWASA during the detailed design and updating of RP and ESIA, implementation of ESMP and RPs, and Project construction phase through ESS of PMU/PMC. The PMU will continue consultants by following ESP of AIIB, by taking following steps:

1. The LWASA through the ESS of PMU and the Contractor staff will keep a close liaison with the stakeholders including women, particularly with AP; record and address their concerns relating to the implementation of RP and construction related works.
2. The project will engage a female social staff to ensure on-going consultations with women and address their issues, and to ensure that women and girls are equally benefitted from the project. During implementation of the RP, the LWASA and PMU will take into account the women and young girl's views and priorities, through planned consultations.
3. Consultations will be held with male and female members of AHs for formulating and implementing detailed livelihood restoration activities involving activities related to improving access to project-related jobs, training, development and other related activities).
4. Organize public meetings particularly with APs and AHs and appraise them about implementation progress of RP, particularly payment of compensation, R&R assistance, and other social activities;
5. Make extra efforts to ensure that vulnerable APs understand the process and their entitlements, and mitigation measure will be taken by the project authorities to address AP and other stakeholder concerns, in accordance with the ESP of AIIB.
6. Detail and outcomes of all consultation activities will be included in Bi-Annual and Annual Monitoring Reports.
7. Disclose all monitoring reports of the ESMP and RP implementation in the same manner as that of the RP at LWASA and AIIB websites and to the AP, and other stakeholders.

CHAPTER 07

7 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

7.1 Introduction

349. This section discusses the project's potential impacts on the area's physical and biological resources along with socioeconomic conditions and, where appropriate, identifies mitigation measures that will lessen, if not eliminate, the potential adverse impacts.

350. The assessment carried out in this section is based on project potential positive and negative impact on overall environmental and social receptors present within the project area or in its immediate vicinity.

7.2 Positive Impacts (Package 03 and 04)

351. The positive impacts associated with the proposed project are discussed below:

7.2.1 Improved Health Status

352. The project will provide sustainable and clean water source in serving areas. Access to clean water will improve the general health status of the area and reduce exposure to waterborne diseases.

7.2.2 Continuous Water Availability

353. The construction of water storage tanks will balance the water shortage in distribution network and ensure long pumping periods and sufficient availability of water all the time.

7.2.3 Reduction in Non-Revenue Water (NRW)

354. The project will improve accessibility and efficiency of water supply services by minimizing the chances of water losses occurring due to water leakages though old pipes and illegal house connections.

355. The project will maximize the efficiency of the water supply system by creating self-sustaining Distribution Management Zones (DMZs) and Distribution Management Areas (DMAs), acting as Cost Centres. Project will also provide a robust water measurement and monitoring system at the production, distribution and consumer end to minimize Non-Revenue Water (NRW).

7.2.4 Reduced Water Consumption

356. Unmetered service with tariffs below costs means that the connected wealthy receive the highest subsidies. The under-pricing of water creates regressive water subsidies that benefit wealthy households who are connected first and who use more water than poor households. The proposed project will sensitize all consumers to use less water as LWASA

will charge them according to their consumption. Furthermore, the project will also reduce burden on the use of groundwater resource, resulting in extended lifetime of aquifer.

7.2.5 Creation of Market for Material

357. There will be need of large quantities of materials required for construction and operation of the project. The majority of which will be sourced locally and from surrounding areas. This will eventually offer a ready market for suppliers in and outside the project area.

7.2.6 Employment Generation

358. Both skilled and unskilled labour will be employed in both phases of the project i.e. construction and operation. Women in the neighbouring villages to the project sites can initiate small income generating activities such as preparing and selling of food and other basic goods to the construction workers. This will have an overall impact on reducing poverty and gender empowerment. Increased income streams in the communities will host the project and upgrade socio-economic status of their families.

7.2.7 Reduced Burden on Women

359. The Project will provide relief, social burdens imposed on women as they are the caretakers of their sick children and elderly groups.

7.2.8 Positive impact on Climate

360. The proposed project will have positive impact on climate as presently there are 60 tube wells in the areas using approximately 13.75MW of power. However, the proposed SWTP will only require 4 MW to operate. The detailed calculations are attached as **Annexure- U.**

361. In order to calculate greenhouse gases (GHG) potential of the proposed project on climate, Scope 2 emissions as per IPCC[38] guidelines of 2006, were accounted using the following formula:

$$\text{Emissions}_{GHG,\,fuel} = \text{Activity Data}_{(KWH)l} \times \text{Emission Factor}_{GHG,\,fuel}$$

362. As per the calculations, it was found that GHG potential of 60 tubewells is around 6.28 tons of CO_{2eq} per hour. However, SWTP only contributes 1.828 tons of CO_{2eq} per hour in the atmosphere.

- [38] Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, 2006

7.3 Scoping of Anticipated Negative Impacts

363. **Table 7.1** and **7.2** provides summary of all anticipated impacts associated with the Package 03 and 04 respectively. The detailed methodology of impact assessment is provided in **Chapter 1.**

Table 7.1 Summary of Anticipated Negative Impacts

(Package 03)

Nuisance and Health Effects on Human due to Dust Emissions						
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**	
3	2	3	3	11	High	
Human Receptors		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	Impact Significance	Residual Impact	
Presence	**Resilience**					
2	2	4	Medium	Major	Minor	
Dust Emission Impact on Flora and Crops						
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**	
3	2	1	3	9	High	
Biological Receptors		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	Impact Significance	Residual Impact	
Presence	**Resilience**					
3	2	5	High	Major	Minor	
Nuisance and Health Effects on Human due to Exhaust Emissions						
Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude	
3	2	3	2	10	High	
Human Receptors		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**	
Presence	**Resilience**					
2	2	4	Medium	Major	Minor	
Exhaust Emissions Impacts on Flora and Crops						
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**	
2	3	2	2	9	High	
Biological Receptors		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**	
Presence	**Resilience**					
3	2	5	High	Major	Minor	
Increased Water Demand						

Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude
2	3	3	3	11	High

Physical Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
3	3	6	High	Major	Minor

Soil Loss Resulting from Erosion

Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude
2	2	2	2	8	Medium

Physical Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
2	2	4	Medium	Moderate	Minor

Effects of Noise and Vibration

Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude
2	3	2	3	10	High

Human Receptor		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
3	3	6	High	Major	Minor

Improper Management of Solid and Liquid Waste

Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude
1	3	2	3	9	High

Human Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
3	2	5	High	Major	Minor

Impact on Flora

Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude
3	2	1	3	9	High

Biological Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
3	1	4	Medium	Major	Minor

Impact on Crops

Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude

3	2	2	3	10	High

Biological Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
3	3	6	High	Major	Minor

Impact on Aquatic Habitat

Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude
2	2	2	2	8	Medium

Biological Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
2	2	4	Medium	Moderate	Minor

Impact on Area Wildlife

Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude
1	2	2	2	7	Medium

Biological Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
1	1	2	Low	Minor	Negligible

Greenhouse Gases and Climate Change

Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude
3	3	2	3	11	High

Human Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
3	1	4	Medium	Moderate	Minor

Impact of Fire Incident

Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude
1	1	1	3	6	Medium

Human Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
3	3	6	High	Major	Minor

Exposure of Workers to Health and Safety Hazards						
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**	
1	2	2	3	8	Medium	
Human Receptor		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**	
Presence	**Resilience**					
3	3	6	High	**Major**	Minor	
Exposure of Residents to Health and Safety Hazards						
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**	
1	1	3	3	8	Medium	
Human Receptor		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**	
Presence	**Resilience**					
3	2	5	High	Major	Minor	
Impact of Traffic Congestion						
Event Magnitude		**Receptor Sensitivity**		**Impact Significance**	**Residual Impact**	
High		High		Major	Minor	
Impact on Affected People due to Land Loss and Livelihood						
Event Magnitude		**Receptor Sensitivity**		**Impact Significance**	**Residual Impact**	
High		High		Major	Moderate	
Child Labour Impact						
Event Magnitude		**Receptor Sensitivity**		**Impact Significance**	**Residual Impact**	
Low		Low		Negligible	Negligible	
Influx of Labour						
Event Magnitude		**Receptor Sensitivity**		**Impact Significance**	**Residual Impact**	
Gender-based Violence (GBV)						
Event Magnitude		**Receptor Sensitivity**		**Impact Significance**	**Residual Impact**	
Medium		High		Major	Minor	
Impact on Cultural and Archaeological Assets						

Event Magnitude	Receptor Sensitivity	Impact Significance	Residual Impact
Low	Low	Negligible	Negligible

Table 7.2 Summary of Anticipated Negative Impacts

(Package 04)

Nuisance and Health Effects on Human due to Dust Emissions					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
2	3	2	3	10	High
Human Receptors		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**
Presence	**Resilience**				
3	3	6	High	Major	Minor
Dust Emission Impact on Flora					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
2	2	2	1	7	Medium
Biological Receptors		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**
Presence	**Resilience**				
3	1	4	Medium	Moderate	Negligible
Nuisance and Health Effects on Human due to Exhaust Emissions					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
2	2	2	3	9	High
Human Receptors		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**
Presence	**Resilience**				
3	3	6	High	Major	Minor
Exhaust Emissions Impacts on Flora					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
2	3	2	2	9	High
Biological Receptors		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**
Presence	**Resilience**				
3	2	5	High	Moderate	Negligible
Increased Water Demand					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**

2	3	2	2	9	High

Physical Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
2	3	5	High	Major	Minor

Soil Loss Resulting from Erosion					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
1	1	2	1	5	Medium

Physical Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
1	1	2	Low	Minor	Negligible

Impact of Waste Disposal in Drainage Channels					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
2	2	1	3	8	Medium

Physical Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
3	3	6	High	Major	Minor

Effects of Noise and Vibration					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
2	2	2	3	9	High

Human Receptor		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
3	3	6	High	Major	Minor

Improper Management of Solid and Liquid Waste					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
1	2	3	3	9	High

Human Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	Resilience				
3	3	6	High	Major	Minor

Impact on Flora					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
1	2	2	1	6	Medium

Biological Receptors		Receptor Sensitivity	Receptor Sensitivity Ranking	Impact Significance	Residual Impact
Presence	**Resilience**				
3	1	4	Medium	Moderate	Negligible
Impact on Wildlife					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
1	1	2	1	5	Medium
Biological Receptors		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**
Presence	**Resilience**				
1	1	2	Low	Minor	Negligible
Greenhouse Gases and Climate Change					
Extent/Scale	Frequency	Duration	Intensity	Score	Event Magnitude
3	3	2	3	11	High
Human Receptors		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**
Presence	**Resilience**				
3	1	4	Medium	Moderate	Minor
Exposure of Workers to Health and Safety Hazards					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
1	2	2	2	8	Medium
Human Receptor		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**
Presence	**Resilience**				
3	1	4	Medium	Moderate	Minor
Exposure of Residents to Health and Safety Hazards					
Extent/Scale	**Frequency**	**Duration**	**Intensity**	**Score**	**Event Magnitude**
2	2	2	3	9	High
Human Receptor		**Receptor Sensitivity**	**Receptor Sensitivity Ranking**	**Impact Significance**	**Residual Impact**
Presence	**Resilience**				
3	3	6	High	Major	Minor
Traffic Congestion Impact					

Event Magnitude	Receptor Sensitivity	Impact Significance	Residual Impact
High	High	Major	Minor
Child Labour Impact			
Event Magnitude	**Receptor Sensitivity**	**Impact Significance**	**Residual Impact**
Low	Low	Negligible	Negligible
Influx of Labour			
Event Magnitude	**Receptor Sensitivity**	**Impact Significance**	**Residual Impact**
Medium	High	Major	Minor
Gender-Based Violence			
Event Magnitude	**Receptor Sensitivity**	**Impact Significance**	**Residual Impact**
Medium	High	Major	Minor
Impact on Utilities			
Event Magnitude	**Receptor Sensitivity**	**Impact Significance**	**Residual Impact**
Medium	Medium	Moderate	Negligible
Impact on Cultural and Archaeological Assets			
Event Magnitude	**Receptor Sensitivity**	**Impact Significance**	**Residual Impact**
High	High	Major	Minor

7.4 Anticipated Environmental Impact

364. The anticipated environmental impacts of the project are categorized into four phases:

- Design/Pre-Construction Phase
- Construction Phase
- Operational Phase
- Decommissioning Phase

7.4.1 Anticipated Impacts during Design Phase (Package 03)

365. Anticipated impacts which may occur during design phase of the project are as follows:

7.4.1.1 Inappropriate Design of Water Intake Channel

366. Presently, fish species found in BRBD canal includes: Rohu, Thela and Malli. Rohu and Thaila are very popular and considered an excellent food. Due to high demand and price

in market, it is commonly cultured in BRBD. Whereas, Malli has lower market value as it is carnivore and feeds on dead body. All these species are common and can be easily found in fresh water bodies and rivers of Pakistan. The common breeding season of these species start from April and ends in August. They generally spawn during the monsoon season and reach maturity within 2 years.

367. Inappropriate design of water intake channel will interfere with fish and other aquatic organisms (in the main canal) preferably during their in peak breading seasons (April to August) thus affecting their uniform movement across downstream and upstream.

368. In addition, poor designing of water tanks and other allied facilities can rupture during natural disasters such as earthquakes or floods and can cause serious damage to the plant property as well as mixing of large amount of clean water with floods consequently causing spoiling of portable water

Mitigation Measures

- Install suitably designed fish screens at the intake channel to protect fish population of BRBD Canal. Screens should be angled to the incoming water current to guide fish along the face of the screen to an exit at the downstream end which returns them to the canal
- The design of the water tank should adopt a number of measures to avoid unpredictable consequences of natural disasters. The tank should be designed as a semi underground structure; since the area is considerably flat and does not require elevated tanks for gravity flows. This is a significant safety measure when considering the risk of seismic activities
- The tank structure should be designed to withstand earthquake loads, and should be provided with sufficient earth retaining structures, as well as enough considerations to withstand seismic behaviour of the liquid.
- The structure should be closed one and elevated by nearly two (02) meters above the ground, which is also important to prevent water from mixing with floods[39].

7.4.1.2 Involuntary Resettlement of Package (03)

369. The involuntary resettlement impacts of SWTP and raw water Intake Channel involve: (i) permanent loss of 324 acres (131 hectares) of private agriculture land by 110 households (HHs) with 51 female and 114 male titleholders, out of which 2 AHs are involved in sharecropping, (ii) loss of agriculture land by 4 AHs of agriculture tenants; (iii) loss of an orchard at 2 acres (0.8 hectare) with 343 guava trees (iv) loss of 118 other different types of

[39] World Bank Group, August (2017). ESIA and ESMP – Baghdad Water Supply and Sewerage Improvement Project

fruit trees (v) loss of crops on 321 acres of land, (vi) loss of 481 wood trees; (vii) demolition of 11 structures that including one temporarily non-operational steel casting factory; one cattle cum dairy farm with residence of farm labour; 7 farm houses having residences of 9 HHs of permanent agriculture laborer, one room built for tube well, and one under construction dairy farm. (viii) The loss of farm houses will cause physical displacement of 9 HHs. These farm houses are also used for storage of agriculture inputs, agriculture produce and farm implements; (ix) cause loss of income and livelihood by 50 HHs of permanent agriculture laborer; (x) loss of income and livelihood by 4 households of seasonal labor contractors (2 female and 2 male contractors); (xi) approx. 50 households of 84 female and 38 male daily wage seasonal agriculture laborer; (xii) dismantling of 15 tube well boreholes and tubes and their relocation; (xiii) partial loss and severance of two formal roads and a number of informal access ways of villages; (xiv) rehabilitation of electricity transmission lines; (xv) impact on the quality of two main road due to transportation of construction machinery and material.

Mitigation Measures

370. Two Resettlement Plans (RP) for LWWM Project has been developed based on AIIB ESP. The resettlement policy for the LWWM Project evolved after a number of consultation meetings with APs and other stakeholders. By following the objectives and principles of AIIB, the core involuntary resettlement principles for this project are:

- land acquisition, and other involuntary resettlement impacts will be avoided or minimized by exploring all viable alternatives of the project design;
- where unavoidable, time-bound Resettlement Plan (RP) will be prepared and APs will be assisted in improving or at least regaining their pre-project standard of living;
- provision of income restoration and rehabilitation to agriculture tenants, vendors, employees of shopkeepers etc.;
- consultations with APs on compensation and resettlement options, disclosure of resettlement information to APs, and participation of APs in planning and implementation of project will be ensured;
- payment of compensation to APs including non-titled persons (e.g., informal dwellers/squatters and encroachers) for acquired assets at replacement rates;
- vulnerable groups and severely affected displaced persons will be provided special assistance;
- payment of compensation and resettlement assistance prior to the construction contractor taking physical acquisition of the land and prior to the commencement of any construction activities; and

- establishment of appropriate institutional, grievance redress, internal and external monitoring and reporting mechanisms.

7.4.1.3 Visual Amenity

371. The overhead power transmission line that transport electricity from Momin Pura grid station to the SWTP may be visually intrusive and undesirable to local residents.

Mitigation Measures

- Site power lines, with due consideration to landscape views and important environmental and community features
- Change the alignment of transmission line (if possible) as its passing through the densely populated

7.4.1.4 Electromagnetic Fields

372. Electromagnetic fields (EMF) are invisible lines of force emitted by and surrounding any electrical device (e.g. power lines and electrical equipment). Electric fields are produced by voltage and increase in strength as the voltage increases. Magnetic fields result from the flow of electric current and increase in strength as the current increases.

373. Both electric and magnetic fields decrease rapidly with distance. Power frequency EMF typically has a frequency in the range of 50 – 60 Hertz (Hz) and is considered Extremely Low Frequency (ELF).[40]

374. The proposed power transmission lines will be laid down in densely populated area. There is public and scientific concern over the potential health effects associated with exposure to EMF (not only high-voltage power lines, but also from everyday household uses of electricity), there is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines and equipment[41]. However, while the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern.[42] **Table 7.3** lists exposure limits for general public exposure to electric and magnetic fields published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Table 7.3 ICNIRP Exposure Limits for General Public Exposure to Electric and Magnetic Fields

Frequency	Electric Field (V/m)	Magnetic Field (μT)

[40]National Institute of Environmental Health Sciences (2002)

[41] International Commission on Non-Ionizing Radiation Protection (ICNIRP) (2001); International Agency for Research on Cancer (2002); U.S. National Institute of Health (2002); Advisory Group to the Radiation Protection Board of the UK (2001), and U.S. National Institute of Environmental Health Sciences (1999))

[42] U.S. National Institute of Environmental Health Sciences (2002)

50 Hz	5000	100
60 Hz	4150	83

Source: ICNIRP (1998): Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)[7].

Mitigation Measures

- LESCO should evaluate potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP)[4,5]. Average and peak exposure levels should remain below the ICNIRP recommendation for General Public Exposure[43]
- Avoid Installation of transmission lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g. schools or offices)
- Assessment of EMF levels to determine the expected level to remain within the recommended exposure limits, in case of non-compliance, application of engineering techniques should be considered to reduce the EMF produced by power lines. Examples of the techniques used include:
  - Shielding with specific metal alloys
  - Burying transmission lines
  - Increasing height of transmission towers
  - Modifications to size, spacing, and configuration of conductors

7.4.1.5 Electrocution Hazard

375. The height of transmission towers and the electricity carried by transmission lines can pose potentially fatal risk to birds and bats through collisions and electrocutions.

376. According to baseline data, there are small birds and bats exist within the project RoW i.e. 5.7 km strip from Momin Pura to SWTP, these birds and bats can be get affected if proper measures are not taken during design phase.

377. Avian collisions with power lines can occur in large numbers if located within daily flyways, or if groups are traveling at night or during low light conditions (e.g. dense fog). In addition, bird and bat collisions with power lines may result in power outages and fires.

[43]ICNIRP (1998): Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz).

Mitigation Measures

- Align transmission corridors to avoid critical habitats (e.g. nesting grounds, heronries, rookeries, bat foraging corridors, and migration corridors)
- Distances between conductors (140 cm), and between perch sites and energized elements (60 cm), have to be larger, where species of large birds are present (bat and eagles etc.).

7.4.2 Anticipated Impacts During Design Phase (Package 04)

378. Anticipated impacts which may occur during design phase of the project are as follows:

7.4.2.1 Over Flow and Leakages

379. Inappropriate size and use of low-quality pipes can be burst in the event of natural disaster such as earthquake and can cause urban flooding in the low laying areas such as Fateh Garh and Baghbanpura. The burst or ruptured pipes can also cause water losses in the area and ingress of wastewater into portable water leading to waterborne disease.

Mitigation Measures

- All pipes should be designed with adequate capacity and flow velocity
- Develop a detailed pressure and leakage management plan for the project

7.4.3 Anticipated Environmental During Construction Phase

380. The significant environmental impacts associated with the proposed project construction are discussed as follows.

7.4.3.1 Anticipated Impacts on Physical Environment (Package 03)

7.4.3.1.1 Impacts on Air Quality

381. Construction activities are likely to generate air pollutants which have potential to adversely affect local air quality, and consequently effect on vegetation and human health. Such activities include: dust and exhaust emissions.

7.4.3.1.1.1 Dust Emission

382. The air emissions monitored at construction site of SWTP were found to be compliant with Punjab Environmental Quality Standards (PEQS), as mentioned in **Table 4.8**. However, the construction activities might violate these standards as the they include: site preparation, grading, excavations/earthworks, spoil and stockpiling of materials, construction of foundation, construction machinery (such as asphalt and batching plant) and vehicular movement which will have a potential to generate substantial amount of dust. Other potential source of dust emission could be the material transporting vehicles on unpaved road which is going towards

proposed site of SWTP i.e. Bhaini and Ganj-e-Sindhwan Road. The movement of vehicles on unpaved road will generate kick-off dust emissions and enhance existing dust levels of the area specially during dry weather conditions. Dust emissions generated at SWTP will significantly affect site workers and sensitive receptors present close to proposed site of SWTP such as School located on Ganj-e-Sindhwan Road.

383. The installation of tubular poles for power transmission lines will be done on roads. The dust generated during digging for pole holes will also generate kick off dust and degrade the local air quality of the area.

384. Presently, no major respiratory diseases have been reported in the baseline survey conducted for this project. Whereas, the present project is very much capable of generating the extensive dust emissions from its construction sites. The dust generated during the construction period may cause nuisance and serious health issues such as asthma, tuberculosis and other respiratory issues in the project area.

385. Furthermore, the dust emitted by the construction activities will also impact the existing flora and crop cover of the area adjacent to the project site by inhibiting the ability of the plants and crops to germinate and flourish through the process of photosynthesis, as the dust particles can clog the stomata of the plants and hence cause them to wither and die off.

386. As per the above-mentioned impact assessment, the dust emissions generated during the project construction can be anticipated as Major as shown in Table 7.1.

Mitigation Measures

- The material transportation should be carried out after school timings
- Adequately cover all materials stored or stockpiled at the site
- The surplus water from the construction activities should be used in spraying and sprinkling of the area to reduce the dust emissions
- All roads within the plant site will be paved as early as possible after completion of construction work. Until roads are paved, they should be sprayed with water regularly to prevent dust emission. Other temporary tracks within the site boundary should be regularly sprayed with water
- Aggregate material should be delivered to the batching plant in a damp condition, and water sprays will be applied
- Project traffic should respect a maximum speed limit of 20km/h (as per OSHA standards) on un surfaced roads such as on Bhaini and Ganj e Sindhwan Road
- Use tarpaulins to cover truck carting away the spoils using public road
- Proper planning in transportation of spoil to ensure that number of trips done, or the number of vehicles used is as minimum as possible

- Provide appropriate Personal Protective Equipment (PPE) such as dust mask to the site workers.

Residual Impact

387. With the help of the above mitigation measures, the potential impacts of dust are likely to be adequately addressed and hence the residual impact is likely to be minor in significance, as shown in **Table 7.1.**

7.4.3.1.1.2 Exhaust Emissions

388. Major sources of exhaust emissions may include diesel generators, construction machinery (such as batching plant) and earth moving equipment (fork lifters, excavators and bulldozers etc.) and the vehicles which will be used to transport construction material. Emission from these sources will contribute to increase in concentration of SO_2, NO_2, CO and PM_{10} in the project area, and may increase the global warming potential of the project.

389. Presently, gaseous emissions parameters monitored at the project site showed their compliance with Punjab Environmental Quality Standards (PEQS), **(Refers to Table 4.8**). It can be anticipated that the construction activities might violate these standards and pose threat to the workers and nearby sensitive receptors **(Refers to Figure 4.8).** The continuous exposures to these pollutants can cause nuisance and serious health issues such as respiratory disorder, lung disorder and asthma.

390. Excessive amount of exhaust emissions can cause crop loss as some of the pollutants such as SOx and PM may directly affect soil fertility by introducing toxicity in the soil and disturbing its pH as acid rain leaches out nutrients from the soil which renders it infertile.

***As per the above-mentioned impact assessment, the exhaust emissions generated during the project construction can be anticipated as Major as shown in Table 7.1*.**

Mitigation Measures

- Batching plants and all the associated machinery should be installed with suitable pollution abatement technology such as scrubbers
- Asphalt plant to be used should have zero emission technology
- The batching plant (s), should be installed considering the parameters like; the wind direction and the distance from the nearby sensitive receptors
- Carryout regular monitoring at the site or near the sensitive receptors in order to ensure that ambient air quality remains within the standards limits set by PEQS
- Use environment friendly fuel such as low sulphur diesel for diesel powered equipment and vehicles
- Reduce vehicle idling time to minimum or shut down when not in use

- All construction machinery should be properly tuned and maintained in good working condition in order to minimize emission of pollutants
- Provide personal protective equipment (PPE) such as masks to all site workers.

Residual Impact

391. With the help of the above mitigation measures, the potential impacts of exhaust emissions are likely to be adequately addressed and hence the residual impact is likely to be minor in significance, as shown in **Table 7.1.**

7.4.3.1.2 Impact on Water Resouces and Quality

392. Currently, water is not scarce in the project area. The people in project area are fullfilling their water demands through BRBD canal as well as ground water resource (agriculture and domestic purpose respectively).

Presently, a 3 cusec channel is provided by the irrigation department to nearby six villages i.e. Ganj-e-Sindhwan, Natt Kallan, Dhaewala, Jandiala, Marl Mari and Talwari to meet their demand of water for the irrigational purposes.

393. The construction of the proposed project would require approximately 80 m^3/day[44] amount of water, which will be fulfilled by groundwater resource. This water will be used in concrete and asphalt batching plant, domestic, and cleaning purposes.

394. The extraction of 80 m^3/day of water will cause additional burden on groundwater resource which is currently being used by the residents to meet their domestic water demands. However, no major impact is anticipated on irrigational land.

395. Furthermore, the poor construction management practices during the construction of raw water intake channel can contaminate the surface water quality of BRBD canal, whereas, the groundwater may get contaminate due to improper management of solid waste, sanitary waste and hazardous materials at site. It is anticipated that, approximately, 64 m^3/day[7]amount of waste water will be expected to generate during the whole course of the proposed project.

As per the above-mentioned impact assessment, the impact on water resources is anticipated to be Major during the project construction, as shown in Table 7.1.

Mitigation Measures

- A containerized sewage treatment plant (STP) can be installed for the duration of construction period which may treat water and make it reusable for green areas. After, the construction the same can be utilized for any other project

[44] McGhee, T. J., & Steel, E. W. (1991). Water supply and sewerage (Vol. 6): McGraw-Hill New York.

- The contractor should ensure efficient use of water at site by sensitizing construction staff to prevent irresponsible water usage to reduce pressure on existing local water source.
- The surplus water should be used in spraying and sprinkling of the area to reduce the dust emissions
- To prevent surface/ground water contamination, spillage prevention and control measures should be instituted where hazardous materials are stored in pallets and where possible under cover in secondary containment
- Ample supplies of clean-up materials should be kept and readily accessible at site
- All generated waste from construction site should be disposed off in designated areas to avoid soil contamination/land degradations

Residual Impact

396. After implementation of the above mitigation measures, the significance of residual impacts on water resources is expected to be minor, as shown in **Table 7.1.**

7.4.3.1.3 Soil Erosion

397. The existing soil quality of the area is loamy which is considered best for plant growth.

398. Project construction will require earthworks involving site clearance, grading, topsoil removal and excavation for foundations. The establishment of permanent facilities such as the tanks, treatment works and access roads will result in the permanent loss of topsoils from these sites. Furthermore, the crop clearing will enhance the soil erosion of the area, and the area may become barren or partially infertile due to the erosion/removal of the topsoil during the construction activities.

399. Compaction of soils during construction may occur where the bearing strength is exceeded by the weight of construction vehicles. This is most likely to occur on unsurfaced access roads, such as Gunj e Sidhwan and Bhaini Road which will be subject to repeated vehicle movements during construction phase.

400. Topsoil stripping at the various construction sites also breaks up the soil structure, and this may lead to an increase in erosion (from the topsoil and subsoil piles).This erosion is expected to enhance during the windy and rainy seasons.

As per the above-mentioned impact assessment, the impact on soil resources is anticipated to be Moderate during the project construction, as shown in Table 7.1.

Mitigation Measures

- The risks of soil erosion and degradation can be significantly reduced by adoption of good construction site management practices, such as establishment of vegetative buffer zones, slope stabilization, protection of soil storage areas and use of sediment traps.

- Establish a sufficient vegetation cover to minimize erosion at disturbed areas
- Carryout work under mild weather, avoid working in heavy rains and wind
- Ensure protection of topsoil through separation from subsoil and storage in a manner that, as far as possible, retains the soil structure and seed bank and minimize the risk of topsoil loss. Backfilling should start with subsoil, followed by topsoil
- Adequate reinstatement ensuing construction will help the subsequent re-establishment of vegetation and thereby reduce the risk of soil erosion.
- Restoration of a stable landform that reflects the pre-disturbed condition as this will curtail the risk of preferential erosion and therefore facilitate natural revegetation

Residual Impact

401. After implementation of the above mitigation measures, the significance of residual impacts on soil resources is expected to be negligible, as shown in **Table 7.1.**

7.4.3.1.4 Nosie and Vibration

402. Noise and vibrations are generated during construction using heavy machinery such as bulldozers, excavators, concrete mixers, stone crushers and transportation vehicles. These noise sources will most likely to affect the sensitive receptors present within the proximity of these activities **(refers to Figure 4.8).** Presently, noise monitored in all project sites was assessed to be compliant with Punjab Environmental Quality Standards (PEQS), **(refers to Table 4.8).**

403. Further, no other significant source of noise is currently present near the proposed site of SWTP. However, high noise levels might be generated during construction period of the project and can cause many health problems such as irritability, headache and in severe cases hearing loss in workers and nearby sensitive receptors such as school which is present at a distance of 16 m and residents of Natt Kalan and Ganj e Sidhwan road, located at 90 meters and 30meters respectively from the project site.

404. Moreover, vibrations from machinery and equipment such as hand-held compactors and concrete vibrators can produce easy fatigability and generalized aches in the persons operating these machines.

As per the above-mentioned impact assessment, the noise generated during the project construction can be anticipated as Major as shown in Table 7.1.

Mitigation Measures

- All noisy equipment should be installed and operated as far away from the sensitive receptors as practicably possible

- The contractor should ensure that, the high noisy activities should be carried out after the school timings
- Where exposure to vibration may affect any body part or full body, the Contractor shall ensure that exposures are assessed, eliminated or otherwise controlled
- All installed equipment should have noise insulator
- Contract specifications during construction will specify that the use of equipment likely to generate noise greater than PEQS should not be allowed during construction activities of the project.
- The construction contractor should try to use machinery installed with appropriate noise control devices
- High noise generating construction activities like, compactors etc. should be carried out only during day time
- Appropriate Personal Protective Equipment (PPE) such as ear muffs and ear plugs should be given to the workers exposed to high levels of noise
- All machinery and vehicles to be used at site should be in good working condition and properly lubricated and maintained to keep noise levels within the acceptable range of PEQS

Residual Impact

405. With the help of the above mitigation measures, the potential impacts associated with noise generation are likely to be adequately addressed and hence the residual impact is likely to be minor in significance, as given in **Table 7.1.**

7.4.3.1.5 Solid and Liquid Waste

406. Various types of waste will generate in the course of construction. This include spoil (from excavation), shrubs, stumps and felled trees, packaging wastes (cement bags, plastics, excess rejected material), and liquid waste (washout and washroom waste). Approximately, 227 kg/day and 19 m3/day[45] of solid and liquid waste respectively is expected to be generate from labour camps. However, the process waste from construction can be predicted approximately 560 kg/day and 19 m3/day[8]of solid and liquid waste respectively. Improper management of such waste at construction site and camps will impact the health and safety of the workers, local residents and aesthetics of the area.

[45] Ashraf, U., Hameed, I., & Chaudhary, M. N. (2016). Solid waste management practices under public and private sector in Lahore, Pakistan. Bulletin of Environmental Studies, 1(4), 98-105

The impact of improper solid and liquid waste management during the project construction can be predicted as Major, as shown in Table 7.1.

Mitigation Measures

- The waste that is recyclable or reusable (aluminium or iron bars) should be sold to waste vendors and those that cannot be sold out (broken brick pieces) should be used as a filling material for levelling the depressions, subject to technical feasibility.
- Establish a system for collection, segregation and disposal of waste generated at the site.
- Construction contractor should educate and encourage site workers to practice waste minimization, reuse and recycling to reduce quantity of the waste for disposal
- The contractor should put in place measures to ensure construction material requirements are sensibly budgeted and to ensure that amount of material left at the site is kept nominal
- Bins and skips should be placed within the camp site and should be adequately designed and covered to prevent access to mosquitos and vermin.
- Provide proper toilets at the camp for use by site workers.
- Vehicles and machinery coated with concrete should be washed at a designated place.
- Ensure cleaning of the provided toilet system on daily basis. Install suitably designed septic tank to treat the sewage waste generated from the camp site, after sewage settlement it can be sent to the Local Municipal Authority for final disposal.
- All the generated green waste should be used for composting purpose in the agricultural lands adjacent to the site. However, the wood of the felled trees will be sold in the local market.
- All non-recyclable waste generated at the site should be sold to EPA certified waste vendor such as Global Waste Management, Lahore.
- A detailed Labour Camp Management Plan has been developed for the construction phase of the project (attached as **Annexure-V**)

Residual Impact

407. With the help of the above mitigation measures, the potential impacts associated with waste generation are likely to be adequately addressed and hence the residual impact is likely to be minor in significance, as shown in **Table 7.1.**

7.4.3.1.6 Greenhouse Gases and Climate Change

408. Greenhouse gases (GHG) may generate at site due to anthropogenic activities that will be carried out at the construction site. The concentration of GHG in the atmosphere

beyond the level of naturally occurring concentrations could result in more heat being held within the atmosphere.

409. The GHG emission potential of Package 03 was calculated through Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, 2006[46].

410. As per IPCC 2006 guidelines, quantification of GHG emissions includes:

Scope 1: Direct emissions mainly from construction site equipment and site vehicles

Scope 2: Indirect emissions from purchased electricity from external provider

411. Present study of Package 03 has only accounted scope 1 emissions. However, Scope 2 emissions were not calculated as total energy requirement in construction phase is still under consideration with LESCO.

412. GHG emissions are estimated using emission factors for the three (3) main greenhouse gases (CO2, CH4 and N2O), and converted to CO_2 equivalent using global warming potential (GWP). **Table 7.4** presents the GWPs on a 100-year time horizon relative to CO_2 for ozone-depleting substances and their replacements.[47]

Table 7.4 GHG Emissions and Global Warming Potential

Pollutant	Chemical Formula	100-Years GWP
WP Carbon Dioxide	CO_2	1
Methane	CH_4	28
Nitrous oxide	N_2O	265
		Source: IPCC Fifth Assessment Report (2013)[10]

413. GHG emissions are estimated in terms of CO2 equivalent (CO2e) according to the following equation:

$$\text{Emissions}_{\text{GHG, fuel}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{GHG, fuel}}$$

Where:

Emissions GHG, fuel = z

Fuel Consumption fuel = amount of fuel combusted (Liters)

Emission Factor GHG, fuel = default emission factor of a given GHG by type of fuel (kg of greenhouse gas/Liters).

414. The construction machinery, the type of the fuel consumed and the number of days and working hours are accounted as Activity Data mentioned in **Annex-W.** As per the above-

[46] Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, 2006
[47] IPCC Fifth Assessment Report (2013)

mentioned formula, the tonnage greenhouse gases as CO_{2eq} (for Scope 1) emitted in the atmosphere by the constructional activities of package 03 will be **6640.30109 tons of CO_2eq yearly.** This is insignificant emissions according to IFC.

According to above assessment, GHG Potential of Package 03 can be predicted as moderate as shown in Table 7.1.

Mitigation Measures

415. The following measures will be put in place for the Project during construction to reduce GHG emissions;

- LWASA has allocated approximately 10 Million Rupees for compensatory plantation purposes, which is capable of planting approximately 10,000 to 15,000 trees of about 5-6 feet height.
- Use construction machinery designed with suitable pollution abatement technology such as scrubbers
- In order to control N2O emission at site, diesel engine equipment and machinery should be installed with catalytic converter as It allows diesel engine to take advantage of the trade-off between NOx, PM and fuel consumption and calibrate the engine in a lower area of fuel consumption
- Environmentally friendly fuel such as Liquified Petroleum Gas (LPG) can also be used instead of diesel
- Burning of waste should be strictly prohibited at site
- Methane produced from decaying of organic matter can be capture and used as fuel where possible
- Composting can be planned within the plant premises to manage organic waste produced from labour camps

Residual Impacts

416. With the help of the above mitigation measures, the potential impacts on climate are likely to be adequately addressed and hence the residual impact is likely to be remain minor in significance, as shown in **Table 7.1.**

7.4.3.1.7 Fire and Explosions Hazard

417. Smoking at site, improper handling and storage of hazardous substances and empty cement bags at construction site can lead to fire and explosion that may in turn cause injury and possible death of a worker. Fire may also occur due to carelessness of workers in areas where combustibles are present.

This impact can be anticipated as Major during Construction Phase, as shown in Table 7.1

Mitigation Measures

- Routine inspection should be carried out to check that the area is free of clutter and no flammable material is present
- Accidental spillage of chemicals should be immediately cleaned up.
- Workers should be trained on handling and controlling accidental spillage of flammable substances that may trigger fires.
- Appropriate fire safety equipment should be provided at construction site
- "No smoking signs and policy" should be b displayed at sites as appropriate and actions to be taken against those not adhering to this order.

Residual Impacts

418. With the help of the above mitigation measures, the incident of fire can be controlled and hence the residual impact is likely to be Negligible in significance, as shown in **Table 7.1**

7.4.3.1.8 Occupational Health and Safety

419. Construction sites are considered the most dangerous and accident-prone area of any working environment. Construction activities inevitably expose workers to many health and safety risks due to range of activities and work being undertaken at these sites.

420. Health and safety risks that can be anticipated during construction phase are as follow:

- Lack of provision of potable water for drinking and sanitation purposes
- Injury from the loading and unloading of heavy equipment/material
- Injury from overexertion, repetitive manual tasks, or working in awkward positions
- Working in extreme temperatures, with risks of frostbite and heat stress
- Stress and increased injury hazards from shift work and extended work days
- Injuries from using hand tools, powered tools and heavy powered equipment
- Injury due to improper use of Personal Protective Equipment (PPE)
- Injury hazard from working at heights
- Electrical hazards from power tools, equipment, and power lines
- Exposure to paints, solvents, and other toxic chemicals
- Hearing loss from high level of noise exposure.

This impact can be anticipated as Major during Construction Phase, as shown in Table 7.1.

Mitigation Measures

- Contractor should provide necessary Personal Protective Equipment (PPE) such as dust masks, ear plugs, hard hats, foot wear and glasses to all site workers and ensure a safe and healthy environment for their workers
- Workers should be trained on how to properly use the PPEs to avoid the misuse or failure of PPEs.
- Contractor should ensure provision of ample supply of clean portable water at all work sites
- There should be first aid and emergency responses, including monitoring of worker symptoms, and investigating incidents of health-related illnesses
- Contractor should have qualified first aid personnel among the workers and maintains fully stocked first aid kits at the sites
- Contractor should enforce adherence to safety procedures and prepare contingency plans for accident response
- Contractor should provide safety education and training to all site workers
- Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits
- Contractor should not permit or force the workers to work more than the specified number of hours in a day.
- Response or preventative measures should be taken in the extreme temperatures (e.g. increase frequency of breaks, reduce the work pace and workload, avoid working in direct sunlight, schedule heavy work for cooler part of day, wear hat and sun screen outdoors, etc.)
- Install fences and place adequate safety warning signs at the construction site
- Maintain safe distance from all power lines in order to avoid electrical hazards
- A detailed Occupational Health and Safety Plan has been developed for the construction phase of the project (attached as **Annexure-X**)

Residual Impacts

421. Even after implementing the above-listed mitigation measures, the health and safety impacts on site personnel cannot be fully mitigated. Hence the significance of residual impacts will be Medium, as shown in **Table 7.1***.* Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

7.4.3.2 Anticipated Impacts on Biological Environment (Package 03)

422. Anticipated impacts on biological environment of the project area are as follows:

7.4.3.2.1 Impact on Crops and Flora

423. Presently, the proposed area of SWTP comprising of 307 Acre and raw water channel comprising of 17 Acre is being used for the cultivation of vegetables, fodder, wheat, rice and maize. Construction of proposed project will remove these crops from the project area and affect the livelihood of many titleholders.

424. The project also involves loss of approximately 481 wood trees include Pipal, Bargad, Shisham, Jujube (Bair), Mulberry (Shehtoot), Kikar (Acacia), and Neem. Also, cutting of one guava orchard having 343 trees of guava and 118 other different types of fruit trees

425. However, no major tree/plant cutting, and vegetation removal is involved during laying of power transmission lines main, as the transmission route is covered with a very thin layer of vegetation, which is not of any significant importance.

As per the above-mentioned impact assessment, the construction impact of project on flora and crop cover of the area can be anticipated as Major as shown in Table 7.1.

Mitigation Measures

- The contractor should ensure proper demarcation of project area to be affected by project activities
- Cash compensation should be given to the titleholder of the affected land following the RPs for this project.
- Maintain the (Species wise) log of all trees cut and up-rooted.
- LWASA has allocated approximately 10 Million Rupees for compensatory plantation purposes, which is capable of planting approximately 10,000 to 15,000 trees of about 5-6 feet height.

Residual Impact

426. With the help of the above mitigation measures, the potential impacts on flora are likely to be adequately addressed and hence the residual impact is likely to be minor in significance, as shown in **Table 7.1.** However, the impacts on crop will remain major as it is difficult to compensate such as major impact.

7.4.3.2.2 Impact on Aquatic Habitat

427. Presently, there are many fish such as Mulli, Rahu and Thela present in BRBD Canal. During construction phase, there may be short term effects downstream from mobilization of sediments around construction sites caused by soil disturbance and erosion and scouring of the BRBD canal bed at the outlet of the diversion channel. This might lead to increase

sediment loads downstream of construction, mainly during the wet season thus leading to sedimentation downstream and increased turbidity.

428. Increased sedimentation downstream may affect aquatic habitats by covering coarse substrate providing spawning habitat for fish, filling shallow-water refuges for small fish, and smothering aquatic vegetation. This could lead to a decline in the overall productivity of the aquatic ecosystem.

429. Increased turbidity can harm fish gills and accumulate in gill chambers, leading to fish mortality or morbidity. The significance of the effect can be viewed as moderate but can be mitigated by adopting erosion control measures.

As per the above-mentioned impact assessment, the construction impact of project on aquatic organisms of BRBD canal can be anticipated as Moderate, as shown in Table 7.1.

Mitigation Measures

- Minimize shoreline disturbance e. g limiting access of construction activities and workers to vulnerable areas that could contribute to sediment loading
- Establish a buffer strips of natural vegetation along the shore to stabilize shorelines
- Conduct regular monitoring of canal for turbidity and total suspended Solids

Residual Impacts

430. With the help of the above mitigation measures, the potential impacts on aquatic life are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in **Table 7.1.**

7.4.3.2.3 Impact on Terrestrial Fauna

431. Construction activities will generate noise from people, vehicles, and equipment affecting fauna sensitive to disturbance such as reptiles and small mammals like rat, cat, bat and dog. During the construction activities at SWTP, farm animals like cattle and sheep, habituating the adjacent agricultural fields may get displaced and affected by the project activities. The movement of people, vehicles, and continuous operations of the machineries may cause trouble for them to pass through that area. The effects will be minor and localized as most of the temporarily displaced fauna are likely to return to the area when construction is complete.

432. In addition, fauna mortality such as rat and cat can also occur during construction activities in the event of struck with machinery and vehicles. Fauna that are not disperse during site clearing activities are more vulnerable to be injured through interaction with machinery.

433. According to the baseline study of the area, no endangered or threatened species were found in and out of the vicinity of the project areas. The workers present at the construction sites may hunt or kill, the local or birds' animals visiting the area, just for the fun purposes. By this practice, the animal population in the area may decline.

434. Moreover, the bat colony was found in the project area as well. The power transmission lines will pose electrocution threats to bats and birds of the area when they are travelling in group. It will occur when birds get in-touch with two wires and when it perches on conductive tower and comes with the immediate contact with the live wire. This impact will consequently reduce the population of birds and bats in the area.

After above impact assessment, the construction impact of project on wildlife of the area can be expected as Minor, as shown in Table 7.1.

Mitigation Measures

- Use signage and speed humps in the areas where farm animals crossing is possible.
- Strict instructions be given to all personnel working in project area to refrain from killing, capturing or disturbing any species of bird, reptile or mammal encountered during project activities, except in self-defence.
- Demarcate at the site the approved limits of clearing to ensure no additional natural habitat is affected or disturbed
- Train truck drivers regarding driving risk through biodiversity sensitive or remote areas.
- Ensure to maintain safe distance between two phases and phase of the transmission line and ground, so that the group of bats and birds may not get entangled in them.

Residual Impacts

435. With the help of the above mitigation measures, the potential impacts on wild life are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in **Table 7.1.**

7.4.3.3 Anticipated Impacts on Physical Environment (Package 04)

436. Anticipated impacts on physical environment of the project area are as follows:

7.4.3.3.1 Impacts on Air Quality

437. Construction activities are likely to generate air pollutants which have potential to adversely affect local air quality, and consequently effect on vegetation and human health. Such activities include: dust and exhaust emissions.

7.4.3.3.1.1 Dust Emission

438. During construction phase, air quality of the project area is expected to be affected by dust emissions from various construction activities such as site preparation, excavations/earthworks, spoil, trench preparations and stockpiling of materials, construction machinery and vehicular movement. A significant effect on the environment will be understood if there is an increase in visible dust beyond the boundaries of the site, or the dust affects local property or results in any complaints from nearby communities.

439. As the laying of water transmission mains and distribution network will be done on main roads, narrow streets and close to sensitive receptors. Dust generated from above mentioned activities can cause nuisance and severe health effects on workers and sensitive receptors present at site **(Refers to Figure 4.9-4.12).** Presently, the air quality parameters analysed in the baseline study were found to be in compliance with Punjab Environmental Quality Standards (PEQS) as mentioned in the **Table 4.10** and no major respiratory diseases were reported near the proposed construction sites. However, the construction activities can produce the significant amount of dust at the site affecting the site workers and the general public.

440. The dust emission can also moderately affect flora present along the main road and Lahore branch canal. Majority of the flora of Package 04 is comprised of seasonal plants, therefore, this impact can be predicted as moderate.

As per the above-mentioned impact assessment, the dust emissions generated during the project construction can be anticipated as Major on residents and moderate on flora of the area as shown in Table 7.2.

Mitigation Measures

- Avoid and or control blowing of dust from potential sources by shielding them off from the exterior. For example, using tarpaulin or plastic sheets or by sprinkling with water
- Avoid storing materials near to sensitive receptors such as schools, mosque and houses
- The material transportation should be carried out after school timings
- Minimize surface clearing to minimum requirement, where water transmission mains and distribution network is proposed
- As laying of water distribution network is proposed to be carried out in narrow streets and on main roads, the excavated earth material should not be stored on site and the grounds should immediately be refilled after the completion of the works in particular area
- Give special instructions to drivers on safe driving of vehicles particularly on narrow roads. Instruct them to reduce the speed on road bends and earthen tracks to avoid blowing of drag dust
- Provide appropriate Personal Protective Equipment (PPE) such as dust mask to the site workers

- A GRM (discussed later in the document) should be put in place to receive complaints from public on various aspects of environmental issues, including air pollution. These grievances should be addressed by the contractor by adopting necessary pollution control measures.
- Plantation should be done on all disturb areas immediately after completion of work

Residual Impact

441. With the help of the above mitigation measures, the potential impacts of dust are likely to be adequately addressed and hence the residual impact is likely to be minor in significance on residents and negligible on flora, as shown in **Table 7.2.**

7.4.3.3.1.2 Exhaust Emissions

442. As the laying of water transmission mains and distribution network is proposed to be carried out in densely populated area, therefore, construction activities can cause congestion of road and streets and increase exhaust emissions in the project areas. Presently, air quality monitored at all project sites found in compliance with PEQS **(Refer to Table 4.10)**

443. However, the concentration of SO_2, NO_2, CO and PM_{10} may escalate during the peak construction period. The high gaseous emissions in the area will negatively impact on residents, flora and other sensitive receptors present near the proposed project works.

As per the above-mentioned impact assessment, the exhaust emissions generated during the project construction can be anticipated as Major on residents and Moderate on flora as shown in Table 7.2.

Mitigation Measures

- Carryout regular monitoring at the site or near the sensitive receptors in order to ensure that ambient air quality remains within the standards limits set by PEQS
- Use environment friendly fuel such as low sulphur diesel for diesel powered equipment and vehicles
- Reduce vehicle idling time to minimum or shut down when not in use
- All construction machinery should be properly tuned and maintained in good working condition in order to minimize emission of pollutants
- In case access roads have to be closed, local communities and road users will be informed in advance, to minimize traffic congestions and to reduce exhaust emissions of the vehicles
- Reflective signature to direct traffic to designated areas will be used. If traffic management is done accurately, then the accumulation of the Sox, NOx and other such pollutants can be avoided

- Provide personal protective equipment (PPE) such as masks to all site workers.

Residual Impact

444. With the help of the above mitigation measures, the potential impacts of exhaust emissions are likely to be adequately addressed and hence the residual impact is likely to be minor on residents and negligible on flora significance, as shown in ***Table 7.2.***

7.4.3.3.2 Impact on Water Resources and Quality

445. Approximately, 35 m^3/day [48] amount of water is likely to be required during the construction activities, which will be abstracted directly from the ground water. The water will be used in concrete plant, drinking and cleaning purposes.

446. Presently, all serving areas are using groundwater to meet their daily requirements, and use of same resouce of water during construction will cause additional burden on this resource.

447. Cleaning and hydro-testing of the water supply pipelines will also be conducted prior to pipeline commissioning, and this may require significant quantity of water depending on the length of pipe being tested at that time. The key hazard introduced by hydro-testing is in the event of a failure of the line under test, resulting in the accidental discharge of water. This could result in soil erosion leading pollution of water resources with silt.

448. Furthermore, the poor construction management practices during the laying of water transmission main and distribution network near canal can contaminate the surface water quality of canal (i.e. Lahore Branch Canal), whereas, the groundwater may get contaminate due to improper management of solid waste and hazardous materials at site. It is anticipated that, approximately, 28 m^3/day[49] amount of waste water will be expected to generate during the whole course of the proposed project.

As per the above-mentioned impact assessment, the impact on water resources is anticipated to be Major during the project construction, as shown in Table 7.2.

Mitigation Measures

- The contractor should ensure efficient use of water at site by sensitizing construction staff to prevent irresponsible water usage to reduce burden on existing local water source
- To the extent possible, hydrotest water should be used into the next section of the pipeline to be tested. If required, additional water can be added to make-up any losses or

[48] McGhee, T. J., & Steel, E. W. (1991). Water supply and sewerage (Vol. 6): McGraw-Hill New York.
[49] McGhee, T. J., & Steel, E. W. (1991). Water supply and sewerage (Vol. 6): McGraw-Hill New York.

modifications in lengths of test section. If less is needed, the extra water should be discharged in a manner that prevents erosion e.g. discharge it on vegetated ground

- The surplus water should be used in spraying and sprinkling of the area to reduce the dust emissions
- Store all hazardous materials under cover and preferably under secondary containment
- Accidental spillage of chemicals should be immediately cleaned up
- Provide a spill control kit at the site and it should be readily accessible to the site workers
- Wastewater generated at site should be discharged into already laid sewerage network of WASA

Residual Impact

449. After implementation of the above mitigation measures, the significance of residual impacts on water resources is expected to be minor, as shown in ***Table 7.2.***

7.4.3.3.3 Impacts on Soil Resources

450. The works at construction site including removal of topsoil and digging, as well as presence of machinery and workers at site will have minor negative impact on soil quality. The other impacts include: Mechanical impact on soil during trench excavation; Stimulation of water and wind erosion; Soil pollution by spilling or discharge of oil and oil derivates, motor oil, and similar wastes originating from machinery and vehicles on site; Soil pollution due to uncontrolled deposition of solid waste (spoil material) on the land;

As per the above-mentioned impact assessment, the impact on soil resources is anticipated to be Minor during the project construction, as shown in Table 7.2.

Mitigation Measures

- Remove and store topsoil in separate piles and reinstate after refilling of trenches
- A thin layer of grass or native vegetation cover should be provided soon after the completion of works.
- Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil
- To prevent soil contamination, control measures should be instituted where hazardous materials are stored in pallets and where possible under cover in secondary containment.
- Ample supplies of clean-up materials should be kept and be readily accessible at site.
- Do not pile excavated soil to form high stockpiles for long durations

Residual Impact

451. After implementation of the above mitigation measures, the significance of residual impacts on soil resources is expected to be negligible, as shown in ***Table 7.2.***

7.4.3.3.4 Drainage and Flooding

452. The areas under the package 04, has partly functional drainage systems in all serving areas. Improper management of the construction debris may cause the system to fail or get clogged, hence, causing localized flooding of the properties adjacent to these structures. This flooding may negatively impact the people, sensitive receptors present in low lying area such as Fateh Garh and Shadipura.

Mitigation Measures

- The excavated material should be properly managed on site, and the workers will be sensitized by the contractor for the proper management of the construction debris
- The contractor should be responsible for ensuring that no construction material or waste debris shall block the existing drainage channel in the areas of distributions mains.
- The Contractor/site supervisor should be responsible for routine monitoring of drainage channels to ensure they remain free of waste and debris.

As per the above-mentioned impact assessment, the impact can be anticipated to be Major during the project construction, as shown in Table 7.2.

Residual Impact

453. After implementation of the above mitigation measures, the significance of residual impacts on existing drainage system is expected to be minor, as shown in ***Table 7.2.***

7.4.3.3.5 Nosie and Vibration

454. During excavation activities (trenching), noise sources will include: vehicles used to transport materials and equipment to the site, earth digging by heavy machinery and workers' chat and movements.

455. According to baseline data, the existing noise level of the area is compliance with PEQS **(Refers to Table 4.10).** However, the noise levels might enhance during construction as there are many already small-scale industries (such as wood, steel and cold storage) and commercial areas present within the RoW of Main transmission line and distribution network. These industrial sources together with construction work can enhance noise level in the project area

456. Whereas, there are number of old buildings exists in the areas of proposed project, but they are not in the project RoW.

457. If noise from all construction sites is not managed properly, it can cause many health problems in the people of project area such irritability, lack of sleep and hearing loss.

As per the above-mentioned impact assessment, the noise generated during the project construction can be anticipated as Major as shown in Table 7.2.

Mitigation Measures

- In case of any scheduled noise event at site, notice should be given to the community and approval should be obtained
- Limit pickup truck and other small equipment to an idling time of one minute
- Encourage workers to avoid hooting in residential areas and shut off vehicle whenever possible or not in use
- The construction and more specifically excavation of the trenches for the pipelines by the use of hand-held equipment (manual labour) with very limited use of mechanized machinery which would be sources of noise and vibration, would be preferred
- All machinery and vehicles to be used as site should be in good working condition and properly lubricated and maintained to keep noise levels within the acceptable range of PEQS
- Appropriate Personal Protective Equipment (PPE) such as ear muffs and ear plugs should be given to the workers exposed to high levels of noise.

Residual Impact

458. With the help of the above mitigation measures, the potential impacts associated with noise generation are likely to be adequately addressed and hence the residual impact is likely to be minor in significance, as given in ***Table 7.2.***

7.4.3.3.6 Solid and Liquid Waste

459. The project involves decommissioning of old and worn-out pipes. The main waste during laying of water distribution network includes; excavated soil, broken pipes, spoils kitchen, chemicals waste as well as maintenance wastewater (generated while maintenance and cleaning of machinery, equipment and vehicles). It is estimated that, 97.5 kg/day and 28 m^3/day[50] (Ashraf, Hameed, & Chaudhary, 2016) of solid and liquid waste is expected to

[50] Ashraf, U., Hameed, I., & Chaudhary, M. N. (2016). Solid waste management practices under public and private sector in Lahore, Pakistan. Bulletin of Environmental Studies, 1(4), 98-105

generate during the laying of water distribution networks. Whereas, approximately, 500-550 tons[51] of broken, old and rusted pipes will result during their decommissioning.

460. Moreover, as the laying of water distribution system will be held in narrow streets, therefore there will be very less space for the disposal of solid waste. Hence, improper management of such waste can cause nuisance, serious health and safety risks and breeding places for mosquitos and vermin at the sites.

The impact of improper waste management during the project construction can be predicted as Major as shown in Table 7.2.

Mitigation Measures

- The soil excavated should be used as backfill and thereby reducing the generation of spoil material and related waste pollution concern.
- The contractor should put in place measures to ensure construction material requirements are sensibly budgeted and to ensure that amount of material left at the site is kept nominal
- The solid waste produced during construction phase should be transported by the contractor to an appropriately permitted off-site disposal facility
- All hazardous waste generated at the site should be sold to EPA certified waste vendor such as Global Waste Management, Lahore.
- Vehicles and machinery coated with concrete should be washed at a designated place. The area selected for washing should be located at least 60 feet away from drainage channel.
- Store all hazardous materials at designated place or preferably under secondary containment

Residual Impact

461. With the help of the above mitigation measures, the potential impacts associated with waste generation are likely to be adequately addressed and hence the residual impact is likely to be minor in significance, as shown in ***Table 7.2.***

7.4.3.3.7 Greenhouse Gases and Climate Change

462. The GHG Scope 1 emission of Package 04 was calculated through Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, 2006. All emissions were estimated using same method and formula mentioned in section **7.4.3.1.6.**

463. According the calculations, it was found that the Package 04 has a potential to emit

[51] Ashraf, U., Hameed, I., & Chaudhary, M. N. (2016). Solid waste management practices under public and private sector in Lahore, Pakistan. Bulletin of Environmental Studies, 1(4), 98-105

6211.894568 tons of CO_2eq yearly, which are insignificant emissions according to IFC. The detailed activity data has been attached as **Annexure- W.**

According to above assessment, GHG Potential of Package 03 can be predicted as moderate as shown in Table 7.2.

Mitigation Measures

464. The following measures will be put in place for the Project during construction to reduce GHG emissions;

- LWASA has allocated approximately 10 Million Rupees for compensatory plantation purposes, which is capable of planting approximately 10,000 to 15,000 trees of about 5-6 feet height.
- Use construction machinery designed with suitable pollution abatement technology such as scrubbers
- In order to control N2O emission at site, diesel engine equipment and machinery should be installed with catalytic converter as It allows diesel engine to take advantage of the trade-off between NOx, PM and fuel consumption and calibrate the engine in a lower area of fuel consumption
- Environmentally friendly fuel such as Liquified Petroleum Gas (LPG) can also be used instead of diesel
- Burning of waste should be strictly prohibited at site

Residual Impacts

- With the help of the above mitigation measures, the potential impacts on climate are likely to be adequately addressed and hence the residual impact is likely to be remain minor in significance, as shown in **Table 7.2.**

7.4.3.3.8 Occupational Health and Safety

465. Construction activities including excavations, backfilling involve inherent occupation health risks related to operation of equipment and machineries. In the absence of sufficient management of Health and Safety (H&S) issues, the workforce may suffer injury or death. In this project, the use of manual labour is envisaged and will account for over 90% of the construction activities. This is because the project area is congested with little space to employ mechanized equipment.

466. Occupational health and safety impacts during construction is considered to be of moderate in significance due to the expected use of non-mechanized equipment and

machinery. The construction activities will use hand held tools in digging the trenches with very limited use of excavators. Experienced and trained personnel will be engaged in operating equipment.

According to the above discussion, occupational health and safety hazards in Package 04 can be anticipated as Moderate as shown in Table 7.2.

Mitigation Measures

- Contractor should provide necessary Personal Protective Equipment such as mask, helmet, hand gloves and rubber boots to all site workers and ensure a safe and healthy environment for their workers
- Contractor should have qualified first aid personnel among the workers and maintains fully stocked first aid kits at the sites
- Contractor should enforce adherence to safety procedures and prepare contingency plans for accident response
- Contractor should provide safety education and training to all site workers
- Contractor should ensure that work sites (such as excavation work and trenches), especially in the night have proper protection with clear marking of safety borders and signals and fence off all dangerous areas
- Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits

Residual Impacts

467. Even after implementing the above-listed mitigation measures, the health and safety impacts on site personnel cannot be fully mitigated. Hence the significance of residual impacts will be minor, as shown in **Table 7.2.** Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

7.4.3.4 Anticipated Impacts on Biological Environment (Package 03)

468. Anticipated impacts on biological environment of the project area are as follows:

7.4.3.4.1 Impact on Flora

469. During the construction phase of the project, approximately 250 trees will be removed, majority of which are located along the route Lahore Branch canal. Presently, no endangered or internationally protected plant species were found to be reported in the baseline survey of this project. However, on the route of the distribution network, some of the seasonal plants will be removed to give a way to the proposed project, which would ultimately cause the reduction of the aesthetics of the project area. This impact can be observed as moderate in nature.

As per the above-mentioned impact assessment, the construction impact of project on flora of the area can be anticipated as Moderate as shown in Table 7.2.

Mitigation Measures

- The contractor should ensure proper demarcation of project area to be affected by project activities
- The contractor will develop a re-plantation plan for the project area, to improve the aesthetics of the project area
- LWASA has allocated approximately 10 Million Rupees for compensatory plantation, which is capable of planting approximately 10,000 to 15,000 trees of about 5-6 feet height.

Residual Impact

470. With the help of the above mitigation measures, the potential impacts on flora are likely to be adequately addressed and hence the residual impact is likely to be negligible in significance, as shown in ***Table 7.2.***

7.4.3.4.2 Impact on Fauna

471. Presently, no reported ecological sensitive location, migratory path and sanctuaries, etc. exist within the proposed project areas. The proposed project does not envisage any disturbance or displacement of any endemic faunal species during its construction phase. As the project activities will be carried out on in residential communities therefore, no endangered animal species exists in the area. Only the domestic and stray animals like cats and dogs can be seen wondering in the area. There is a minor risk of accidental injury and possible mortality of these animals due to strike with construction machinery, workers and vehicles, which would displace them from streets and roads for the time being.

The impact will be minor and localized as most of the temporarily displaced fauna are likely to return to the area when construction is complete, as shown in Table 7.2.

Mitigation Measures

- Contractor should provide training to truck drivers to maintain speed limits in the congested area or where there is possibility of encountering the stray and domestic animals
- Proper management of the food waste will be carried out, and no open dumping of such waste will be allowed on the site, as it attract the stray animals during night times

Residual Impacts

472. With the help of the above mitigation measures, the potential impacts on wild life are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance, as shown in ***Table 7.2..***

7.4.4 Anticipated Social Impacts during Construction Phase (Package 03 and 04)

473. Anticipated social impacts of both package 03 and 04 which may occur during construction phase of the project are as follows:

7.4.4.1 Impact of Land Take (Package 03)

474. A total land of 324 acres has been acquired by Lahore WASA for the construction of proposed project. However, the construction of SWTP will be done only on 30 acres of land. The remaining land will be used for future extension purpose.

475. The land acquired is currently seasonally cultivated by the surrounding villagers. The impact of land takes on surrounding communities and livelihood is expected to be major as villagers are entirely dependent on agriculture as source of their income. The displacement has likely to destroy the current mode of production, cause environmental problems and impoverishment of the affected people.

476. As per the social impact assessment surveys and studies, the land acquisition will cause following adverse impacts:

477. The involuntary resettlement impacts of SWTP and raw water Intake Channel involve: (i) permanent loss of 324 acres (131 hectares) of private agriculture land by 110 households (HHs) with 51 female and 114 male titleholders, out of which 2 AHs are involved in sharecropping, (ii) loss of agriculture land by 4 AHs of agriculture tenants; (iii) loss of an orchard at 2 acres (0.8 hectare) with 343 guava trees (iv) loss of 118 other different types of fruit trees (v) loss of crops on 321 acres of land, (vi) loss of 481 wood trees; (vii) demolition of 11 structures that including one temporarily non-operational steel casting factory; one cattle cum dairy farm with residence of farm labor; 7 farm houses having residences of 9 HHs of permanent agriculture laborer, one room built for tube well, and one under construction dairy farm. (viii) The loss of farm houses will cause physical displacement of 9 HHs. These farm houses are also used for storage of agriculture inputs, agriculture produce and farm implements; (ix) cause loss of income and livelihood by 50 HHs of permanent agriculture laborer; (x) loss of income and livelihood by 4 households of seasonal labor contractors (2 female and 2 male contractors); (xi) approx. 50 households of 84 female and 38 male daily wage seasonal agriculture laborer; (xii) dismantling of 15 tube well boreholes and tubes and their relocation; (xiii) partial loss and severance of two formal roads and a number of informal access ways of villages; (xiv) rehabilitation of electricity transmission lines; (xv) impact on the quality of two main road due to transportation of construction machinery and material.

After above assessment, the impact of land loss and livelihood can be anticipated as Major Table 7.1.

Mitigation Measures

- Resettlement plan has been developed to address this impact on Project Affected Persons (PAPs)
- Compensation to project affected people should be paid in cash and should be according to the current market value
- Adequate notice to be given to farmers prior to commencement of construction so that the farmers do not unnecessarily lose crops
- Compensation money must be given before the actual move so that displaced households can use the money to overcome the hurdles of dislocation
- Contractor should carry out all construction activities within predefined working areas. Any damage caused during construction outside the marked boundaries should be appropriately compensated by the contractor

Residual Impacts

478. Even after implementing the above listed measures, loss of land and livelihood of people cannot be completely compensated, therefore, the significance of the residual impacts is likely to remain Moderate, as shown in **Table 7.1.**

7.4.4.2 Traffic Congestion (Package 03)

479. Increased traffic flow to and from the site will be an obvious consequence of construction work. Impact on existing traffic will occur mainly during material delivery, waste transportation and workers going to or from work.

480. The access road going towards SWTP project site is unsurfaced and narrow. Presently, the traffic load on Bhaini and Ganj e Sindhwan road is moderate. The road is being used by pedestrians, agriculture vehicles, animal cart riders, cold store employees and truck drivers in order to deliver their product to the market.

481. The overhead transmission line RoW is passing through road and densely populated area which may also create serious traffic issues during installation of power transmission lines.

After above impact assessment, the impact of traffic congestion can be anticipated as Major, as shown in Table 7.1.

Mitigation Measures

- Establish a proper traffic management plan in consultation with traffic police department
- Contact with traffic police departments for maintaining traffic on roads which requires continuous police monitoring
- Identify alternate access routes and communicate to residents prior to start of work

- Construction activities or material delivery should be planned in such way to avoid peak traffic hours
- Provide educational materials to nearby schools and communities to inform children about road safety
- Establish speed limits especially in proximity to sensitive receptors and sensitize the truck drivers on speed limit
- Install necessary safety signs that are visible at night
- In order to avoid complaints from mobile vendors adjust the location of their carts to similar location in the immediate locality of the original location for the duration of the project
- Vehicular access to and from hospitals and fire stations should be maintained through the use of steel road plates over open trenches
- Contractor should strictly follow project completion timeline in order to minimize disruption faced by the residents

Residual Impacts

482. With the help of above mitigation measures, the potential impact associated with traffic congestion are likely to be mostly addressed and hence the significance of residual impacts will be Minor, as shown in **Table 7.1.**

7.4.4.3 Traffic Congestion (Package 04)

483. The excavation of trenches and laying of pipeline work will be done along main roads and streets, near parks and gardens, industries, mosques and near Hospital (e.g. Shalimar Hospital).

484. The machinery used in narrow streets will also cause access problems to pedestrians, possibly to rider of bicycles and motorcycles, vehicles, students, ambulances, mobile vendors, elderly people and handicappers who may have to make tedious long cycles before they reach targeted destinations. Traffic disruption will be most serious when they will block the way of ambulances, blood bank vans, fire brigade and other emergency vehicles.

After above impact assessment, the impact of traffic congestion can be anticipated as Major, as shown in , as shown in Table 7.1 and 7.2.

Mitigation Measures

- Establish a proper traffic management plan in consultation with traffic police department
- Contact with traffic police departments for maintaining traffic on roads which requires continuous police monitoring
- Identify alternate access routes and communicate to residents prior to start of work

- Construction activities or material delivery should be planned in such way to avoid peak traffic hours
- Provide educational materials to nearby schools and communities to inform children about road safety
- Establish speed limits especially in proximity to sensitive receptors and sensitize the truck drivers on speed limit
- Install necessary safety signs that are visible at night
- In order to avoid complaints from mobile vendors adjust the location of their carts to similar location in the immediate locality of the original location for the duration of the project
- Vehicular access to and from hospitals and fire stations should be maintained through the use of steel road plates over open trenches
- Contractor should strictly follow project completion timeline in order to minimize disruption faced by the residents

Residual Impacts

485. With the help of above mitigation measures, the potential impact associated with traffic congestion are likely to be mostly addressed and hence the significance of residual impacts will be Minor, as shown in ***Table 7.2.***

7.4.4.4 Community Health and Safety (Package 03)

486. During construction, works such as excavation, movement of materials and spoils, and the general increase in vehicular traffic is likely to increase dust and noise pollution in the project area.

487. Dust emissions can irritate the eyes causing trachoma and respiratory problems. Although, these problems are reversible, the long-term exposure to dust will have a serious impact on the health status of those present close to construction work such as school (present on Ganj e Sindhwan Road) and residential communities (such as Natt Kalan and Ganj e Sindhwan). Currently, no major respiratory disorders such as asthma, tuberculosis and lung disorder have been reported by the residents of the project area.

488. In addition, noise levels are likely to significantly increase, especially from construction vehicles and machinery. Although intermittent, the noise levels during the peak construction period may cause hearing impairment, sleep disturbance, behavioural change or anxiety.

489. Construction traffic movements (of materials and workforce), in addition to general project traffic vehicles, will result in a significant increase in traffic levels on the local roads especially for traffic to and from the construction sites and construction camp (i.e. Bhaini and Ganj e Sindhwan Road). Presently, traffic load on these roads is moderate.

490. The communities residing in the project area (i.e. Ganj e Sindhwan and Natt Kalan) are settled along main transport routes and are most likely to be impacted by increased traffic with the potential increase in accidents. The overall significance of the impact is judged to be high, but this may reduce depending on the severity of accident and availability of emergency health care to deal with the increased number of incidents.

491. Illegal dumping or improper disposal of solid waste can produce breeding places for mosquitos and vermin as well as water stagnation outside the premises of project boundary can produce dengue larvae at site leading to dengue outbreak in the project area.

After above assessment, the impact of health and safety hazards on nearby residents can be anticipated as Major Table 7.1.

Mitigation Measures

- Regular water sprinkling should be done on all construction active areas present close to sensitive receptors in order to reduce dust exposure
- Limit the construction activities to day time to avoid disturbance to nearby communities
- Regular maintenance should be done of all construction machinery to maintain noise within the permissible limits of PEQS
- Ensure that potentially disturbing construction noise is not produced outside of working hours
- Construction material delivery truck should be planned in such way to avoid peak traffic hours
- Construction material delivery trucks must be assigned with restricted circulation hours
- Establish and enforce speed limits especially in proximity to sensitive receptors such as nearby school and residential communities
- Install necessary safety signs and speed bumps to alert drivers that they are approaching towards sensitive receptors
- Assign a person from traffic police department to manage and handle traffic load during the peak construction times of the project
- Inform local residents in advance regarding road closure and rerouting of vehicles and pedestrians' traffic
- Train truck drivers to avoid unnecessary hooting while passing through sensitive receptors such as residential areas and school
- Contact with traffic police departments for maintaining traffic on roads which requires continuous police monitoring
- Contractor should ensure proper disposal of waste generated at site
- Constructor should strictly prohibit illegal dumping of waste

- Contractor should eliminate unnecessary container habitats that collect water in which dengue larvae can produce
- Contractor should conduct workshops in nearby school and residential communities regarding dengue awareness and precautionary measures

Residual Impacts

492. Even after implementing the above-listed mitigation measures, the health and safety impacts on local communities cannot be fully mitigated. Hence the significance of residual impacts will be Minor, as shown in **Table 7.1.** Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

7.4.4.5 Community Health and Safety (Package 04)

493. Excavation and trenches are counted as most hazardous operation during construction phase. In this project, most of the excavations will be carried out on roads and narrow streets which increase the probability of local residents falling into trenches. The excavated waste can also generate trip and slip hazards such as waste generated can trip the pedestrian into trenches and slurry liquid waste can cause the slipping hazards resulting into serious injury.

494. Excavation work, construction machinery and vehicular movement are capable of generating significant amount of kick off dust at site. The poor construction practices at site can cause many respiratory disorders in residents present close to construction work.

495. All four project serving areas (i.e. Shadipura, Fatehgarh, Baghbanpura and Mustafabad) are congested and densely populated. The sub areas of the main serving areas which will be affect more due to project activities include Ghoray Shah, Madina Colony, Shalimar Tow, Angori Bagh, Muslim Colony, Lakhodair, Akbar Colony, Mehmood Booti, Baghwal Nawan, Gujar Pura, Gunj and Nabi Pura. The areas come under Shadi Pura will suffer more during construction phase as majority of the pipes rehabilitation and water distribution work will carried out in this area.

496. According to baseline data, the existing noise level of the area in under compliance with PEQS **(Refers to Table 4.10).** However, the noise level might enhance during construction as there are many already small-scale industries (such as wood, steel and cold storage) and commercial areas present within the RoW of Main transmission line and distribution network. These two sources together with construction work can enhance noise level, especially, during winter season. Increased noise in the area can cause sleep deprivation and hearing loss among residents.

497. Improper disposal of solid waste can produce breeding places for mosquitos and vermin as well as water stagnation at site can produce dengue larvae or a dengue outbreak in the project area.

After above assessment, the impact of health and safety hazards on nearby residents can be anticipated as Major, as shown in Table 7.2.

Mitigation Measures

- Endeavour to lay pipes and backfill as soon as possible to reduce the time of hazards exposure to the public from open trenches
- Install fences and place adequate safety warning signs at the construction site
- The whole sides of trenches should be strengthened by aluminium reinforcement sheet where sensitive receptors are located within the proximity of project work
- Regular water sprinkling should be done on all construction active areas present close to sensitive receptors in order to reduce dust exposure
- Limit the construction activities to day time to avoid disturbance to nearby communities
- Regular maintenance should be done of all construction machinery
- Ensure that potentially disturbing construction noise is not produced outside of working hours
- Construction material delivery truck should be planned in such way to avoid peak traffic hours.
- Construction material delivery trucks must be assigned with restricted circulation hours
- Establish and enforce speed limits especially in proximity to sensitive receptors
- Install necessary safety signs and speed bumps to alert drivers that they are approaching towards sensitive receptors
- Assign a person from traffic police department to manage and handle traffic load during the peak construction times of the project.
- Inform local residents in advance regarding road closure and rerouting of vehicles and pedestrians' traffic
- Train truck drivers to avoid unnecessary hooting while passing through sensitive receptors such as residential areas, schools and colleges
- Contact with traffic police departments for maintaining traffic on roads which requires continuous police monitoring
- Contractor should ensure proper disposal of waste generated at site.
- Constructor should strictly prohibit illegal dumping of waste
- Contractor should eliminate unnecessary container habitats that collect water in which dengue larvae can produce
- Contractor should conduct workshops in nearby school and residential communities regarding dengue awareness and precautionary measures

Residual Impacts

498. Even after implementing the above-listed mitigation measures, the health and safety impacts on local communities cannot be fully mitigated. Hence the significance of residual impacts will be Minor, as shown in **Table 7.2***.* Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

7.4.4.6 Impacts on Historical, Cultural and Archaeological Sites (Package 03)

499. Features of the project which could impact on archaeological and cultural property may include the removal of topsoil and subsoil during excavation/earthworks.

500. According to the baseline data collected and analysed for the SWTP site shows that there is no historical, cultural or archaeological site exist in the immediate vicinity of the SWTP. There is only a marked graveyard present near the site, but it does not fall under influence of the project.

501. In addition, if Contractor discovers any archaeological remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall follow the instructions given in Chance Find Procedure attached as **Annexure-Z.**

After above assessment, impact on cultural and historical sites is anticipated as Negligible, as shown in Table 7.2.

7.4.4.7 Impacts on Historical and Cultural and Archaeological Sites (Package 04)

502. The Antiquity Act of 1975 ensures the protection of cultural resources in Pakistan. This Act is designed to protect antiquities from destruction, theft, negligence, unlawful excavation, trade and export.

503. According to the baseline data, several graveyards present in the area of Ghoray Shah, Baghbanpura, Nafeesabad and Lakhodair which are coming under the corridor of impact. Other important sites coming under corridor of impact include a Shrine of Madho Lal Hussain, Shah Gor Pir and Takia Shah as well as historical places such as Shalimar Garden and tomb of Dai Anga. Construction activities such as excavation/earthworks at these sites can cause traffic congestion and problems to tourists or visitors coming to and from these areas. Construction activities will also generate dust emissions which can deteriorate the existing condition of the buildings.

The impact can be anticipated as Major during construction phase, as shown in Table 7.2.

Mitigation Measures

- Before start of project, Contractor should obtain necessary approval from Punjab Archaeological department

- Contractor should strictly follow the submitted work plan in order to avoid traffic problems
- Alternate route should be assigned for the people going towards these historical/cultural places
- Ensure regular sprinkling of water in all active construction areas near sites
- Follow steps mentioned in a chance find procedure (attached as **Annexure-Z**) in the event if any unknown cultural heritage is found during any excavation activity
- Contractor should ensure that the chance find procedure is communicated to the construction contractor prior to start of project

Residual Impacts

504. With the help of above mitigation measures, the potential impact associated with construction activities on cultural sites are likely to be mostly addressed and hence the significance of residual impacts will be Minor, as shown in **Table 7.2.**

7.4.4.8 Disruption to Utilities (Package 04)

505. Package 04 will be carried out in a densely congested area, where there are number of shops and small houses; lot of utility infrastructure would be passing through underground and would be very difficult to isolate. The proposed project activities such as road cutting and excavation for trenches may interfere with existing public utilities; gas pipelines, water mains, communication and electric cables and may result in temporary disruption of these services in the project area.

The impact can be anticipated as Moderate during construction phase, as shown in Table 7.2.

Mitigation Measures

506. The contractor shall be asked to adhere to the following:

- Consult with all concerned departments Pakistan Telecommunication Company Limited (PTCL), Sui Northern Gas Pipelines Limited (SNGPL), Lahore Electric Supply Company (LESCO) and Water and Sewerage Authority (WASA) to delineate their network locations and alignments
- Proper compensation should be given to the concerned department in case of utility disturbed or if need relocation
- Inform local residents in advance about complete project program and disruption to utility services while their work
- Layout plans of the existing underground alignment should be shared with the site workers, so that they may avoid any damage to the existing structures/installation

- Concerned department should be informed on immediate basis in case of any damage to utility services to the sub surface infrastructure has occurred.

Residual Impacts

507. With the help of above mitigation measures, the potential impact associated with utilities are likely to be mostly addressed and hence the significance of residual impacts will be negligible, as shown in **Table 7.2.**

7.4.4.9 Influx of Labour (Package 03 and 04)

508. During Construction phase, influx of immigrant workers at site may expose to many communicable diseases such as pulmonary infection, typhoid, tuberculosis, cholera and dysentery. The main factors that will promote transmission of such diseases include: dust and exhaust emissions, unavailability of portable water and improper disposal of waste at project site.

509. The influx of labours, typically young guys seeking construction jobs can be associated with a series of social challenges such as crime, illegal drug abuse and prostitution. Villainy such as drug abuse and prostitution would affect social harmony and security in project area and ruining the image and intent of an otherwise a good project.

510. The young guys and greater number of drivers, who are expected to pass through the settlements, can also cause social disturbance in communities near the project site by spreading Human Immunodeficiency Virus (HIV) / Acquired Immune Deficiency Syndrome (AIDS) and Sexually Transmitted Infections (STIs) among people.

511. Many of the skilled labour employed from outside the project area may cause some antipathy among the local people and outsiders. This influx of immigrant labour may lead to growth of unplanned settlements as the workers will compete for limited resources. This impact will cause strain on local resources especially accommodation and social utilities such as medical Centres and schools located near the project area

The impact can be anticipated as Major during construction phase, as shown in Table 7.1 and 7.2.

Mitigation Measures

- Create awareness among workers on proper sanitation and hygiene practices to endorse proper health
- Maintain good housekeeping practices at all project sites
- Provide adequate personal hygiene facilities in good condition with adequate supply of clean water

- Make arrangements to treat the affected workers on time to control the movement of vectors disease
- Sensitize workers and surrounding communities on awareness and prevention of HIV/AIDS and STI through training, awareness campaigns and workshops during community meetings
- Provide proper and free HIV/AIDS and STI health screening and counselling for site workers and community members
- Develop and enforce a strict code of conduct for workers to regulate behaviour in the local communities
- Eliminate an employee who continues misconduct or lack of care, carries out duties amateurishly or inattentively, fails to conform to provisions of the contract, or persists in any conduct which is harmful to safety, health, or the protection of the environment.
- Taking all sensible precautions to avert illicit, vicious conduct by or amongst the Contractor's personnel, and to preserve unity and harmony and protection of people and property on and near the sites.
- Prohibiting drugs, alcohol, weapons, and ammunition on the worksite among personnel.
- Site security preparations must be contained within the Bills of Quantities (BoQs) to avoid any delays which might be caused due to insecurity.
- The Contractor in cooperation with the security organs must create awareness to the security situation on the ground all the times.
- Appropriate fencing, security check points, gates and security guards are to be provided at the construction sites to ensure the security of all plant, equipment, machinery and materials, as well as to secure the safety of site staff.
- The Contractor must guarantee that good relations are maintained with local communities and their leaders to help reduce the risk of vandalism and theft.
- To avoid conflicts among local people on employment matter, it is proposed that the Contractor employs the locals in cooperation with local administration in unskilled and semi-skilled duties. This will reduce pressure on existing resources such as housing, schools and health facilities
- Unskilled and skilled labour to be hired from the local community as far as possible to minimize on influx of immigrants into the community.
- A detailed Social Framework Agreement (SFA) Plan has been developed for the construction phase of the project (attached as **Annexure-Z**)

Residual Impacts

512. Even after implementing the above-listed mitigation measures, the impact associated with the influx of labour cannot be fully mitigated. Hence the significance of residual impacts will be Minor, as shown in **Table 7.1 and Table 7.2** respectively. Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

7.4.4.10 Gender-Based Violence (GBV) (Package 03 and 04)

1. No violence against women was reported by any male or female but a key informant revealed that the violence against women exist at household level but man and women do not disclose it publicly due to cultural norms.

513. Acts of violence committed against women including, *inter alia*, sexual violence, sexual harassment and other discriminatory practices based on gender, all fall within the ambit of GBV. In this project, gender inequality might arise during construction through discrimination made against women by unequal work distribution and unequal pay structure among others. Sexual harassment against women might occur as a consequence of mixing of men and women at the construction site.

The impact can be anticipated as Major during construction phase, as shown in Table 7.1 and 7.2.

Mitigation Measures

- The Contractor should make sure that no discrimination is made on the basis of gender while hiring of workers
- The Contractor will set the employment relationship on the code of equal opportunity and fair treatment and develop Code of Conduct for workers to address this issue
- The employment decisions should not be made on the basis of personal characteristics unrelated to inherent job requirements, including race, gender, nationality, religion or belief, disability, age, sexual orientation, or ethnic, social and indigenous origin
- Special measures be taken to address harassment, intimidation, and/or exploitation, especially in relation to women.
- Establish and strictly enforce a No Sexual Harassment Policy in accordance with provincial law
- Provision of gender disaggregate bathing, changing, and sanitation facilities.

Residual Impacts

- Even after implementing the above-listed mitigation measures, the impact associated with the gender-based violence cannot be fully mitigated. Hence the significance of residual

impacts will be Minor, as shown in **Table 7.1 and Table 7.2** respectively. Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

7.4.4.11 Child Labour (Package 03 and 04)

514. The child labour is common in the areas of low-income groups. The parents of underage children prefer to get their children hired in small shops as helpers and waiters in hotels for earning money and supporting household livelihoods[52]. However, "The Punjab Restrictions on Employment of Children Act 2016", prohibit the employment of Child and restrict the employment of adolescents in certain occupations and processes such as construction industry. Moreover, in this project, no child having age below 18 would be allowed to be employed in any construction work.

Therefore, impact on child labour is anticipated as Negligible, as shown in Table 7.1 and 7.2.

Mitigation Measures

- Ensure that contractor shall have its employment policy in accordance with relevant act and labour policies in Pakistan.
- Contractor shall ensure the presence of all persons at site are adults and have their proper identity card with them.

Residual Impacts

- After implementing the above-listed mitigation measures, the impact on Child labour labour will be remain Negligible, as shown in **Table 7.1 and Table 7.2** respectively.

7.4.5 Anticipated Environmental Impacts during Operational Phase (Package 03)

515. The anticipated environmental and social impacts associated with the proposed project operational phase are discussed as under:

7.4.5.1 Air Emissions

516. Improperly maintained generators can discharge hot gases / smoke into the air and pollute the existing air quality of the project area.

517. Steel tubular poles will be used for power transmission. SF6 is a gas with excellent insulation performance and used in many tubular poles. This is a potent greenhouse gas with a significantly higher global warming potential than carbon dioxide. The leakage of this gas from poles can cause adverse impacts on local air quality.

[52] Zafar *et al.* (2014), Socioeconomic Conditions of Child Labor in Lahore District, Pakistan Geographical Review, Vol. 69(1), 7-14

518. During its working cycle, SF6 decomposes under electrical stress, forming toxic by-products that are a health threat for working personnel in the event of exposure.

519. In addition, power transmission towers maintenance activities involve gas-powered trucks, grass trimmers, lawn movers and other equipment. The operation of such vehicles and equipment may result in emissions of PM, SO_2, CO, NOx and hydrocarbons and pollute the air quality of the area.

Mitigation Measures

- The generator to be installed at site should be equipped with chimney having proper height to discharge the hot gases/smoke.
- Alternatives to SF6 circuit breakers with insulators made of composite and rubber instead of ceramic insulators should be considered
- LESCO should prefer CF3I insulating gas as alternative to SF6
- LESCO should monitor gas (SF6 or CF3I) on periodic basis through pressure gauges
- LESCO should use hand held leak detectors to monitor leaks of gas (SF6 or CF3I)
- LESCO should maintain an annual inventory checklist of SF6 or CF3I consumption, purchase, and losses to track emissions
- LESCO should provide training to staff on proper handling of SF6 or CF_3I

7.4.5.2 Waste Generation

520. The water treatment process will generate waste from screening, coagulation/flocculation, sedimentation and filtration processes. The sludge generated, if not properly disposed, has potential to pollute the underlying soil, surface and ground water resources.

521. Sludge production is entirely dependent on the raw water quality, the treatment method and efficiencies of the treatment process, and therefore varies in characteristics and quantities from time to time.

522. The categories of waste expected from the SWTP include:

- Screening waste: includes coarse material like litter, shopping bags, rags and other large objects
- Wastes from the sedimentation tank: Wastes generated from the cleaning-up/desilting of sedimentation tank, would be treated as the sludge waste of SWTP, which will be stored in the secured drums and later disposed of either through composting/landfilling/incineration. The sedimentation tank will be cleaned on regular basis.

523. **Coagulant sludge:** The sludge will be generated from use of aluminium sulphate (alum) as a coagulant to remove turbidity. Alum coagulation sludge will contain aluminium

hydroxide, clay and sand, colloidal matter, microorganisms including algae and planktons, and other organic and inorganic matter present in the raw water. The solid concentration of coagulant sludge ranges from 1 to 2% of the sludge volume while the total sludge volume is in the range of 2 to 3 % of the product water. The total amount of coagulant sludge anticipated to generate from SWTP would be 73.5 tons/day (including the waste material from cleaning and desilting of the sedimentation tanks).

524. Filter Backwash Wastewater: A substantial amount wastewater will be produced during the filter washing operation. The filters will be washed on daily basis and generates a large volume of wash water (about 5% of the water filtered) with low solids content. The composition of backwash wastewater will be similar to that of coagulant sludge, but with much finer particles. The wastewater will contain hydroxides of aluminium and iron, fine clay particles, added chemicals and reaction products which did not settle in the sedimentation tank, and a small portion of filter media.

525. Staff houses at the SWTP will also generate domestic waste and sewerage which will require proper disposal to prevent environmental pollution. Approximately, 0.06 m^3/day of domestic waste (such as kitchen, paper and plastic waste) and 15 m^3/day sewerage is expected to be generate from site. Currently, no sewerage system exists in project area, therefore, this impact would be major if not handled and disposed off properly. The improper disposal of solid and sewerage waste at site can affect the aesthetic beauty of the project area and can cause breading places for mosquitos and vermin. However, the improper handling and disposal of hazardous waste generated during the plant operations and maintenance can cause serious health impacts on site workers as well contamination of existing soil and groundwater quality of the area.

Mitigation Measures

- The backwash water will be recycled in the equalization tank (expected to be 5% of the volume abstracted).
- Sludge generation can be minimized through reduction of chemical dosage, chemical recovery, substitution of coagulant and recycling of filter wash water
- The sludge generated from primary sedimentation tank can be used as fertilizer and soil conditioner on adjacent land after being dried in sludge drying beds or can be dumped in dumped in Lakhodair landfill site present at a distance of approximately 3 km from the proposed site of SWTP. The sludge generated by the SWTP will be of inorganic nature, and will only be harmful if sufficient quantity is ingested or accumulated. However, the coagulant sludge which is considered to be toxic and should be sent to the EPA certified waste management vendor such Global Waste Management for incineration

- Integrated waste management system should be developed for the site to manage domestic waste of the site
- All recyclable waste should be sold to local recycling facilities
- Designate proper area at the site for temporary storage of hazardous waste
- All generated hazardous waste from the site should be sent to the EPA certified waste management vendor, such Global Waste Management
- Domestic waste generated from staff housing should be segregated to enable composting of organic waste, recycling of paper and plastics
- Sewerage generated at site should be treated in a septic tank. After treatment, local municipal authorities should remove it for the final disposal.

7.4.5.3 Noise

526. During project operational phase, noise at SWTP might generate by the working of pumps, blowers, motors, generators and vehicular movements. However, the generated noise level would be insignificant as no other major source of noise is present in the area, that would affect the nearby sensitive receptors i.e. residential area (i.e. Natt Kalan and Ganj e Sindhwan) and school present close to SWTP.

Mitigation Measures

- Pumps should be serviced and tested regularly for an engineered fault
- All noisy equipment and machinery such as generators and blowers should be housed in closed rooms or buildings
- Appropriate PPE such as ear plugs and muffs should be provided to the all site workers, specially to those present close to the noisy machinery

7.4.5.4 Impact on Water Availability

527. Currently, total water demand @40 gpcd of targeted population is 44 MGD (200,027.96 m^3/day). This water demand will be increased by 2030 to 55 MGD (250,0034.95 m^3/day). The proposed project of SWTP has been designed on the capacity of 54MGD (245,000 m^3/day).

528. Presently, a 3 cusec channel from BRBD Canal is provided by irrigation depatment to nearby six villages i.e. Ganj e Sindhwan, Natt Kallan, Dhaewala, Jandiala, Marl Mari and Talwari in order to meet their irrigation demand. The proposed project of SWTP will cause additional burden of 100 cusec on BRBD canal, which is expected to increase to 1000 cusec in future. Thus, the agricultural fields already being irrigated by BRBD will face water shortages in near future leading to loss of agriculture and livelihood of the many titleholders.

529. Moreover, all the existing tube wells installed at the project area of SWTP will not be remain in operation after the completion of project. Therefore, the ground water extraction rate

will be minimum. Only during canal closure period some specified tube wells will be operated to meet the water demand of the residents.

Mitigation Measures

- Ensure water abstraction does not exceed quantities agreed with irrigation department
- The canal water will be compensated by constructing a new Syphon parallel to the existing Syphon to increase the capacity and cater the demands of the irrigation department in future.

7.4.5.5 Fire and Explosions Hazard

530. Improper handling and storage of chemicals, poorly designed gas chlorine storage tanks and constructed electric installations can lead to fire and explosion that may in turn cause injury and possible death of a worker. Welding or cutting torch on or near drum (even empty) should never be used because product (even just residue) can ignite explosively.

531. Fuel or oil spills around the generator and presence of combustible materials may pose a risk of a fire explosion.

Mitigation Measures

- The whole plant area and storage tanks should be designed and constructed according to National Fire Protection Association (NFPA) standards for the prevention and control of fire and explosion hazards
- Routine inspection should be carried out to check that the area around the generator is free of clutter and no flammable material is present
- Accidental spillage of chemicals should be immediately cleaned up
- Workers should be trained on handling and controlling accidental spillage of flammable substances that may trigger fires
- Appropriate fire safety equipment should be installed at convenient locations within the plant. Equipment should be regularly examined and maintained by a reputable fire safety and security company
- Fire drills should be conducted at least biannually to ensure that workers are familiar with the action to take in the event of fire or explosions
- Fire awareness materials should be placed in strategic locations within the plant to educate the staff and visitors on what to do in the event of fire
- An elaborated emergency response plan has been developed to address the risks associated with the plant operations (attached as Annexure- AA)
- “No smoking signs and policy” should be displayed as appropriate and actions to be taken against those not adhering to this order.

7.4.5.6 Occupational Health and Safety

532. There could be a number of health and safety hazards during operational phase of the project such as:

- Slipping and falling into open tanks may lead to serious injuries and risk of drowning.
- The water stagnation and open water tanks may produce breeding places for dengue larvae and can cause dengue fever in site workers specially in monsoon season.
- The poor handling and storage of hazardous substances such as alum and chlorine at the plant site may pose serious health hazards at site. Such as eye and nasal irritation, sore throat, coughing and severe burns.
- Leakage of chlorine can cause serious injury to site workers and cause damage to plant property if not handles and stored properly.
- During maintenance of power lines, the worker may get exposed to Electromagnetic field (EMF) and to other occupational hazard from contact with live power lines during stringing activities.
- Inadequate training and avoidance of the use of PPE by workers can cause serious health hazards leading to injuries and possible death.

Mitigation Measures

- Necessary health and safety rules should be enforced by the LWASA for site management
- Proper training should be given to site workers on health and safety measures
- Cleaning and removal of stagnant water from site should be done on daily basis
- Introduce aquarium fish such as Guppy fish into all stagnant water bodies as it will eats the dengue larva and reduce its effecting areas
- Conduct workshops and arrange awareness programs at site regarding dengue awareness and related precautionary measures
- Place awareness material at site related to dengue fever symptoms and necessary precautionary measures
- Instruct site staff to wear long sleeve shirts, long pants, socks and closed shoes to avoid mosquito bites at dusk and dawn especially
- Fumigation should be done on site periodically
- All hazardous substances such as bagged material and drum should be stored on pallets and where possible under the cover of secondary containment
- Hazardous materials should be well labelled and stored in their original containers
- Access of unauthorized person should be strictly restricted in the area where chemicals are being stored

- Material safety data sheets (MSDS) should be available and readily accessible to site workers
- All hazardous substances/chemical should be appropriately handled and disposed off as mentioned in material safety data sheets (MSDS)
- Leak detection system should be installed so that chlorine feed system will automatically shut down when any leak is detected
- Place an adequately stocked first aid kit at the site; and staff members should train in first aid administration
- Provide appropriate PPEs such as ear plugs, ear muffs, safety boots, hard hats and full body suits to all site staff and provide air respirator, full face mask, chemical resistant shoes, gloves and clothing to the staff dealing with hazardous substances
- Clear signage should be posted alerting of possible danger at locations where dangerous and hazardous materials are present
- During maintenance of power transmission towers, ensure that the live wire work is conducted by trained workers with strict adherence to specific safety and insulation standards (Pakistan Electric and telecommunication Safety Code-PETSAC-2014)
- Establish and identify safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limit access to properly trained workers
- Develop and Implement action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by International Commission on Non-Ionizing Radiation Protection (ICNIRP), and the Institute of Electrical and Electronics Engineers (IEEE)
- Personal exposure monitoring equipment should be set to warn of exposure levels that are below occupational exposure reference levels (e.g. 50 percent). Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.

7.4.6 Anticipated Social Impacts during Operational Phase (Package 03)

533. The anticipated social impacts associated with the proposed project operational phase are discussed as under:

7.4.6.1 Traffic Congestion

534. Presently, traffic load on Bhaini and Ganj e Sindhwan road is moderate. However, during project operations, the existing traffic load might negligibly increase at site mainly during workers going to or from work, raw material delivery and waste transportation. The increased

traffic load will create congestion on these roads and disturb the nearby sensitive receptors i.e. school and local residents of Ganj-e-Sindhwan and Nat Kalan.

Mitigation Measures

- Raw material delivery should be planned in such way to avoid peak traffic hours
- Raw material delivery trucks must be assigned with restricted circulation hours
- Inform local residents in advance regarding road closure and rerouting of vehicles and pedestrians' traffic
- Train truck drivers to avoid unnecessary hooting while passing through sensitive receptors such as residential areas and school.

7.4.7 Anticipated Environmental Impacts During Operational Phase (Package 04)

535. The anticipated environmental and social impacts associated with the proposed project operational phase are discussed as under:

7.4.7.1 Water Losses and Leakages

536. Once the water distribution network is laid, tested and commissioned, there would be no such impact anticipated except for rare pipes leaks and breaks. The leaks may occur due to water overflow or when the pipe becomes old and ruptures due to natural incidents such as earthquake.

537. Leaking water pipes can allow potentially harmful contaminants to enter into existing drinking water system thus deteriorating the water quality.

538. In addition, the BRBD Canal runs throughout 11 months of a year. Under the annual canal closure plan, Indus River System Authority (IRSA), BRBD canal remain close for 20-25 days. In this period of time, the surface water will not be available in these areas. The consumers of the selected areas, after completion of the SWTP project, will be affected. So, there is a need of proper approach and plan for these particular 20-25 days.

Mitigation Measures

- All water pumping stations should be adequately maintained
- Prompt action should be taken against burst and leak pipes
- Establish a leakage management plan for all District Metered Zones (DMZ) and District Metered Areas (DMAs)
- Constant checking of water distribution network to identify water being theft and illegal connections and to avoid water contamination
- LWASA has planned to make the 28 tube wells remain operational to compete their water demand during canal closure period.

7.4.7.2 Noise

539. Pipe repair and fitting work may generate noise at site. This impact can be anticipated as minor and insignificant as this will remain only for very short period of time.

Mitigation Measures

- Inform local residents about the noisy activity that will generate during pipe repairing
- Limit the noisy activity only to day time
- Ensure that worker repairing the pipe should use ear plugs while working.

7.4.7.3 Waste Generation

540. Solid waste generated during maintenance work will consist of excess soil, broken concrete, pipe and fitting material. This impact can be anticipated minor as a very little amount of waste is expected to generate.

541. There would be no additional wastewater generation is anticipated in the operational phase of the project. LWASA will charge the consumers of the serving areas according to the amount of water consumed by them. The new water metering system will induce efficient water consumption by the households of the serving areas of the project.

Mitigation Measures

- Immediately backfill the disturbed areas after completion of work
- Prepare an integrated waste management system
- Sell all recyclable waste to recycling facilities where possible
- Dispose-off all waste in an environmentally friendly way
- Strictly prohibit improper or illegal dumping of waste.

7.4.8 Decommissioning Phase Impacts (Package 03)

542. Decommissioning is a formal process to remove something from an active area status. The proposed project has been designed for an operational period of 25 years.

543. Decommissioning of the project involves dismantling of treatment plant, storage tanks, plant structure and all allied utilities. The impact associated with decommissioning activities are both positive and negative.

Positive Impact

- Creation of employment opportunities

Negative Impact

- Land Use Change
- Dust Generation

- Solid and Hazardous Waste
- Noise and Vibration

Mitigation Measures

544. The project proponent in combination with a Health, Safety, and Environment expert should develop environmental, health, and safety procedures for decommissioning phase of project. These procedures should, among other issues, address the following:

- Health and safety plan
- Pollution prevention plans including water, noise, soil and air pollution prevention plans
- Waste management plans
- Restoration plans.

7.4.9 Decommissioning Impacts (Package 04)

545. The project can be decommissioned when its life or design period ends. The total life of this project is 20 years. Other reason of decommissioning can be considered if water distribution network become ineffective due to unexpected change in climate.

546. Following positive and negative impacts can be anticipated during decommissioning phase.

Positive Impact

- Employment Generation

Negative Impacts

- Loss of Portable Water
- Dust Generation
- Noise and Vibration
- Waste Generation

Mitigation Measures

- All the waste should be reused and recycled to ensure that materials that would otherwise be disposed of as waste are used for productive purpose
- Solid waste generated during dismantling should be safely disposed in defined waste disposal sites
- The wastes which are reusable or recyclable (iron bars, aluminium etc.) should be sold to waste contractor and those which cannot be sold out (excess soil and brick pieces) should be used as a filling material for levelling the depressions. In addition, all non-recyclable waste should be sent to the EPA licensed waste facility

- Adopt practices to prevent waste to enter in nearby drainage system and surface water source
- Open burning of solid waste should be prohibited at site
- Revegetate the disturbed area after completion of work
- Sprinkle the water on all active dust areas of the site
- Provide appropriate PPE to all workers carrying out dismantling activity
- Limit work as far as possible to day time.

CHAPTER 08

8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 Environmental and Social Management Plan (Package 03 and 04)

547. This chapter describes the management plan to be implemented to avoid or mitigate the anticipated negative environmental and social impacts and enhance the positive impacts of the sub-project activities.

548. The objectives of the Environmental and Social Management Plan (ESMP) are to:

- Provide a comprehensive listing of the various mitigation and monitoring measures that are to be implemented to avoid, minimize or mitigate negative impacts and enhance positive impacts
- Institutional arrangements that are and will be put in place by LWASA for the environmental and social compliance
- Detail the plan of periodic monitoring for the effectiveness of the suggested mitigation measures
- Design the training and capacity building plan for enhancing the capacities of the key stakeholders on environmental and social management
- Detail the budget requirements for implementation of the ESMP

8.2 Institutional Arrangement for ESMP Implementation (Package 03 and 04)

549. The key institutional arrangements for the implementation of ESMP are:

8.2.1 Housing Urban Development and Public Health Engineering Department

550. The Housing Urban Development and Public Health Engineering Department is the sponsoring agency of the Project. The Project will be implemented under the overall control of Secretary Housing Urban Development and Public Health Engineering Department (HUD and PHED), Gov't of Punjab.

8.2.2 Project Steering Committee (PSC)

551. For internal coordination and smooth implementation of the Project, a committee will be set up as under: A Project Steering Committee (PSC) will be established in the HUD & PHED chaired by the Chairman P &D, to provide overall guidance and policy direction. The PSC will comprise of WASA Lahore, Representatives of P & D, Finance, Irrigation, LDA, EPA and District Administration. The PSC will review the semi-annual and annual project performance reports and based on periodic discussions issue directions for effective implementation of the Project by WASA Lahore. The PSC will meet every quarter or more frequently if required, to take stock of project progress and make course corrections. The PSC

will review the semi-annual and annual project performance reports and based on periodic discussions issue directions for effective implementation of the Project.

8.2.3 LWASA-Project Management Unit (PMU)

552. The Executing Agency (EA) for the Project will be Lahore WASA under the overall control of Secretary HUD & PHED, Govt. of the Punjab. The EA will establish a Project Management Unit (PMU) headed by the Project Director (PD), located at LWASA. The organogram of LWASA-PMU is provided in **Figure 8.1.**

553. The PMU supported by a team of consultants called Project Management Consultants (PMC) will assist LWASA in implementation of the project and will also support in supervision and monitoring. PMU staff would be recruited on contract or from within WASA Staff. The PMU role will include management of environmental and social safeguards, approving contractors' site specific environmental and social management plan (SSESMP), supervising and reporting contractors' environmental and social performance, management of grievance redress mechanism (GRM), ensuring availability of committed human resources and sufficient budget for successful implementation of ESMP.

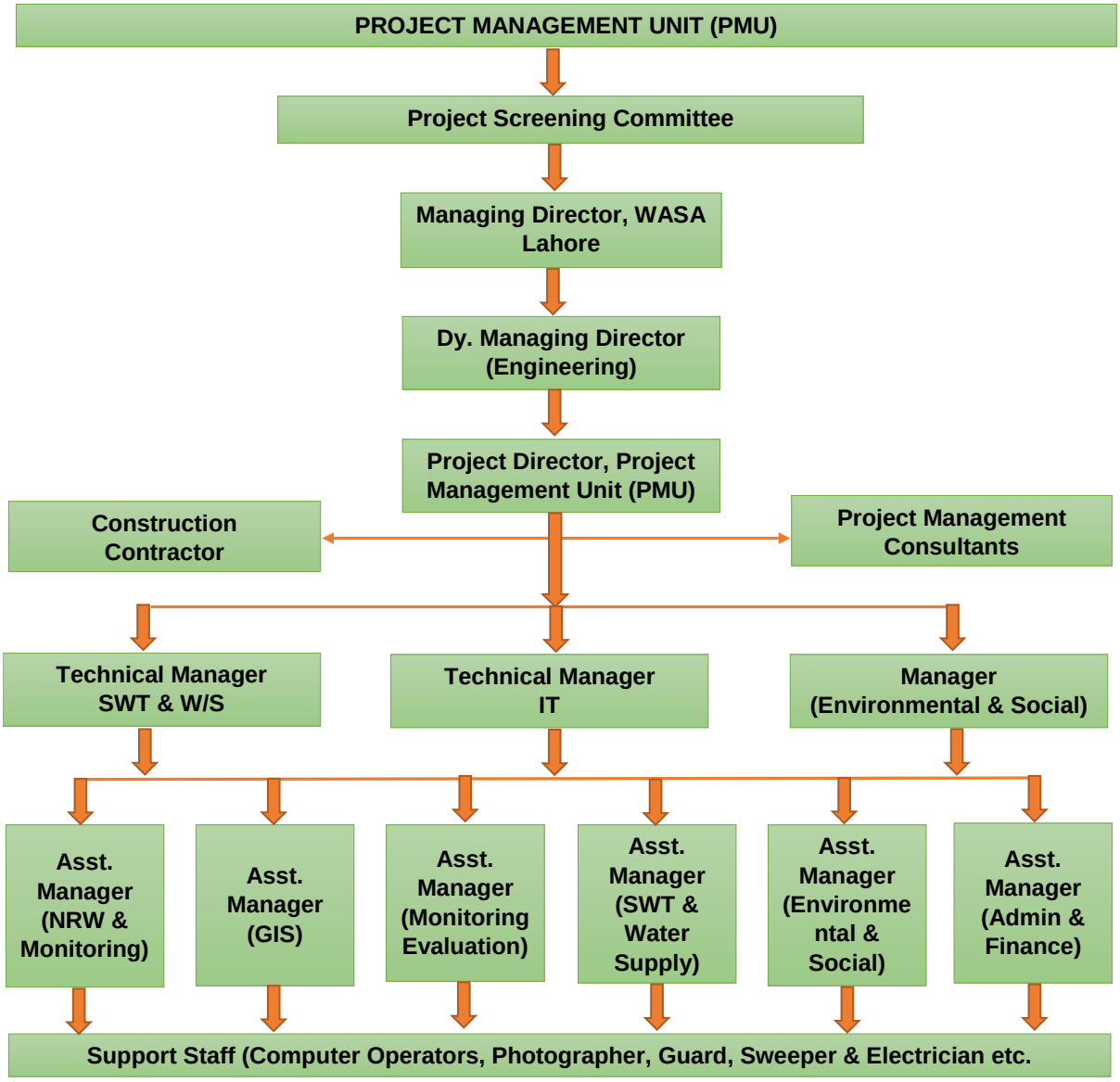


Figure 8.1 Organogram-LWASA-PMU

(Source PC-I)

8.2.4 Project Management Consultant

554. The Consultant shall work in close liaison with the LWASA-PMU, the dedicated team of Environment and Social Specialist of Consultant will support PMU in hiring of contractor, reviewing and approving site specific environmental and social management plan (SSESMP) submitted by the contractor, supervising and reporting contractors' environmental and social performance, assessing the contractor compliance with the submitted ESMP, SSESMP and contractor's code of conduct, as well as fulfilling requirements of AIIB and other stakeholders including Government departments.

8.2.5 Construction Contractors

555. The contractor will be responsible for preparing site specific environmental and social management plan (SSESMP), code of conduct for construction staff and employment policy as well as obtaining all necessary approvals, permits and clearances and implementation and adherence to all the mitigation and monitoring measures outlined in this ESMP. The contractor will be required to comply with the mitigation and monitoring provisions of the ESMP and with any related codes of conduct required by LWASA-PMU. The contractor will be hired through proper bidding procedure. The biding process of hiring of contractor will be transparent and solely depend upon the capabilities and capacities (as per the prescribed TORs) to ensure compliance to legal environmental and social requirements as well as adherence to the ESMP. The Contractor must have a qualified Environmentalist and Social Experts on full time basis to interpret and implement the ESMP.

8.3 Bidding and Contract Documents (Package 03 and 04)

556. ESMPs are to be included in bidding and contract documents and verified by the LWASA-PMU. The LWASA-PMU shall also ensure that bidding and contract documents include specific provisions requiring contractors to submit a site-specific environmental and social management plan (SSESMP) prior to start of work. The selected contractor will be audited and monitored on the clauses mentioned in the SSESMP. No works can start prior to the approval of SSESMP from L-WASA PMU and AIIB. A copy of the approved SSESMP will be kept all the time on site during the construction period of the project. Non-compliance with, or any deviation from, the conditions set out in the SSESMP may leads to failure in compliance and shall require corrective actions.

8.4 Contractors' Code of Conduct (Package 03 and 04)

557. The contractor should prepare a Site-Specific Environmental and Social Management Plan (SSESMP). The plan should include (i) proposed sites/locations for construction labour camps, storage areas, hauling roads, disposal areas for solid, hazardous and liquid wastes; (ii) specific mitigation measures ensuing the approved ESMP; (iii) monitoring program as per ESMP; and (iv) budget implementation of SSESMP.

558. The Contractor shall submit the Code of Conduct that will apply to all of the contractor's staff. The contractor shall submit an outline of how the Code of Conduct will be implemented. The aspects to be addressed include:

- Contractor should ensure compliance with the submitted Site-Specific Environmental and Social Management Plan (SSESMP)
- Ensure training for contractor and its staff

- Ensure compliance with applicable environment, health and safety requirements with the understanding of site-specific risks associated with project activities
- Ensure Compliance with all the obtained approvals applicable to the proposed project
- Ensure protection of local community (including vulnerable and disadvantaged groups), and the Contractor's staff, sub-contractors and day/site workers
- Ensure employment of fulltime watchmen and necessary warning system at site
- Ensure provisions and use of personal protective equipment (PPE) by site workers
- Ensure provision of adequately stocked first aid kit at site for dealing with accidents, snake bite incident and emergency handlings
- Prohibit use of illegal items such as weapons, alcohol and drugs at site
- Ensure that project property is protected against vandalism, theft, and noxious activity
- Ensure that positive attitude of respect and affection is given to local communities and their culture.
- Ensure good housekeeping practices shall be adopted at site.
- Ensure that employment decisions are not made on the basis of personal characteristics unrelated to inherent job requirements, including race, gender, nationality, religion or belief, disability, age, sexual orientation, or ethnic, social and indigenous origin
- Ensure establishment and strictly enforcement of "No Sexual Harassment Policy"
- Ensure provision of necessary sanitation requirements for site workers (both for men and women)
- Ensure workers only use specified sanitary facilities provided by their employer and not in open areas

559. The Code of Conduct should be written in local/simple language and signed by each site staff to specify that they have: received a copy of the code; had the code explained and clarified to them; acknowledged that adherence to this Code of Conduct is a condition of employment; and understood that violations of the Code can result in serious consequences. A copy of the code shall be displayed at strategic location of the site and mainly in the contractor's site office.

8.5 Emergency Preparedness and Response Planning (Package 03 and 04)

560. The 'On-site Emergency Plan' will be developed by contractor and shall include minimum the following information:

- Site Locations
- Emergency contact numbers such as police, fire brigade, bomb disposal, rescue 1122, nearby hospitals and ambulances
- List of emergency equipment including fire extinguishers, fire suits etc.

- Layout maps mentioning the locations of emergency exit points/signs, emergency assembly area, emergency evacuation routes, locations of firefighting equipment and fire alarms
- Identification of Potential Emergency Situations, preventive, control and response measures
- Medical service / first aid

8.6 Mitigation Plan (Package 03 and 04)

561. The detailed mitigation plan for both Package 03 and 04 are given in **Table 8.1** and **Table 8.2** respectively. The impacts have been classified into three phases of the project i.e. the design stage, construction stage and operation stage. The mitigation plan presents a listing of the mitigation measures to be taken for each identified potential impact along with the timing of implementation as well as implementation and supervision responsibility at each phase of the project.

Table 8.1 Mitigation Plan (Package 03)

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
ANTICIPATED ENVIRONMENTAL AND SOCIAL IMPACTS DURING DESIGN AND PRE-CONSTRUCTION PHASE						
1	**Inappropriate design of water intake channel**	Inappropriate design and construction of water intake will interfere with fish and other aquatic organisms thus affect their movement to migrate upstream and downstream Poor designing of water tanks and other allied facilities can rupture during natural disasters such as earthquakes or floods and can cause serious damage to the plant property as well as mixing of large amount of clean water with	• Install suitably designed fish screens at the intake channel to protect fish population of BRBD Canal. Screens should be angled to the incoming water current to guide fish along the face of the screen to an exit at the downstream end which returns them to the canal • The design of the water tank should adopt a number of measures to avoid unpredictable consequences of natural disasters. The tank should be design as a semi underground structure; since the area is considerably flat and does not require elevated tanks for gravity flows. This is a significant safety measure when considering the risk of seismic activities	During design phase	LWASA-PMU and Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
		floods consequently causing spoiling of portable water	• The structure should design to withstand earthquake loads, and should be provided with sufficient earth retaining structures, as well as enough considerations to withstand seismic behaviour of the liquid • The structure should be closed one and elevated by nearly two (02) meters above the ground, which is also important to prevent water from mixing with floods.			
2	**Impact of Land to be Acquired**	Loss of agriculture and livelihood of many titleholders	• Suitable land or cash compensation should be given to the titleholder/project affectees • All the concerns of the titleholders should be resolved prior to start construction of the project • The land to be acquired may be minimized to approximately 100 acres as the current requirement requires 30 acres of land only.	During Design Phase	LWASA-PMU	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
3	**Electric and Magnetic Field**	Exposure to electric and magnetic field may cause health effects on residents of project area	• LESCO should evaluate potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Average and peak exposure levels should remain below the ICNIRP recommendation for General Public Exposure • Avoid Installation of transmission lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g. schools or offices) • Assessment of EMF levels to determine the expected level to remain within the recommended exposure limits, in case of non-compliance, application of engineering techniques should be	During Design Phase	LESCO	LWASA-PMU and LESCO

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			considered to reduce the EMF produced by power lines. Examples of the techniques used include: • Shielding with specific metal alloys • Burying transmission lines • Increasing height of transmission towers • Modifications to size, spacing, and configuration of conductors			
4	**Visual Amenity**	Disturbance to visual amenity	• Site power lines, with due consideration to landscape views and important environmental and community features • Change the alignment of transmission line (if possible) as its passing through the densely populated	During Design Phase	LESCO	LWASA-PMU and LESCO
5	**Electrocution Hazard**	Overhead transmission line will pose electrocution threats to	• Align transmission corridors to avoid critical habitats (e.g. nesting grounds, heronries, rookeries, bat	During design phase	LESCO	LWASA-PMU and LESCO

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
		bats and birds present in the project area	foraging corridors, and migration corridors) • Distances between conductors (140 cm), and between perch sites and energized elements (60 cm), have to be larger, where species of large birds are present (bat and eagles etc.).			
6	**ESMP Design and Provision to Contractor**	Poorly/inadequately designed ESMP and its non- provision to contractor	• Make sure ESMP covers all aspects of the project in detail • Make sure ESMP is distributed among the contractors well in time	During design phase	Contractor and LWASA-PMU	LWASA-PMU
7	**Contractor training for ESMP implementation**	Failure to brief and train the contractors for effective ESMP implementation	• LWASA should conduct and deliver 1-week workshop as needed for implementation of ESMP	During design phase	Contractor and LWASA-PMU	LWASA-PMU
8	**Project Disclosure**	Project delay	• Ensure all changes to alignment are included in the ESMP and disclosed to EPA • Determine whether changes to alignment need additional	During design phase	Contractor and LWASA-PMU	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			environmental assessment and carry out the environmental assessment, if necessary			
9	**Planning construction camps and materials management**	Harm to environment due to construction camps	• Plan sites for worker camps and back up areas for stockpiling materials and equipment in advance • Consult local community and locate to use waste/barren land and non-agricultural plots.	During design phase	Contractor and LWASA-PMU	LWASA-PMU
10	**Traffic Condition**	Blockage of roads during construction works	• Avoid the blocking of existing roads and other access near the works route during construction through use of traffic management plan	During design phase	Contractor and LWASA-PMU	LWASA-PMU
11	**Waste disposal**	Soil and water contamination. Public health issues	• Create waste management plan to identify sufficient locations for storage, reuse and recycling of material and disposal of residually contaminated soils and scrap metal • After agreement with local authority, designate disposal sites in the contract and decide disposal rates accordingly	During design phase	Contractor and LWASA-PMU	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
12	**Institutional strengthening and capacity building**	Failure in effective and timely completion of project	• Develop strengthening plan for the environmental management by LWASA as the Project rolls out • Increase staffing of LWASA • Train Environmentalists/ Officials to apply the ESMP and to evaluate the environmental requirements and contractors' mitigation measures	During design phase	Contractor and LWASA-PMU	LWASA-PMU
13	**Orientation for Contractor, and Workers**	Lack of contractor training and awareness contributing to environmental damage	• Conducting special briefing and / or on-site training for the contractors and workers on the environmental requirement of the project. Record attendance and achievement. • Agreement on critical areas to be considered and necessary mitigation measures, among all parties who are involved in project activities • Periodic progress review sessions to be conducted on regular basis	During design phase	Contractor and LWASA-PMU	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
14	**Equipment Maintenance**	Poor performance of equipment and project delays	• Use fully tuned vehicles and machinery. • Prepare and keep the record of equipment maintenance log • Prepare proper maintenance sheets for vehicles.	During design phase	Contractor and LWASA-PMU	LWASA-PMU
ANTICIPATED ENVIRONMENTAL IMPACTS DURING CONSTRUCTION PHASE						
15	**Dust Emission**	Deterioration of air quality and impacts on human, flora and crops present in the area	• The material transportation should be carried out after school timings • Adequately cover all materials stored or stockpiled at the site • The surplus water from the construction activities should be used in spraying and sprinkling of the area to reduce the dust emissions • All roads within the plant site will be paved as early as possible after completion of construction	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			work. Until roads are paved, they should be sprayed with water regularly to prevent dust emission. Other temporary tracks within the site boundary should be regularly sprayed with water • Aggregate material should be delivered to the batching plant in a damp condition, and water sprays will be applied • Project traffic should respect a maximum speed limit of 20km/h (as per OSHA standards) on un surfaced roads such as on Bhaini and Ganj e Sindhwan Road • Use tarpaulins to cover truck carting away the spoils using public road			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Proper planning in transportation of spoil to ensure that number of trips done, or the number of vehicles used is as minimum as possible • Provide appropriate Personal Protective Equipment (PPE) such as dust mask to the site workers.			
16	**Exhaust Emission**	Deterioration of air quality and impacts on human, flora and crops present in the area	• Batching plants and all the associated machinery should be installed with suitable pollution abatement technology such as scrubbers • Asphalt plant to be used should have zero emission technology • The batching plant (s), should be installed considering the parameters like; the wind direction and the distance from the nearby sensitive receptors	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Carryout regular monitoring at the site or near the sensitive receptors in order to ensure that ambient air quality remains within the standards limits set by PEQS • Use environment friendly fuel such as low sulphur diesel for diesel powered equipment and vehicles • Reduce vehicle idling time to minimum or shut down when not in use • All construction machinery should be properly tuned and maintained in good working condition in order to minimise emission of pollutants • Provide personal protective equipment (PPE) such as masks to all site workers			
17	**Water Resources**	Depletion of water resources Improper handling and storage of hazardous	• A containerized sewage treatment plant (STP) can be installed for the duration of construction period which may treat water and make it	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
		materials may deteriorate water quality of the project area	reusable for green areas. After, the construction the same can be utilized for any other project • The contractor should ensure efficient use of water at site by sensitizing construction staff to prevent irresponsible water usage to reduce pressure on existing local water source • The surplus water should be used in spraying and sprinkling of the area to reduce the dust emissions • To prevent surface/ground water contamination, spillage prevention and control measures should be instituted where hazardous materials are stored in pallets and where possible under cover in secondary containment • Ample supplies of clean-up materials should be kept and readily accessible at site			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• All generated waste from construction site should be disposed off in designated areas to avoid soil contamination/land degradations			
18	**Solid Waste**	Improper management of waste at construction site and camps will affect the aesthetic value of the surrounding area and may also cause nuisance, health and safety risks and breading places for mosquitos and vermin	• The waste that is recyclable or reusable (aluminium or iron bars) should be sold to waste vendors and those that cannot be sold out (broken brick pieces) should be used as a filling material for levelling the depressions, subject to technical feasibility • All the generated green waste should be used for composting purpose in the agricultural lands adjacent to the site. However, the wood of the felled trees will be sold in the local market. • Establish a system for collection, segregation and disposal of waste generated at the site	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Construction contractor should educate and encourage site workers to practice waste minimization, reuse and recycling to reduce quantity of the waste for disposal • The contractor should put in place measures to ensure construction material requirements are sensibly budgeted and to ensure that amount of material left at the site is kept nominal • Bins and skips should be placed within the camp site and should be adequately designed and covered to prevent access to mosquitos and vermin • Ensure cleaning of the provided toilet system on daily basis • All non-recyclable waste generated at the site should be sold to EPA certified waste vendor such as Global Waste Management, Lahore			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• A detailed labour camp management plan has been developed for the construction phase (attached as Annexure-V)			
19	**Liquid Waste**	Improper management of liquid waste at construction site and camps will affect the aesthetic value of the surrounding area and may also cause nuisance, health and safety risks and breading places for mosquitos and vermin	• Ensure cleaning of the provided toilet system on daily basis. Install suitably designed septic tank to treat the sewage waste generated from the camp site, after sewage settlement it can be sent to the Local Municipal Authority for final disposal.	During Construction Phase	Contractor	LWASA-PMU
20	**Soil Erosion**	Loss of soil cover increases the soils' vulnerability to erosion	• The risks of soil erosion and degradation can also be significantly reduced by adoption of good construction site management practices, such as establishment of vegetative buffer zones, slope stabilization, protection of soil	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			storage areas and use of sediment traps. • Establish a sufficient vegetation cover to minimize erosion at disturbed areas • Carryout work under mild weather, avoid working in heavy rains and wind • Ensure protection of topsoil through separation from subsoil and storage in a manner that, as far as possible, retains the soil structure and seed bank and minimize the risk of topsoil loss. Backfilling should start with subsoil, followed by topsoil • Adequate restoration ensuing construction will help the subsequent re-establishment of vegetation cover and thereby reduce the risk of soil erosion • Restoration of a stable landform that reflects the pre-disturbed condition			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			as this will curtail the risk of preferential erosion and therefore facilitate natural revegetation			
21	**Nosie and Vibration**	Noise adversely affects sensitive receptors	• All noisy equipment should be installed and operated as far away from the sensitive receptors as practicably possible • The contractor should ensure that, the high noisy activities should be carried out after the school timings • Where exposure to vibration may affect any body part or full body, the Contractor shall ensure that exposures are assessed, eliminated or otherwise controlled • All installed equipment should have noise insulator	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Contract specifications during construction will specify that the use of equipment likely to generate noise greater than PEQS should not be allowed during construction activities of the project. • The construction contractor should try to use machinery installed with appropriate noise control devices • High noise generating construction activities like, compactors etc. should be carried out only during day time • Appropriate Personal Protective Equipment (PPE) such as ear muffs and ear plugs should be given to the workers exposed to high levels of noise			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• All machinery and vehicles to be used at site should be in good working condition and properly lubricated and maintained to keep noise levels within the acceptable range of PEQS			
22	**Aquatic Habitat**	Increased turbidity and sedimentation downstream may affect aquatic habitats	• Minimize shoreline disturbance e. g limiting access of construction activities and workers to vulnerable areas that could contribute to sediment loading • Establish a buffer strips of natural vegetation along the shore to stabilize shorelines • Conduct regular monitoring of canal for turbidity and total suspended Solids	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
23	**Wildlife**	Establishment of construction camp has potential to dislocate wildlife from the associated vegetative cover within the site and from the immediate surrounding area	• Use signage and speed humps in the areas where farm animals crossing is possible • Strict instructions be given to all personnel working in project area to refrain from killing, capturing or disturbing any species of bird, reptile or mammal encountered during project activities, except in self-defence. • Demarcate at the site the approved limits of clearing to ensure no additional natural habitat is affected or disturbed • Train truck drivers regarding driving risk through biodiversity sensitive or remote areas • Ensure to maintain safe distance between two phases and phase and ground, so that the group of bats and birds may not get entangled in them	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
24	**Impact on Crop and Flora**	Cutting or removal of crop and flora of the area	• The contractor should ensure proper demarcation of project area to be affected by project activities • Cash compensation should be given to the titleholder of the affected land • Maintain the (Species wise) log of all trees cut and up-rooted • LWASA has allocated approximately 10 Million Rupees for compensatory plantation purposes, which is capable of planting approximately 10,000 to 15,000 trees of about 5-6 feet height. • Allocate at least 15-20% area of SWTP as green belts and parks to compensate the environmental degradation occurred due to cutting of trees.	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
25	**Greenhouse Gases and Climate Change**	Greenhouse gases may generate at site due to many anthropogenic activities during construction	• LWASA should plan for compensatory plants for five trees against each tree cut of similar species in adjacent suitable area after consultation with forest department and Parks and Horticulture Authority (PHA) • Use construction machinery designed with suitable pollution abatement technology such as scrubbers • In order to control NOx emission at site, diesel engine equipment and machinery should be installed with catalytic converter as It allows diesel engine to take advantage of the trade-off between NOx, PM and fuel consumption and calibrate the engine in a lower area of fuel consumption	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Environmentally friendly fuel such as Liquified Petroleum Gas (LPG) can also be used instead of diesel • Burning of waste should be strictly prohibited at site • Methane produced from decaying of organic matter can be capture and used as fuel where possible • Composting can be planned within the plant premises to manage organic waste produced from labour camps • An adequately designed septic tank should be constructed at site to manage sewage waste			
26	**Occupational Health and Safety**	Construction activities inevitably expose workers to many health and safety risks due to range of activities and work being undertaken at these sites.	• Contractor should provide necessary Personal Protective Equipment (PPE) such as dust masks, ear plugs, hard hats, foot wear and glasses to all site workers and ensure a safe and healthy environment for their workers	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Workers should be trained on how to properly use the PPEs to avoid the misuse or failure of PPEs. • Contractor should ensure provision of ample supply of clean portable water at all work sites • There should be first aid and emergency responses, including monitoring of worker symptoms, and investigating incidents of health-related illnesses • Contractor should have qualified first aid personnel among the workers and maintains fully stocked first aid kits at the sites • Contractor should enforce adherence to safety procedures and prepare contingency plans for accident response • Contractor should provide safety education and training to all site workers			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits • Contractor should not permit or force the workers to work more than the specified number of hours in a day. • Response or preventative measures should be taken in the extreme temperatures (e.g. increase frequency of breaks, reduce the work pace and workload, avoid working in direct sunlight, schedule heavy work for cooler part of day, wear hat and sun screen outdoors, etc.) • Install fences and place adequate safety warning signs at the construction site • Maintain safe distance from all power lines in order to avoid electrical hazards			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• A detailed Occupational Health and Safety Plan has been developed for the construction phase of the project (attached as **Annexure-X**)			
ANTICIPATED SOCIAL IMPACTS DURING CONSTRUCTION PHASE						
27	**Land Acquisition**	Loss of land and disruption of livelihood	• Resettlement plan is being developed in agreement with Project Affected Persons (PAPs) • Compensation to project affected people should be paid in cash and should be according to the current market value • Adequate notice to be given to farmers prior to commencement of construction so that the farmers do not unnecessarily lose crops • Compensation money must be given before the actual move so that displaced households can use the money to overcome the hurdles of dislocation	Before Construction Phase	LWASA-PMU	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Contractor should carry out all construction activities within predefined working areas. Any damage caused during construction outside the marked boundaries should be appropriately compensated by the contractor			
28	**Community Health and Safety**	Poor construction management practices by the Contractor have potential to cause adverse effects on safety, health and wellbeing of the residents of surrounding communities	• Regular water sprinkling should be done on all construction active areas present close to sensitive receptors in order to reduce dust exposure • Limit the construction activities to day time to avoid disturbance to nearby communities • Regular maintenance should be done of all construction machinery to maintain noise within the permissible limits of PEQS • Ensure that potentially disturbing construction noise is not produced outside of working hours	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Construction material delivery truck should be planned in such way to avoid peak traffic hours • Construction material delivery trucks must be assigned with restricted circulation hours • Establish and enforce speed limits especially in proximity to sensitive receptors such as nearby school and residential communities • Install necessary safety signs and speed bumps to alert drivers that they are approaching towards sensitive receptors • Assign a person from traffic police department to manage and handle traffic load during the peak construction times of the project • Inform local residents in advance regarding road closure and rerouting of vehicles and pedestrians' traffic			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Train truck drivers to avoid unnecessary hooting while passing through sensitive receptors such as residential areas and school • Contact with traffic police departments for maintaining traffic on roads which requires continuous police monitoring • Contractor should ensure proper disposal of waste generated at site • Constructor should strictly prohibit illegal dumping of waste • Contractor should eliminate unnecessary container habitats that collect water in which dengue larvae can produce • Contractor should conduct workshops in nearby school and residential communities regarding dengue awareness and precautionary measures			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
29	**Traffic Congestion**	Blockage of roads during construction works	• Establish a proper traffic management plan in consultation with traffic police department • Contact with traffic police departments for maintaining traffic on roads which requires continuous police monitoring • Identify alternate access routes and communicate to residents prior to start of work • Construction activities or material delivery should be planned in such way to avoid peak traffic hours • Provide educational materials to nearby schools and communities to inform children about road safety • Establish speed limits especially in proximity to sensitive receptors and sensitize the truck drivers on speed limit • Install necessary safety signs that are visible at night	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• In order to avoid complaints from mobile vendors adjust the location of their carts to similar location in the immediate locality of the original location for the duration of the project • Vehicular access to and from hospitals and fire stations should be maintained through the use of steel road plates over open trenches • Contractor should strictly follow project completion timeline in order to minimize disruption faced by the residents			
30	**Child Labour**	Due to the high poverty level within the project area, there could be cases of child labour hired for construction works	• Ensure that contractor should have its employment policy • Contractor should ensure the presence of all persons at site are adults and have their proper identity card with them	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
31	**Spread of Communicable Diseases and other Infections**	Improper disposal of waste Poor hygiene practices at labour camp site Risk of occurrence of communicable diseases	• Create awareness among workers on proper sanitation and hygiene practices to endorse proper health • Maintain good housekeeping practices at all project sites • Provide adequate personal hygiene facilities in good condition with adequate supply of clean water • Make arrangements to treat the affected workers on time to control the movement of vectors disease • Sensitize workers and surrounding communities on awareness and prevention of HIV/AIDS and STI through training, awareness campaigns and workshops during community meetings • Provide proper and free HIV/AIDS and STI health screening and counselling for site workers and community members	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
32	**Influx of Labour**	Strain on the existing social utilities such as medical centers and schools located near the project area. Creation of employment opportunities by the project could result into conflict between local inhabitants and outsiders, if not appropriately managed. Disturbance to social harmony of the project area Crime and security issues may arise due to bad behaviour of the workforce such as gambling and alcoholism	• The contractor should give employment opportunities to extent possible to local unskilled labour so as to reduce pressure on housing • To avoid conflicts among local people on employment matter, it is proposed that the Contractor employs the locals in cooperation with local administration in unskilled and semi-skilled duties. This will reduce pressure on existing resources such as housing, schools and health facilities • Unskilled and skilled labour to be hired from the local community as far as possible to minimize on influx of immigrants into the community • Develop and enforce a strict code of conduct for workers to regulate behaviour in the local communities • Eliminate an employee who continues misconduct or lack of	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			care, carries out duties amateurishly or inattentively, fails to conform to provisions of the contract, or persists in any conduct which is harmful to safety, health, or the protection of the environment • Taking all sensible precautions to avert illicit, vicious conduct by or amongst the Contractor's personnel, and to preserve unity and harmony and protection of people and property on and near the sites • Prohibiting drugs, alcohol, weapons, and ammunition on the worksite among personnel • Site security preparations must be contained within the Bills of Quantities (BoQs) to avoid any delays which might be caused due to insecurity • The Contractor in cooperation with the security organs must create			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			awareness to the security situation on the ground all the times • Appropriate fencing, security check points, gates and security guards are to be provided at the construction sites to ensure the security of all plant, equipment, machinery and materials, as well as to secure the safety of site staff. • The Contractor must guarantee that good relations are maintained with local communities and their leaders to help reduce the risk of vandalism and theft • A detailed Social Framework Agreement (SFA) has been developed for the construction phase of the project (attached as Annexure-Z)			
33	**Gender-based Violence**	Negative gender impacts may arise if priority is given to men	• The Contractor should make sure that no discrimination is made on the	During Construction Phase	Contractor	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
		who are supposed to be stronger and more resilient. Sexual harassment against women might occur as a consequence of mixing of men and women	basis of gender while hiring of workers • The Contractor should set the employment relationship on the code of equal opportunity and fair treatment • The employment decisions should not be made on the basis of personal characteristics unrelated to inherent job requirements, including race, gender, nationality, religion or belief, disability, age, sexual orientation, or ethnic, social and indigenous origin • A Gender Action Plan (GAP) is being developed which will include at minimum, conformance with relevant laws, equal opportunity employment and gender sensitization • Special measures be taken to address harassment, intimidation,			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			and/or exploitation, especially in relation to women • Establish and strictly enforce a No Sexual Harassment Policy in accordance with provincial law • Provision of gender disaggregate bathing, changing, and sanitation facilities			
34	**Impacts on Cultural and Archaeological Assets**	Construction activities may damage any existing archaeological assets or cultural property.	• If Contractor discovers any archaeological remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall follow the instructions given in Chance Find Procedure attached as Annexure-Y	During Construction Phase	Contractor	LWASA-PMU
35	**Grievance Redress**	Complaints/concerns of the stakeholders due to project activities	• A multi-tier grievance redress mechanism (GRM) has been developed to address/resolve complaints and grievances receive from the affected people (AP) and other stakeholders	During Construction Phase	Contractor and LWASA-PMU	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
ANTICIPATED ENVIRONMENTAL IMPACTS DURING OPERATIONAL PHASE						
36	**Air Emissions**	Deterioration of local air quality	• The generator to be installed at site should be equipped with chimney having proper height to discharge the hot gases/smoke • Alternatives to SF6 circuit breakers with insulators made of composite and rubber instead of ceramic insulators should be considered • LESCO should prefer CF3I insulating gas as alternative to SF6 • LESCO should monitor gas (SF6 or CF3I) on periodic basis through pressure gauges • LESCO should use hand held leak detectors to monitor leaks of gas (SF6 or CF3I) • LESCO should maintain an annual inventory checklist of SF6 or CF3I consumption, purchase, and losses to track emissions	During Operational Phase	LESCO and LWASA-PMU	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• LESCO should provide training to staff on proper handling of SF6 or CF3I			
37	**Waste Generation**	The water treatment process will generate waste from coagulation/flocculation, sedimentation and filtration processes. The sludge generated, if not properly disposed, has potential to pollute the underlying soil, surface and ground water resources	• The backwash water will be recycled in the equalization tank (expected to be 5% of the volume abstracted). • Sludge generation can be minimized through reduction of chemical dosage, chemical recovery, substitution of coagulant and recycling of filter wash water • The sludge generated from primary sedimentation tank can be used as fertilizer and soil conditioner on adjacent land after being dried in sludge drying beds or can be dumped in dumped in Lakhodair landfill site present at a	During Operational Phase	LWASA-PMU	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			distance of approximately 3 km from the proposed site of SWTP. The sludge generated by the SWTP will be of inorganic nature, and will only be harmful if sufficient quantity is ingested or accumulated. However, the coagulant sludge which is considered to be toxic and should be sent to the EPA certified waste management vendor such Global Waste Management for incineration • Integrated waste management system should be developed for the site to manage domestic waste of the site • All recyclable waste should be sold to local recycling facilities			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Designate proper area at the site for temporary storage of hazardous waste • All generated hazardous waste from the site should be sent to the EPA certified waste management vendor, such Global Waste Management • Domestic waste generated from staff housing should be segregated to enable composting of organic waste, recycling of paper and plastics • Sewerage generated at site should be treated in a septic tank. After treatment, local municipal authorities should remove it for the final disposal.			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
38	**Noise and Vibration**	Use of noisy machinery and equipment at site may generate noise at the site	• Pumps should be serviced and tested regularly for an engineered fault • All noisy equipment and machinery such as generators and blowers should be housed in closed rooms or buildings • Appropriate PPE such as ear plugs and muffs should be provided to the all site workers, specially to those present close to the noisy machinery	During Operational Phase	LWASA-PMU	LWASA-PMU
39	**Impact of Hydrology**	Excessive abstraction from canal might reduce the existing water level due to ineffective compensation	• Ensure water abstraction does not exceed quantities agreed with irrigation department • The canal water will be compensated by constructing a new Syphon parallel to the existing Syphon to increase the capacity and cater the demands of the irrigation department in future.	During Operational Phase	LWASA-PMU	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
40	**Occupational Health and Safety**	Improper use of PPE and storage of hazardous substances such as alum and chlorine at the site poses health and safety hazards at site	• Necessary health and safety rules should be enforced by the LWASA for site management • Proper training should be given to site workers on health and safety measures • Cleaning and removal of stagnant water from site should be done on daily basis • Introduce aquarium fish such as Guppy fish into all stagnant water bodies as it will eats the dengue larva and reduce its effecting areas • Conduct workshops and arrange awareness programs at site regarding dengue awareness and related precautionary measures • Place awareness material at site related to dengue fever symptoms and necessary precautionary measures	During Operational Phase	LWASA-PMU and LESCO	LWASA-PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Instruct site staff to wear long sleeve shirts, long pants, socks and closed shoes to avoid mosquito bites at dusk and dawn especially • Fumigation should be done on site periodically • All hazardous substances such as bagged material and drum should be stored on pallets and where possible under the cover of secondary containment • Hazardous materials should be well labelled and stored in their original containers • Access of unauthorized person should be strictly restricted in the area where chemicals are being stored • Material safety data sheets (MSDS) should be available and readily accessible to site workers			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• All hazardous substances/chemical should be appropriately handled and disposed off as mentioned in material safety data sheets (MSDS) • Leak detection system should be installed so that chlorine feed system will automatically shut down when any leak is detected • Place an adequately stocked first aid kit at the site; and staff members should train in first aid administration • Provide appropriate PPEs such as ear plugs, ear muffs, safety boots, hard hats and full body suits to all site staff and provide air respirator, full face mask, chemical resistant shoes, gloves and clothing to the staff dealing with hazardous substances • Clear signage should be posted alerting of possible danger at locations where dangerous and hazardous materials are present			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• During maintenance of power transmission towers, ensure that the live wire work is conducted by trained workers with strict adherence to specific safety and insulation standards (Pakistan Electric and telecommunication Safety Code-PETSAC-2014) • Establish and identify safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limit access to properly trained workers • Develop and Implement action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by International Commission on Non-Ionizing Radiation Protection (ICNIRP), and			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			the Institute of Electrical and Electronics Engineers (IEEE) • Personal exposure monitoring equipment should be set to warn of exposure levels that are below occupational exposure reference levels (e.g. 50 percent). Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.			
41	**Fire and Explosions**	Poorly designed gas chlorine storage tanks and constructed electric installations can lead to fire and explosion that may in turn lead to injury and possible death of a worker	• The whole plant area and storage tanks should be designed and constructed according to National Fire Protection Association (NFPA) standards for the prevention and control of fire and explosion hazards • Routine inspection should be carried out to check that the area around the	Operational Phase	LWASA-PMU	LWASA -PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			generator is free of clutter and no flammable material is present • Accidental spillage of chemicals should be immediately cleaned up • Workers should be trained on handling and controlling accidental spillage of flammable substances that may trigger fires • Appropriate fire safety equipment should be installed at convenient locations within the plant. Equipment should be regularly examined and maintained by a reputable fire safety and security company • Fire drills should be conducted at least biannually to ensure that workers are familiar with the action to take in the event of fire or explosions • Fire awareness materials should be placed in strategic locations within the plant to educate the staff and			

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			visitors on what to do in the event of fire • An elaborated emergency response plan has been established to address the risks associated with the plant operations (attached as Annexure- AA) • "No smoking signs and policy" should be b displayed as appropriate and actions to be taken against those not adhering to this order			
ANTICIPATED SOCIAL IMPACT DURING OPERATIONAL PHASE						
42	**Traffic Congestion**	Increased traffic load will create congestion on these roads and disturb the nearby sensitive receptors	• Raw material delivery should be planned in such way to avoid peak traffic hours • Raw material delivery trucks must be assigned with restricted circulation hours • Inform local residents in advance regarding road closure and rerouting of vehicles and pedestrians' traffic	Operational phase	LWASA-PMU	LWASA -PMU

Sr. No	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Train truck drivers to avoid unnecessary hooting while passing through sensitive receptors such as residential areas and school			

Table 8.2 Mitigation Plan (Package 04)

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
ANTICIPATED ENVIRONMENTAL IMPACTS DURING DESIGN PHASE AND PRE-CONSTRUCTION PHASE						
1	**Overflow and Pipe Leakages**	Inappropriate size and use of low-quality pipes can be burst in the event of natural disaster such as earthquake and can cause urban flooding in the low laying areas	• All pipes should be designed with adequate capacity and flow velocity • Develop a detailed pressure and leakage management plan for the project	During design phase	LWASA-PMU	LWASA-PMU
2	**ESMP Design and Provision to Contractor**	Poorly/inadequately designed ESMP and its non- provision to contractor	• Make sure ESMP covers all aspects of the project in detail • Make sure ESMP is distributed among the contractors well in time	During design phase	Contractor and LWASA-PMU	LWASA-PMU
3	**Contractor training for EMP implementation**	Failure to brief and train the contractors for effective ESMP implementation	• LWASA should conduct and deliver 1-week workshop as needed for implementation of ESMP	During design phase	Contractor and LWASA-PMU	LWASA-PMU
4	**Project Disclosure**	Project delay	• Ensure all changes to alignment are included in the ESMP and disclosed to EPA	During design phase	Contractor and LWASA-PMU	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Determine whether changes to alignment need additional environmental assessment and carry out the environmental assessment, if necessary			
5	**Planning construction camps and materials management**	Harm to environment due to construction camps	• Plan sites for worker camps and back up areas for stockpiling materials and equipment in advance • Consult local community and locate to use waste/barren land and non-agricultural plots	During design phase	Contractor and LWASA-PMU	LWASA-PMU
6	**Traffic Condition**	Blockage of roads during construction works	• Avoid the blocking of existing roads and other access near the works route during construction through use of traffic management plan	During design phase	Contractor and LWASA-PMU	LWASA-PMU
7	**Waste disposal**	Soil and water contamination. Public health issues	• Create waste management plan to identify sufficient locations for storage, reuse and recycling of material and disposal of residually contaminated soils and scrap metal	During design phase	Contractor and LWASA-PMU	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• After agreement with local authority, designate disposal sites in the contract and decide disposal rates accordingly			
8	**Institutional strengthening and capacity building**	Failure in effective and timely completion of project	• Develop strengthening plan for the environmental management by LWASA as the Project rolls out • Increase staffing of LWASA • Train Environmentalists/ Officials to apply the ESMP and to evaluate the environmental requirements and contractors' mitigation measures	During design phase	Contractor and LWASA-PMU	LWASA-PMU
9	**Orientation for Contractor, and Workers**	Lack of contractor training and awareness contributing to environmental damage	• Conducting special briefing and / or on-site training for the contractors and workers on the environmental requirement of the project. Record attendance and achievement. • Agreement on critical areas to be considered and necessary mitigation measures, among all parties who are involved in project activities. • Periodic progress review sessions to be conducted on regular basis	During design phase	Contractor and LWASA-PMU	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
10	**Equipment Maintenance**	Poor performance of equipment and project delays	• Use fully tuned vehicles and machinery. • Prepare and keep the record of equipment maintenance log • Prepare proper maintenance sheets for vehicles	During design phase	Contractor and LWASA-PMU	LWASA-PMU
ANTICIPATED ENVIRONMENTAL IMPACTS DURING CONSTRUCTION PHASE						
11	**Dust Emission**	Deterioration of air quality and human health impacts	• Avoid and or control blowing of dust from potential sources by shielding them off from the exterior. For example, using tarpaulin or plastic sheets or by sprinkling with water • Avoid storing materials near to sensitive receptors such as schools, mosque and houses • The material transportation should be carried out after school timings • Minimize surface clearing to minimum requirement, where water transmission mains and distribution network is proposed • As laying of water distribution network is proposed to be carried out in narrow	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			streets and on main roads, the excavated earth material should not be stored on site and the grounds should immediately be refilled after the completion of the works in particular area • Give special instructions to drivers on safe driving of vehicles particularly on narrow roads. Instruct them to reduce the speed on road bends and earthen tracks to avoid blowing of drag dust • Provide appropriate Personal Protective Equipment (PPE) such as dust mask to the site workers • A GRM (discussed later in the document) should be put in place to receive complaints from public on various aspects of environmental issues, including air pollution. These grievances should be addressed by the contractor by adopting necessary pollution control measures.			

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Plantation should be done on all disturb areas immediately after completion of work			
12	**Exhaust Emission**	Deterioration of air quality and human health impacts	• Carryout regular monitoring at the site or near the sensitive receptors in order to ensure that ambient air quality remains within the standards limits set by PEQS • Use environment friendly fuel such as low sulphur diesel for diesel powered equipment and vehicles • Reduce vehicle idling time to minimum or shut down when not in use • All construction machinery should be properly tuned and maintained in good working condition in order to minimise emission of pollutants • In case access roads have to be closed, local communities and road users will be informed in advance, to minimize traffic congestions and to reduce exhaust emissions of the vehicles	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Reflective signature to direct traffic to designated areas will be used. If traffic management is done accurately, then the accumulation of the Sox, NOx and other such pollutants can be avoided • Provide personal protective equipment (PPE) such as masks to all site workers.			
13	**Water Resources**	Depletion of water resources	• The contractor should ensure efficient use of water at site by sensitizing construction staff to prevent irresponsible water usage to reduce burden on existing local water source • To the extent possible, hydrotest water should be used into the next section of the pipeline to be tested. If required, additional water can be added to make-up any losses or modifications in lengths of test section. If less is needed, the extra water should be discharged in a manner that prevents erosion e.g. discharge it on vegetated ground	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• The surplus water should be used in spraying and sprinkling of the area to reduce the dust emissions • Store all hazardous materials under cover and preferably under secondary containment • Accidental spillage of chemicals should be immediately cleaned up • Provide a spill control kit at the site and it should be readily accessible to the site workers • Wastewater generated at site should be discharged into already laid sewerage network of WASA			
14	**Drainage and Flooding**	Drainage structures may fail, or get clogged with construction debris during the construction phase of the Project	• The excavated material should be properly managed on site, and the workers will be sensitized by the contractor for the proper management of the construction debris • The contractor should be responsible for ensuring that no construction material or waste debris shall block the existing	Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			drainage channel in the areas of distributions mains. • The Contractor/site supervisor should be responsible for routine monitoring of drainage channels to ensure they remain free of waste and debris			
15	**Solid, Liquid and Hazardous Waste**	Improper management of waste at construction site and camps will affect the aesthetic value of the surrounding area and may also cause nuisance, health and safety risks and breading places for mosquitos and vermin.	• The soil excavated should be used as backfill and thereby reducing the generation of spoil material and related waste pollution concern. • The contractor should put in place measures to ensure construction material requirements are sensibly budgeted and to ensure that amount of material left at the site is kept nominal • The solid waste produced during construction phase should be transported by the contractor to an appropriately permitted off-site disposal facility • All hazardous waste generated at the site should be sold to EPA certified	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
		Improper waste management can also affect existing surface and groundwater quality of the area	waste vendor such as Global Waste Management, Lahore. • Vehicles and machinery coated with concrete should be washed at a designated place. The area selected for washing should be located at least 60 feet away from nearby drainage channel (i.e. Ganda Nala passing by Shalimar town) • Store all hazardous materials at designated place or preferably under secondary containment • All hazardous waste generated at the site should be sold to EPA certified waste vendor such as Global Waste Management, Lahore. • All liquid waste from site should be disposed off in already laid network of WASA			
16	**Soil Erosion**	Removal of topsoil and digging, as well as presence of	• Remove and store topsoil in separate piles and reinstate after refilling of trenches	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
		machinery and workers at site will have negative impact on soil quality	• A thin layer of grass or native vegetation cover should be provided soon after the completion of works. • Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil • To prevent soil contamination, control measures should be instituted where hazardous materials are stored in pallets and where possible under cover in secondary containment. • Ample supplies of clean-up materials should be kept and be readily accessible at site. • Do not pile excavated soil to form high stockpiles for long durations			
17	**Nosie and Vibration**	Noise adversely affects sensitive receptors	• In case of any scheduled noise event at site, notice should be given to the community and approval should be obtained	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Where exposure to vibration may affect any body part or full body e.g. during working with pneumatic drills, the Contractor shall ensure that exposures are assessed, eliminated or otherwise controlled. • Limit pickup truck and other small equipment to an idling time of one minute • Encourage workers to avoid hooting in residential areas and shut off vehicle whenever possible or not in use • The construction and more specifically excavation of the trenches for the pipelines by the use of hand-held equipment (manual labour) with very limited use of mechanized machinery which would be sources of noise and vibration, would be preferred • The contractor should inform the local authorities about the proposed project activities and the extent to which the			

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			machinery might create vibrations during the construction activities, so that the old and dilapidated can be evacuated during the construction activities and suitable temporary compensatory living space can be provided to the residents. • All machinery and vehicles to be used as site should be in good working condition and properly lubricated and maintained to keep noise levels within the acceptable range of PEQS • Appropriate Personal Protective Equipment (PPE) such as ear muffs and ear plugs should be given to the workers exposed to high levels of noise.			
18	**Greenhouse Gases and Climate Change**	Greenhouse gases may generate at site due to many anthropogenic activities during construction	• LWASA should plan for compensatory plants for five trees against each tree cut of similar species in adjacent suitable area after consultation with forest department and Parks and Horticulture Authority (PHA)	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Use construction machinery designed with suitable pollution abatement technology such as scrubbers • In order to control N2O emission at site, diesel engine equipment and machinery should be installed with catalytic converter as It allows diesel engine to take advantage of the trade-off between NOx, PM and fuel consumption and calibrate the engine in a lower area of fuel consumption • Environmentally friendly fuel such as Liquified Petroleum Gas (LPG) can also be used instead of diesel • Burning of waste should be strictly prohibited at site			
19	**Wildlife**	Establishment of construction camp has potential to dislocate wildlife from the associated vegetative cover within the site	• Train drivers to maintain speed limits in the congested area or where there is possibility of encountering the stray and domestic animals • Proper management of the food waste will be carried out, and no open dumping	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
		and from the immediate surrounding area.	of such waste will be allowed on the site, as it attract the stray animals during night times •			
20	**Impact on flora**	Disturbance to flora due to project activities	• The contractor should ensure proper demarcation of project area to be affected by project activities • The contractor will develop a re-plantation plan for the project area, to improve the aesthetics of the project area • Plan for compensatory planting for five trees against each tree cut of similar species in adjacent suitable area after consultation with forest department and Parks and Horticulture Authority (PHA)	During Construction Phase	Contractor	LWASA-PMU
21	**Fire and Explosion Hazard**	improper handling and storage of hazardous substances and empty cement bags at construction site can	• Routine inspection should be carried out to check that the area is free of clutter and no flammable material is present • Accidental spillage of chemicals should be immediately cleaned up.	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
		lead to fire and explosion	• Workers should be trained on handling and controlling accidental spillage of flammable substances that may trigger fires • Appropriate fire safety equipment should be provided at construction site • "No smoking signs and policy" should be b displayed at sites as appropriate and actions to be taken against those not adhering to this order			
22	**Occupational Health and Safety**	Construction activities inevitably expose workers to many health and safety risks due to range of activities and work being undertaken at these sites.	• Contractor should provide necessary Personal Protective Equipment such as mask, helmet, hand gloves and rubber boots to all site workers and ensure a safe and healthy environment for their workers • Contractor should have qualified first aid personnel among the workers and maintains fully stocked first aid kits at the sites • Contractor should enforce adherence to safety procedures and prepare	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			contingency plans for accident response • Contractor should provide safety education and training to all site workers • Contractor should ensure that work sites (such as excavation work and trenches), especially in the night have proper protection with clear marking of safety borders and signals and fence off all dangerous areas • Confine access to restricted work sites (including those with operation mechanical and electric equipment) to persons with permits			
ANTICIPATED SOCIAL IMPACTS DURING CONSTRUCTION PHASE						
23	**Disruption to Utilities**	Temporary disruption of utility services in the project area	• Consult with all concerned departments Pakistan Telecommunication Company Limited (PTCL), Sui Northern Gas Pipelines Limited (SNGPL), Lahore Electric Supply Company (LESCO) and Water and Sewerage Authority (WASA)	During design phase	Contractor and LWASA-PMU	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			to delineate their network locations and alignments • Proper compensation should be given to the concerned department in case of utility disturbed or if need relocation • Inform local residents in advance about complete project program and disruption to utility services while their work • Layout plans of the existing underground alignment should be shared with the site workers, so that they may avoid any damage to the existing structures/installation • Concerned department should be informed on immediate basis in case of any damage to utility services to the sub surface infrastructure has occurred			
24	**Community Health and Safety**	Poor construction management practices by the Contractor have	• Endeavour to lay pipes and backfill as soon as possible to reduce the time of hazards exposure to the public from open trenches	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
		potential to cause adverse effects on safety, health and wellbeing of the residents of surrounding communities.	• Install fences and place adequate safety warning signs at the construction site • The whole sides of trenches should be strengthened by aluminium reinforcement sheet where sensitive receptors are located within the proximity of project work • Regular water sprinkling should be done on all construction active areas present close to sensitive receptors in order to reduce dust exposure • Limit the construction activities to day time to avoid disturbance to nearby communities • Regular maintenance should be done of all construction machinery • Ensure that potentially disturbing construction noise is not produced outside of working hours • Construction material delivery truck should be planned in such way to avoid peak traffic hours.			

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Construction material delivery trucks must be assigned with restricted circulation hours • Establish and enforce speed limits especially in proximity to sensitive receptors • Install necessary safety signs and speed bumps to alert drivers that they are approaching towards sensitive receptors • Assign a person from traffic police department to manage and handle traffic load during the peak construction times of the project. • Inform local residents in advance regarding road closure and rerouting of vehicles and pedestrians' traffic • Train truck drivers to avoid unnecessary hooting while passing through sensitive receptors such as residential areas, schools and colleges			

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Contact with traffic police departments for maintaining traffic on roads which requires continuous police monitoring • Contractor should ensure proper disposal of waste generated at site. • Constructor should strictly prohibit illegal dumping of waste • Contractor should eliminate unnecessary container habitats that collect water in which dengue larvae can produce • Contractor should conduct workshops in nearby school and residential communities regarding dengue awareness and precautionary measures			
25	**Traffic Congestion**	Blockage of roads during construction works	• Establish a proper traffic management plan in consultation with traffic police department • Contact with traffic police departments for maintaining traffic on roads which requires continuous police monitoring	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Identify alternate access routes and communicate to residents prior to start of work • Construction activities or material delivery should be planned in such way to avoid peak traffic hours • Provide educational materials to nearby schools and communities to inform children about road safety • Establish speed limits especially in proximity to sensitive receptors and sensitize the truck drivers on speed limit • Install necessary safety signs that are visible at night • In order to avoid complaints from mobile vendors adjust the location of their carts to similar location in the immediate locality of the original location for the duration of the project • Vehicular access to and from hospitals and fire stations should be maintained			

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			through the use of steel road plates over open trenches • Contractor should strictly follow project completion timeline in order to minimize disruption faced by the residents			
26	**Child Labour**	Due to the high poverty level within the project area, there could be cases of child labour hired for construction works	• Ensure that contractor should have its employment policy • Contractor should ensure the presence of all persons at site are adults and have their proper identity card with them	During Construction Phase	Contractor	LWASA-PMU
27	**Spread of Communicable Diseases and other Infections**	Improper disposal of waste Poor hygiene practices at labour camp site Risk of occurrence of communicable diseases	• Create awareness among workers on proper sanitation and hygiene practices to endorse proper health • Maintain good housekeeping practices at all project sites • Provide adequate personal hygiene facilities in good condition with adequate supply of clean water • Make arrangements to treat the affected workers on time to control the movement of vectors disease	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Sensitize workers and surrounding communities on awareness and prevention of HIV/AIDS and STI through training, awareness campaigns and workshops during community meetings • Provide proper and free HIV/AIDS and STI health screening and counselling for site workers and community members •			
28	**Influx of Labour**	Strain on the existing social utilities such as medical centers and schools located near the project area. Creation of employment opportunities by the project could result into conflict between local inhabitants and outsiders, if not	• The contractor should give employment opportunities to extent possible to local unskilled labour so as to reduce pressure on housing. • To avoid conflicts among local people on employment matter, it is proposed that the Contractor employs the locals in cooperation with local administration in unskilled and semi-skilled duties. This will reduce pressure on existing resources such as housing, schools and health facilities	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
		appropriately managed. Disturbance to social harmony of the project area Crime and security issues may arise due to bad behaviour of the workforce such as gambling and alcoholism	• Unskilled and skilled labour to be hired from the local community as far as possible to minimize on influx of immigrants into the community • Develop and enforce a strict code of conduct for workers to regulate behaviour in the local communities • Eliminate an employee who continues misconduct or lack of care, carries out duties amateurishly or inattentively, fails to conform to provisions of the contract, or persists in any conduct which is harmful to safety, health, or the protection of the environment. • Taking all sensible precautions to avert illicit, vicious conduct by or amongst the Contractor's personnel, and to preserve unity and harmony and protection of people and property on and near the sites.			

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Prohibiting drugs, alcohol, weapons, and ammunition on the worksite among personnel. • Site security preparations must be contained within the Bills of Quantities (BoQs) to avoid any delays which might be caused due to insecurity. • The Contractor in cooperation with the security organs must create awareness to the security situation on the ground all the times. • Appropriate fencing, security check points, gates and security guards are to be provided at the construction sites to ensure the security of all plant, equipment, machinery and materials, as well as to secure the safety of site staff. • The Contractor must guarantee that good relations are maintained with local communities and their leaders to help reduce the risk of vandalism and theft.			

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• A detailed Social Framework Agreement (SFA) has been developed for the construction phase of the project (attached as Annexure-Z)			
29	**Gender-based Violence**	Negative gender impacts may arise if priority is given to men who are supposed to be stronger and more resilient. Sexual harassment against women might occur as a consequence of mixing of men and women	• The Contractor should make sure that no discrimination is made on the basis of gender while hiring of workers • The Contractor should set the employment relationship on the code of equal opportunity and fair treatment • The employment decisions should not be made on the basis of personal characteristics unrelated to inherent job requirements, including race, gender, nationality, religion or belief, disability, age, sexual orientation, or ethnic, social and indigenous origin • A Gender Action Plan (GAP) is being developed which will include at minimum, conformance with relevant laws, equal opportunity employment and gender sensitization	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Special measures be taken to address harassment, intimidation, and/or exploitation, especially in relation to women. • Establish and strictly enforce a No Sexual Harassment Policy in accordance with provincial law • Provision of gender disaggregate bathing, changing, and sanitation facilities			
30	**Impacts on Cultural and Archaeological Assets**	Construction activities may damage any existing archaeological assets or cultural property.	• Before start of project, Contractor should obtain necessary approval from Punjab Archaeological department • Contractor should strictly follow the submitted work plan in order to avoid traffic problems • Alternate route should be assigned for the people going towards these historical/cultural places • Ensure regular sprinkling of water in all active construction areas near sites	During Construction Phase	Contractor	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Follow steps mentioned in a chance find procedure (attached as Annexure-Y) in the event if any unknown cultural heritage is found during any excavation activity • Contractor should ensure that the chance find procedure is communicated to the construction contractor prior to start of project			
31	**Grievance Redress**	Complaints/concerns of the stakeholders due to project activities	• A multi-tier grievance redress mechanism (GRM) has been developed to address/resolve complaints and grievances receive from the Affected People (AP) and other stakeholders	During Construction Phase	Contractor and LWASA-PMU	LWASA-PMU
ANTICIPATED ENVIRONMENTAL IMPACTS DURING OPERATIONAL PHASE						
32	**Solid Waste**	Improper management of waste may cause nuisance, health and safety risks at site	• Immediately backfill the disturbed areas after completion of work • Prepare an integrated waste management system • Sell all recyclable waste to recycling facilities where possible	During Operational Phase	LWASA-PMU	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
			• Dispose-off all waste in an environmentally friendly way • Strictly prohibit improper or illegal dumping of waste			
33	**Noise and Vibration**	Use of noisy machinery and equipment and pipe repair and fitting work may generate noise at the site	• Inform local residents about the noisy activity that will generate during pipe repairing • Limit the noisy activity only to day time • Ensure that worker repairing the pipe should use ear plugs while working	During Operational Phase	LWASA-PMU	LWASA-PMU
34	**Water losses or Leakages**	The leaks may occur due to water overflow or when the pipe became old and rupture due to natural incidents such as earthquake. Leaking water pipes can allow potentially harmful contaminants to enter into our	• All water pumping stations should be adequately maintained • Prompt action should be taken against burst and leak pipes • Establish a leakage management plan for all District Metered Zones (DMZ) and District Metered Areas (DMAs) • Constant checking of water distribution network to identify water being theft and illegal connections and to avoid water contamination	During Operational Phase	LWASA-PMU	LWASA-PMU

Sr. No.	Aspect	Environmental and Social Impact/issue	Mitigation Measures	Implementation Time	Implementation Responsibility	Supervision Responsibility
		drinking water system thus deteriorates the water quality.	• LWASA has planned to make the 28 tube wells remain operational to compete their water demand during canal closure period			

8.7 Monitoring Plan (Package 03 and 04)

8.7.1 Effects Monitoring

562. The actual impacts on physical, biological and socio-economic receptor of the project area due to project activities will be monitored. The Effect Monitoring is done to identify any effects either not anticipated in ESIA or exceeding the level anticipated in the mitigation plan so that appropriate mitigation measures can be adopted in time. The common theme of Effect Monitoring is the proper management of environmental risks and uncertainties. The Effect monitoring has following objectives:

- To verify that the impact of the proposed project is within acceptable limits, thus establishing credibility.
- To facilitate research and development by documenting the effects of the proposed project that can be used to validate impact- predication techniques and provided a basis for more accurate prediction of future impact.
- In case of adverse impacts or sudden changes in the anticipated impacts immediately inform the PMU and other regulatory agencies so that the corrective actions can be taken such as modification of mitigation measures and inclusion of additional measures
- To minimize the effects, control the timing, location and level of certain project activities

563. The detailed effects monitoring plan for Package 03 and 04 is given is **Table 8.3** and **Table 8.4** respectively.

Table 8.3 Effects Monitoring Plan (Package 03)

Sr No.	Aspects	Parameters to be monitored	Monitoring Frequency	Method	Responsibility
Environmental Monitoring Schedule for Construction Phase					
1	Ambient Air	SO_2, NO_x, CO, PM_{10}, $PM_{2.5}$, HC	Quarterly	Instrumental monitoring, technical inspection of machinery, visual control	Contractor/LWASA-PMU
2	Vehicular Emissions	SO_2, NO_x, CO, HC, Smoke, noise	Quarterly	Instrumental monitoring, technical inspection of machinery	Contractor/LWASA-PMU
3	Gaseous Emissions	SO_2, NO_x, CO, PM	Quarterly	Instrumental monitoring, technical inspection of machinery	Contractor/LWASA-PMU
4	Noise	Day and night time levels on Db (A) Scale (min-max)	monthly	Instrumental monitoring	Contractor/LWASA-PMU
5	Soil	pH, EC, RAS, calcium, magnesium, iron, fluoride, sulphide, sulphate, zinc, barium, sodium, potassium	Annually	Laboratory control	Contractor/LWASA-PMU
6	Water quality	Total coliform, fecal coliform, *E. Coli*, pH, TDS, total hardness, alkalinity, nitrates,	Monthly	Laboratory control	Contractor/LWASA-PMU

Sr No.	Aspects	Parameters to be monitored	Monitoring Frequency	Method	Responsibility
		chlorides, sodium, iron, zinc, lead, manganese			
7	Wastewater quality	pH, TDS, TSS, BOD, COD, chloride, iron, nitrates	Quarterly	Laboratory control	Contractor/LWASA-PMU
8	Grievance	Number and record of complaints	Regularly	Complaint Management Register and 3 tier GRM	LWASA-PMU
9	Accidents	Frequency of accidents, No. of injuries and care provided	Regularly	Visual/ site inspection	LWASA-PMU
Environmental Monitoring Schedule for Operation Phase					
8	Water quality supplied to consumers	Total coliform, fecal coliform, E. *Coli*, pH, TDS, total hardness, alkalinity, nitrates, chlorides, sodium, iron, zinc, lead, manganese	Monthly	Laboratory control	LWASA-PMU
9	Ambient Air	SO_2, NO_x, CO, PM_{10}, $PM_{2.5}$, HC	Quarterly	Instrumental monitoring, technical inspection of machinery, visual control	LWASA-PMU
10	Gaseous Emissions	SO_2, NO_x, CO, PM	Quarterly	Instrumental monitoring, technical inspection of machinery	LWASA-PMU

Sr No.	Aspects	Parameters to be monitored	Monitoring Frequency	Method	Responsibility
11	Noise	Day and night time levels on Db (A) Scale (min-max)	Quarterly	Instrumental monitoring	LWASA-PMU
12	Wastewater quality	pH, TDS, TSS, BOD, COD, chloride, iron, nitrates	Quarterly	Laboratory control	LWASA-PMU
13	Waste and sludge management	Record of waste generation, sludge treatment and disposal	Monthly	Visual/Site inspection	LWASA-PMU
14	Solid Waste	Record of waste generated and waste disposal practice	Quarterly	Visual/ site inspection	LWASA-PMU
16	Emergency	Frequency of accidents, No. of injuries and care provided	Regularly	Visual/ site inspection	LWASA-PMU

Table 8.4 Effects Monitoring Plan (Package 04)

Sr No.	Aspects	Parameters to be monitored	Monitoring Frequency	Method	Responsibility
Environmental Monitoring Schedule for Construction Phase					
1	Ambient Air	SO_2, NO_x, CO, PM_{10}, $PM_{2.5}$, HC	Quarterly	Instrumental monitoring, technical inspection of machinery, visual control	Contractor/LWASA-PMU

Sr No.	Aspects	Parameters to be monitored	Monitoring Frequency	Method	Responsibility
2	Vehicular Emissions	SO_2, NO_x, CO, HC, Smoke, noise	Quarterly	Instrumental monitoring, technical inspection of machinery	Contractor/LWASA-PMU
3	Gaseous Emissions	SO_2, NO_x, CO, PM	Quarterly	Instrumental monitoring, technical inspection of machinery	Contractor/LWASA-PMU
4	Noise	Day and night time levels on Db (A) Scale (min-max)	Monthly	Instrumental monitoring	Contractor/LWASA-PMU
5	Soil	pH, EC, RAS, calcium, magnesium, iron, fluoride, sulphide, sulphate, zinc, barium, sodium, potassium	Annually	Laboratory control	Contractor/LWASA-PMU
6	Water quality	Total coliform, fecal coliform, *E. Coli*, pH, TDS, total hardness, alkalinity, nitrates, chlorides, sodium, iron, zinc, lead, manganese	Monthly	Laboratory control	Contractor/LWASA-PMU
7	Wastewater quality	pH, TDS, TSS, BOD, COD, chloride, iron, nitrates	Quarterly	Laboratory control	Contractor/LWASA-PMU
Environmental Monitoring Schedule for Operation Phase					

Sr No.	Aspects	Parameters to be monitored	Monitoring Frequency	Method	Responsibility
8	Water quality supplied to consumers	Total coliform, fecal coliform, *E. Coli*, pH, TDS, total hardness, alkalinity, nitrates, chlorides, sodium, iron, zinc, lead, manganese	Monthly	Laboratory control	LWASA-PMU
15	Leak detection and maintenance	Localized flooding, check for leaks, user complaint	Quarterly	Visual/site inspection	LWASA-PMU

8.7.2 Compliance Monitoring (Package 03 and 04)

564. Compliance with the requirement of mitigation plan given in **Table 8.1** and **Table 8.2** will be checked by monitoring the activities of the contractor on daily basis by the environmental and social specialist of the consultants. The objectives of ESIA compliance monitoring will be:

- Systematically observe the activities undertaken by the contractor in the civil and mechanical works.
- Verify that the activities undertaken are in compliance with the ESIA and other conditions identified by PMU
- Document and communicate the observations to the concerned persons in PMU so the corrective action, if required, can be taken timely.
- Maintain a record of all incidents of the environmental significance and related action and corrective measures
- Prepare periodic reports of the environmental performance of PMU and its consultant and contractor
- Develop an environmental issue tracking system (format attached as Annexure-BB) for an effective monitoring and ensuring that all environmental concerns are identified and addressed in a timely manner.

565. The Mitigation Measures Implementation Plan will be used as a management and monitoring tool for compliance monitoring.

8.7.3 Post-Project Monitoring

566. The objective of this monitoring will be to determine the level of residual impact of the project on physical, biological and socio-economic receptors of the project area. This monitoring may be carried out within one month of the end of project activities. Post project monitoring is included in effects monitoring, discussed in **Table 8.3** and **8.4**.

8.7.4 Third Party Monitoring / Environmental and Social Audit Annually

567. The LWASA-PMU will engage a third-party monitor to do the environmental and social audit annually during the construction period. The firm's terms of reference will define a clear work plan, including performance indicators, and reporting structures and timelines. The LWASA will provide the necessary logistical support to facilitate the selected firm in Environmental audit.

8.8 Capacity Building and Training (Package 03 and 04)

568. The successful implementation of the ESMP will require a robust environmental health and safety training plan which will ensure that the job specific training will be provided to the

LWASA staff to encourage the implementation of environmentally sound practices and adherence to all regulatory compliance requirements. This will help in minimizing or reducing adverse environmental and social impacts and achieving better performance beyond compliance. The same level of awareness and commitment will be communicated to the contractors, sub-contractors and service providers prior to the commencement of the project. The **Table 8.5** and **Table 8.6** below gives a brief overview of the capacity building and training plan for Package 03 and 04 respectively.

Table 8.5 Training Program (Package 03)

Target Audience	Trainer	Training Contents	Schedule	Methodology
LWASA-PMU Representative, Project Management Consultant (PMC) Environmental and Social Staff, Construction Contractor	Senior Environmental and Social Specialist (LWASA) and Consultant	• Environmental and Social Management Plan (ESMP) • Resettlement Plan (RP) • Site Specific Environmental and Social Management Plan (SSESMP)	Before Project Activities	Workshop
Contractor Staff	Contractor and Environmental and Social Specialist of LWASA-PMU	• Environmental and Social Management Plan (ESMP) • Site Specific Environmental and Social Management Plan (SSESMP) • Resettlement Plan (RP) • Labour Influx Management • Occupational Health and Safety Plan (OHS) • Basic First Aid • Community Health and Safety Management • Environment Health and Safety Management • Dust Control Management • Labour Camp Management • Traffic Management	Before Project Activities	Orientation Session, On-site awareness program at construction and labour camp site

Target Audience	Trainer	Training Contents	Schedule	Methodology
		• Waste Management • Dengue Prevention and Control • Use and Importance of Personal Protective Equipment (PPE) • Fire Safety and Emergency Response Measures		
Operation and Maintenance (O and M) Workers	LWASA	• Environmental and Social Management Plan (ESMP) • Dengue Prevention and Control • Environment Health and Safety Management • Occupational Health and Safety • Basic First Aid • Waste Management • Fire Safety and Emergency Response Measures • Electrical Safety • Use and Importance of Personal Protective Equipment (PPE)	Before project operation, During the operations phase progress as required.	Workshop

Table 8.6 Training Program (Package 04)

Target Audience	Trainer	Training Contents	Schedule	Methodology
LWASA-PMU Representative, Project Management Consultant (PMC) Environmental and Social Staff, Construction Contractor	Senior Environmental and Social Specialist (LWASA) and Consultant	• Environmental and Social Management Plan (ESMP) • Site Specific Environmental and Social Management Plan (SSESMP)	Before Project Activities	Workshop
Contractor Staff	Contractor and Environmental and Social Specialist of LWASA-PMU	• Environmental and Social Management Plan (ESMP) • Site Specific Environmental and Social Management Plan (SSESMP) • Labour Influx Management • Occupational Health and Safety Plan (OHS) • Basic First Aid • Community Health and Safety Management • Environment Health and Safety Management • Dust Control Management • Labour Camp Management • Traffic Management • Waste Management • Dengue Prevention and Control • Use and Importance of Personal Protective Equipment (PPE) • Fire Safety and Emergency Response Measures	Before Project Activities	Orientation Session, On-site awareness program at construction and labour camp site

Target Audience	Trainer	Training Contents	Schedule	Methodology
Operation and Maintenance (O and M) Workers	LWASA	• Environmental and Social Management Plan (ESMP) • Occupational Health and Safety • Noise and Waste Management • Leakage Management Plans • Use and Importance of Personal Protective Equipment (PPE)	Before project operation, During the operations phase progress as required.	Workshop

8.9 ESMP Budget

569. The indicative breakdown of capital and recurring cost for the environmental management of the Package 03 and 04 is presented in **Table 8.7.** It is important to mention that recurring cost for personnel to be hired for environmental management has not been reflected in the budget as it is considered as part of the project operations.

Table 8.7 Indicative Budgetary Allocation for ESMP Implementation (Package 03 and 04)

Sr. No.	Particular	Mitigation /Monitoring Component	Cost (PKR)
A)	**Construction Phase**		
(i) Environmental Mitigation Measures			
1.	**Emission Control**	• Ensure construction machinery, equipment and vehicles are regularly maintained • Use of low sulphur diesel	700,000/-
2.	**Dust Control**	• Sprinkle water on all active construction areas as and when necessary to reduce dust. • Use tarpaulin sheets to cover spoil, sand and other loose material when transported by trucks and stored at site	300,000/-
3.	**Noise Pollution Control**	• Minimize noise from construction machinery and equipment by using fitting jack hammers with noise- reducing mufflers, vehicle silencers, and portable street barriers • Maintain maximum sound levels not exceeding the PEQS value (i.e. day time 55 dB(A) and nigh time 45 dB(A)	500,000/-
4.	**Construction Debris and Solid Waste Management**	• Re-use of excavated materials in the works as far as reasonably possible to reduce waste in landfill • Establish a system for collection, segregation and disposal of waste generated at the site • Bins and skips should be placed within the camp site and should be adequately designed and covered to prevent access to mosquitos and vermin. • Provision of toilets • Waste Management Contract • Vehicles for transport of solid waste management and dumper bins wherever required	3,000,000/-
5.	**Maintaining**	• Proper barricading should be provided at worksites close proximity to sensitive receptors such as schools and residential area	600,000/-

Sr. No.	Particular	Mitigation /Monitoring Component	Cost (PKR)
	Accessibility	• Provide metal sheets and walkways where required to maintain access across for people and vehicles	
6.	**Capacity building on Environment, Health and Safety Awareness and Trainings**	• Trainings to be provided to Contractor's staff/workers with information pertaining to good housekeeping practices, Environment, Health and Safety (EHS) Aspects, occupational health and safety including usage of PPEs, minimizing solid waste, usage of designated toilets, HIV/AIDS and STI prevention, gender and maintaining Workplace EHS signage and on ESMP implementation	3,000,000/-
7.	**Establishment of Labour Camp and Ancillary Facilities, Labour Health and Safety Labour welfare and Hygiene on Construction Sites**	• As per specifications listed in Labour camp management plan attached as **Annexure-V** • At every construction labour camps and on-site construction areas clean and sufficient water supply shall be maintained to avoid waterborne diseases to ensure the health and hygiene of workers. • Ensure provision of appropriate PPEs to site workers • Adequate mobile toilets shall be provided at construction sites both for men and women • Necessary medical and emergency care on site shall be provided to workers.	3,000,000/-
8.	**Green Belt Plantation**	• Ensure plantation at the site specially at disturbed areas	10,000,000/-
9.	**Third Party Verification (TPV)**	• Hiring a third-party for verification of Contractors compliance with submitted ESMP	7,000,000/-
10.	**Restoration of road**	• Restoration of disturbed roads	50, 000, 000/-

Sr. No.	Particular	Mitigation /Monitoring Component	Cost (PKR)
11.	**Interference with Public Utilities**	• Work plan with clear responsibilities for each department/agency should be developed by LWASA-PMU to ensure smooth execution of any utility relocation	150,000,000/-
(i)	**Sub total**		**228, 100,000/-**
(ii) Environmental Quality Monitoring (Construction Phase)			
1.	**Air Quality Monitoring**	SO_2, NO_x, CO, PM_{10}, $PM_{2.5}$, HC	20,000/Spot 40,000 x 4= 160,000/annum
	Monitoring Frequency	Quarterly (two spots four times a year)	
2.	**Gaseous Emission**	SO_2, NO_x, CO, PM	5000/Spot 10,000 x 4= 40,000/annum
	Monitoring Frequency	Quarterly (two spot four times a year)	
3.	**Water Quality Monitoring**	Total coliform, fecal coliform, *E. Coli*, pH, TDS, total hardness, alkalinity, nitrates, chlorides, sodium, iron, zinc, lead, manganese	20,000/Sample 20,000 x 4= 80,000/annum
	Monitoring Frequency	Quarterly	
4.	**Noise Monitoring**	Day and Night Time Noise Levels	4000/Spot 4,000 x 12= 48,000/annum
	Monitoring Frequency	Monthly	
5.	**Wastewater Quality**	pH, TDS, TSS, BOD, COD, chloride, iron, nitrates	10,000/Sample 10,000 x 4= 40,000/annum
	Monitoring Frequency	Quarterly	
6.	**Soil Testing**	pH, EC, calcium, magnesium, iron, fluoride, sulphide, sulphate, zinc, barium, sodium, potassium	20,000/Sample . 20,000 x 1= 20,000/annum
	Monitoring Frequency	Annually	
7.	**Vehicular Emission**	SO_2, NO_x, CO, HC, Smoke, noise	4000/Sample 4,000 x 1= 4,000/annum
	Monitoring Frequency	Annually	

Sr. No.	Particular	Mitigation /Monitoring Component	Cost (PKR)
(ii)	**Sub Total**	**392,000/annum**	
		1,176,000 (3 years)	
(B) Operational Phase			
(iii) Environmental Management Cost Operational Phase			

1.	**Environment, Health and Safety Awareness and Trainings**	• Develop in-house guidelines on environment, health and safety management
		• Conduct training workshops on following
		  • Environmental and Social Management Plan (ESMP)
		  • Dengue Prevention and Control
		  • Environment Health and Safety Management
		  • Occupational Health and Safety
		  • Basic First Aid
		  • Waste Management
		  • Fire Safety and Emergency Response Measures
		  • Electrical Safety
		  • Use and Importance of Personal Protective Equipment (PPE)
			2,000,000/annum

2.	**Sludge management**	• Sludge from SWTP to EPA certified waste management vendor	26,827,500/annum
3.	**Health, Safety and Hygiene for workers**	• Implementation of an emergency response plan (EPR) • Fire safety arrangement at site • Installation of necessary safety signs at site • Purchase of Personal Protective Equipment (PPE)	600,000/ annum
4.	**Machinery maintenance to reduce emissions and noise level**	• Ensure construction machinery, equipment and vehicles are regularly maintained	1,000,000/annum
5.	**Waste Management**	Waste Management arrangement in staff quarters and at SWTP	200,000/annum
(iii)	**Sub Total**		**32,427,500/**

Sr. No.	Particular	Mitigation /Monitoring Component	Cost (PKR)
	(iv) Environmental Quality Monitoring Operational Phase		
1.	**Water quality monitoring**	Total coliform, fecal coliform, *E. Coli*, pH, TDS, total hardness, alkalinity, nitrates, chlorides, sodium, iron, zinc, lead, manganese	20,000/Sample 20,000 x 1= 20,000/annum
	Monitoring Frequency	Monthly	
2.	**Air Quality Monitoring**	SO_2, NO_x, CO, PM_{10}, $PM_{2.5}$, HC	20,000/Sample 40,000 x 4= 160,000/annum
	Monitoring Frequency	Quarterly (two spots four times a year)	
3.	**Gaseous Emission**	SO_2, NO_x, CO, PM	5000/Sample 10,000 x 4= 40,000/annum
	Monitoring Frequency	Quarterly (two spots four times a year)	
4.	**Noise Monitoring**	Day and Night Time Noise Levels	4000/Sample 4,000 x 12= 48,000/annum
	Monitoring Frequency	Monthly	
5.	**Wastewater Quality**	pH, TDS, TSS, BOD, COD, chloride, iron, nitrates	10,000/Sample 10,000 x 4= 40,000/annum
	Monitoring Frequency	Quarterly	
6.	**Soil Testing**	pH, EC, calcium, magnesium, iron, fluoride, sulphide, sulphate, zinc, barium, sodium, potassium	20,000/Sample 20,000 x 1= 20,000/annum
	Monitoring Frequency	Annually	
7.	**Vehicular Emission**	SO_2, NO_x, CO, HC, Smoke, noise	4000/Sample 4,000 x 1= 4,000/annum
	Monitoring Frequency	Annually	
(iv)	**Sub Total**		**332,000**

8.10 Documentation and Record Keeping

570. Documentation and record keeping of requirements specified in ESMP will include the following databases and registers:

- Quarterly progress reports
- Quarterly ESMP compliance monitoring and verification report by LWASA-PMU specialists and submitted to the AIIB
- Summaries of non-compliances reported, and non-compliances addressed
- GRM details (complaints received; complaints addressed)
- ESMP compliance, findings and addressal of all safeguard audit issues.
- Monthly ESMP progress report submitted by contractor to LWASA-PMU
- Monthly monitoring ESMP verification report maintained by LWASA-PMU
- Annual Environmental Audit report by third party to LWASA-PMU
- End of Project report submitted by LWASA-PMU to the AIIB which contains all aspects of

571. In addition, the PMU will maintain a file comprising of the following documents:

- Legal register to track details of all NOCs, licenses and permits pertaining to the project
- Record of all project impacted entities to be compensated as per grievance records.
- Labour camp monitoring checklist and accident/injury incidents handling and reporting,
- compliance with OHS arrangements
- Records of accidents, injuries, near-misses, and others
- Record of registration of all workers and labour camp establishment permit
- Training register for project staff and contractor's team
- Record on Environmental Quality monitoring
- Waste management plan monitoring register
- Record of Tree plantation done at site
- Environment and social audit findings and compliance report

CHAPTER 09

9 GRIEVANCE REDRESS MECHANISM

9.1 Introduction

9.1.1 Regulatory Framework for Grievance Redressal Mechanism

572. The Land Acquisition Act 1894 contains provisions pertaining to objections and hearing of affected people of land and associated assets. The Act is limited to address grievances pertaining to compensation and there is no provision in the legal framework for a continuous grievance redress mechanism on the concerns and grievance of the affected people other than land acquisition, compensation and related matters.

9.1.2 The Punjab Environment Protection Act 1997 (Amended 2012)

573. The environmental aspects of any developmental project are governed by the PEPA 1997, Amended 2012. The Act is implemented by the Environmental Protection Agency which is headed operationally by the director general of EPA Punjab.

574. The Act sets up rules pertaining to all type of pollution caused by the person or entity to any aggrieved person or owned property. Section 12 discuss about the environmental approval of any developmental project, section 11 discuss about the discharges by a project, section 14 discuss about the handling and storage of hazardous substances, Section 6 (2), 21 and 24 discuss about the complaints of the aggrieved persons

9.1.3 AIIB Requirements:

575. The AIIB requires establishment of a suitable project level grievance redress mechanism in accordance with AIIB's Environment and Social Policy, framework and applicable standards, for the project affected people and to address the concerns and grievances of the stakeholders. This mechanism can receive and facilitate resolution of the concerns or grievance of people who believe they have been adversely affected by the LWWM Project's environmental or social impacts including construction and operations activities. There is also provision for protection of complainants from retaliation and the right to remain anonymous, if requested, to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's social, resettlement and environment performance.

576. The measures have been identified to mitigate environment, social and resettlement impacts to be caused due to implementation of the LWWM Project works. However, in spite of best efforts, there is every chance that the individuals / households affected by the project or other stakeholders are dissatisfied with measures adopted to address adverse environment and social impacts of the Project. To address such situation, an effective Grievance Redress Mechanism (GRM) will be established to ensure timely and successful implementation of the

project. It will also provide a public forum to the aggrieved to raise their concerns and address them adequately. It will receive, evaluate and facilitate the resolution of affected People's concerns, complaints and grievances about the environmental and social performance at the level of the Project.

9.2 The Aims and Objectives of GRM

577. The GRM will aim to investigate charges of irregularities and complaints and grievances receive from the Affected People (AP) and other stakeholders and provide a time-bound early, transparent and fair resolution to voice and resolve environmental and social concerns and grievances link to the project. The objectives of the grievance redressal mechanism are:

- to provide AP and other stakeholders with a clear process for providing comment and raising grievances;
- to allow AP and other stakeholders the opportunity to raise concerns, complaints and grievances anonymously through using the several intake locations and modes;
- to structure and manage the handling of concerns and grievances, and allow monitoring of effectiveness of the mechanism; and
- to ensure that concerns and grievances are handled in a fair and transparent manner, in line with provincial laws and regulation, AIIB environment and social policy, framework and standards, and international best practices.

9.3 Nature of Complaints to be Redressed

578. It is anticipated that the nature of such complaints will relate to compensation and resettlement assistance matters, damages, mobility and access issues of general public or disruptions of services during civil works related to the project functionaries. Some of the grievances that may arise are listed below:

i. Name of an AP may be missing from the eligible AP's list;
ii. Losses (such as damage to assets or loss of income) may not identified correctly during detailed design stage;
iii. Improper distribution of compensation and/or resettlement assistance
iv. Delays in the payment of compensation and resettlement assistance,
v. Any disruption by the civil works contractors;
vi. Non-observance of project principles, by different parties, as laid down in the RP
vii. Environmental issues; Air, water, soil or noise pollution causing disturbance to person
viii. Any other issue arising during the project implementation

579. The PMU environment and social staff (ESS) with the assistance of ESS of PMC and EPC/DBO Contractor shall make the public aware of the GRM particularly the AP through

public awareness campaigns, information dissemination material and face-to-face meetings. The name of the ESS of PMU, their contact numbers and the Universal Access Number (UAN) of LWASA, the names and contract numbers of ESS of Project Management Consultants (PMC) and Engineering Procurement and Construction (EPC) or Design, Built and Operate (DBO) Contractor will serve as hotlines for complaints and grievances and shall be publicized through the notice boards at their site offices, construction camps, and at accessible and visible locations at the SWTP site and along the corridor of transmission main, feeding mains and distribution system, and also shared with the AP through face-to-face meetings. The information about GRM disseminated to the AP and concerned stakeholders through face-to-face meetings, information dissemination material and workshops. The project information brochure will include information on the GRM and shall be widely disseminated throughout the SWTP site and corridor of water transmission pipelines by the ESS of PMU/PMC and EPC/DBO Contractors. Grievances can be filed in writing, via web-based provision of LWASA website and the LWWMP website or by phone with designated staff of the PMU/PMC, EPC/DBO Contractor and UAN of LWASA.

580. A three-tier GRM designed to provide a time-bound, early, transparent and fair resolution for AP and stakeholder grievances (**Figure 9.1**). The ES of PMU will undertake public awareness campaigns on the GRM with the assistance of ESS of PMC and EPC/DBO Contractor. All complaints received verbally or in writing will be properly documented and recorded in the Complaint Management Register(s), sample provided in **Annexure-AA**. In addition, an easy-to-access web-based GRM will be implemented.

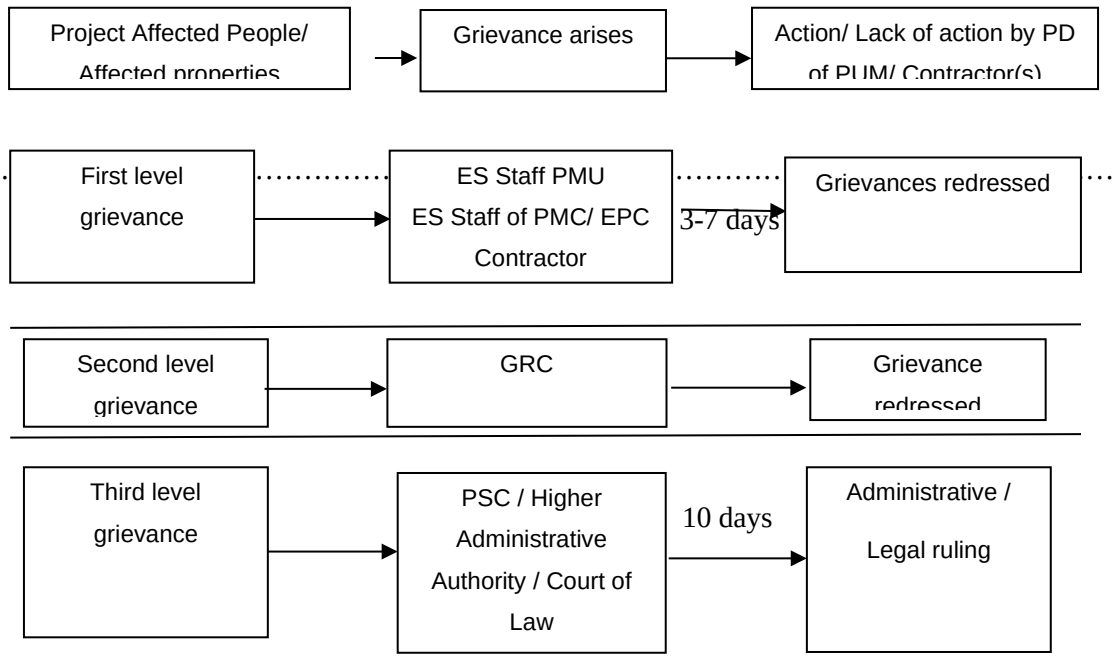


Figure 9.1 Grievance Redress Mechanism

9.3.1 First Tier of GRM

581. The PMU will be the first tier of GRM which will offer the fastest and most accessible mechanism for resolution of grievances. The ESS of PMU shall be designated as the key personnel for grievance redress. Resolution of complaints will be completed within two (2) to fifteen (10) working days, depends on the nature of grievance. First, concerns and grievances resolution will be attempted at village or local level by the ESS of PMU/PMC, EPC/DBO Contractor and PMU through the involvement of the AP Committee/AP representatives and informal mediators. At this stage, ESS of PMU/PMC may ask LWASA for additional support and guidance in grievance redress matters. Investigation of grievances will involve site visits and consultations with relevant parties (e.g. Affected People, DC office staff, contractors, traffic police, general public, utilities companies etc.). Grievances will be documented and personal details (name, address, date of complaint, nature of complaint etc.) will be included unless anonymity is requested. A tracking number shall be assigned for each grievance, including the following elements:

i. Initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
ii. Grievance monitoring sheet, mentioning actions taken (investigation, corrective measures);
iii. Closure sheet, one copy of which will be handed to the complainant after s/he agrees to the resolution and signed-off.

9.3.2 Second Tier of GRM

582. The ESS in PMU will refer the unresolved issues (with written documentation) to the second tier of GRM, the Grievance Redress Committee (GRC). The GRC shall be established by LWASA at the designing stage of the Project prior to the approval of ESIA and RP reports so that the AP and other stakeholders have recourse to refer their concerns and grievances. The GRC will consist of the following persons: (i) MD-LWASA as head of GRC; (ii) Deputy Managing Director; (iii) Project Director-PMU; (iii) representative of DC office; (iv) representative of PMC; (v) representative of EPC/DBO Contractor; (vi) representative of relevant government offices; (vi) three representative of the affected people. The ESS staff of PMU shall organize training on GRC for the LWASA, PMU, EPC/DBO Contractor, sub-contractors and service providers with the assistance of ESS of PMC to orient about the GRM, grievance registration and handling procedures as laid down in the ESIA and RP.

583. A hearing can be called with the GRC, if necessary, where the AP can present details of his/her concerns/grievance. The process will facilitate resolution through mediation. The

GRC will meet as necessary when there are grievances to be addressed. The GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within fifteen (2–30) working days, depending on the nature of grievance. The ESS staff of PMC and EPC/DBO Contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the government's administrative or judicial remedies.

584. The functions of the GRC are as follows: (i) resolve problems and provide support to displaced persons arising from various social, resettlement and environmental issues. Social and resettlement issues including land acquisition (temporary or permanent, as applicable), asset acquisition, eligibility for entitlements, compensation and resettlement assistance as well as environment issues including dust, noise, utilities such as electric power, gas, telephone optical fibre, water supply, waste disposal, traffic interference, access and public safety, etc.; (ii) reconfirm grievances of AP, categorize and prioritize them and aim to provide solutions maximum within 2 to 30 days; and (iii) report to the aggrieved parties about developments regarding their grievances and decision(s) of the GRC. The ESS of PMU will be responsible for processing and presenting all relevant documents, field enquiries and evidences/proofs to the GRC, maintaining a database of complaints, recording decisions, issuing minutes of meetings and monitoring to see that formal orders are issued and to ensure that required actions against decisions are being carried out.

9.3.3 Third Tier of GRM

585. In the event that a grievance cannot be resolved directly by the PMUs (first tier) or GRC (second tier), the affected people can seek alternative redress through the district administration or city government, court of law or as appropriate. The PMU or GRC will be kept informed by the city district government or local administration, or any other authorities. The grievance redress mechanism and procedures are depicted in **Figure 9.1.** The monitoring reports of the RP and ESMP implementation shall include the following aspects pertaining to progress on grievances: (i) number of cases registered, level of jurisdiction (first, second and third tiers), number of hearings held, decisions made, status of pending cases; and (ii) lists of cases in process and already decided upon, may be prepared with details such as name with copy of NIC, complaint number, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, pending, closed).

9.4 Purpose of the Grievance Redressal Committee

586. The purpose of this grievance redressal committee (GRC) is to provide means to seek effective redressal through investigation and resolution of grievances related to any of the issues on social, resettlement and environment performance of the project. And the purpose

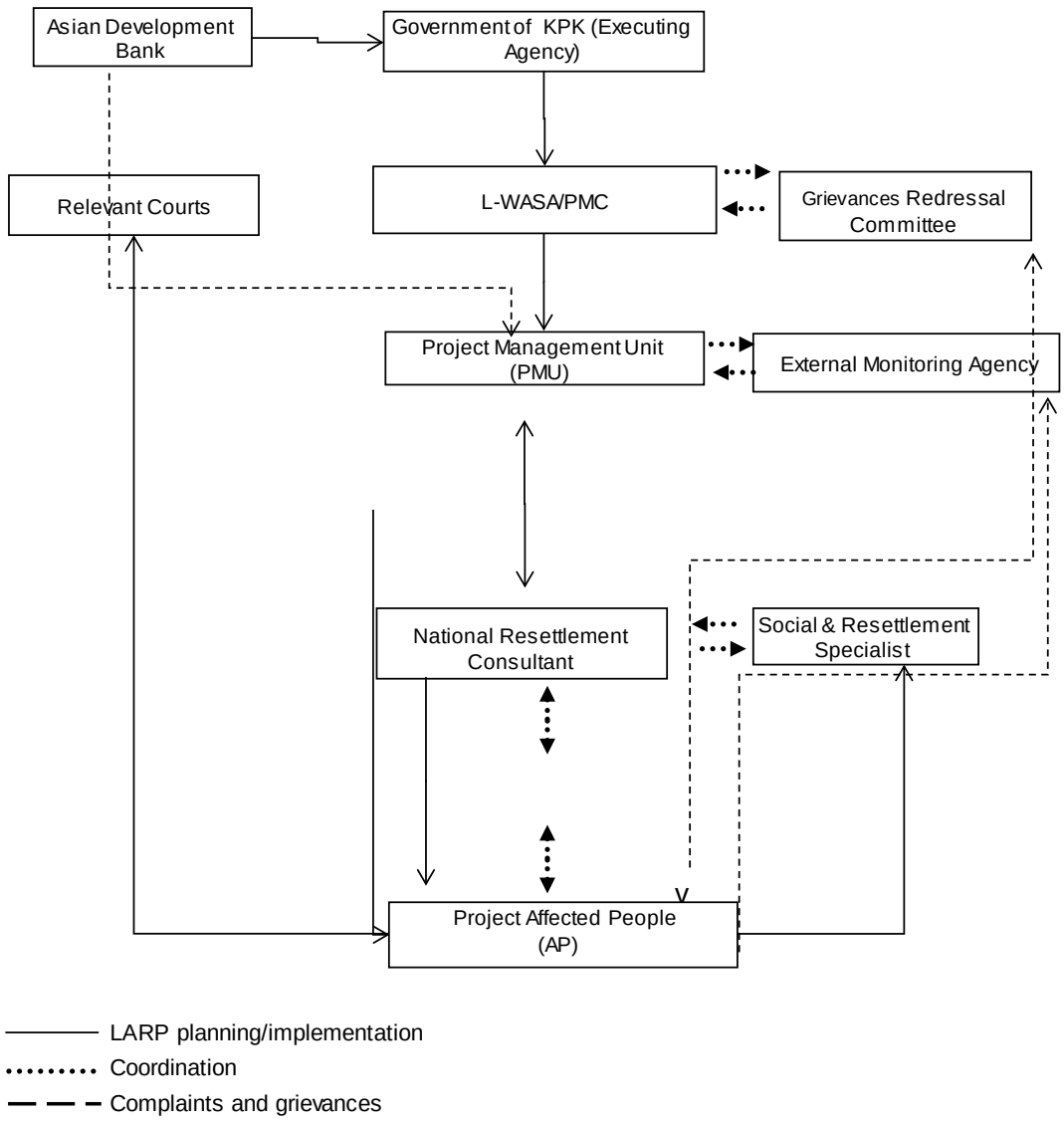
of LAR Coordination Committee (LCC) is to provide means to seek effective redressal of issues related to land acquisition and compensation.

Table 8.1 Composition-Project Level GRC

1.	Managing Director-Lahore WASA	Chair of the Committee
2.	DMD Engineering-Lahore WASA	Deputy Chair, will preside over meetings when Chair is unable to attend
3.	Director ……..	Member
4.	Land Acquisition Collector of LWASA/LDA	Member
5.	Assistant Land Acquisition Collector of LWASA	Member
6.	Project Director-LWWMP	Member (also act as secretary of the committee)
7.	Environment and Social Staff-PMU	Member
8.	Environment and Social Staff-PMC	Observer
9.	Environment and Social Staff-PMC	Observer
10.	Team Leader-PMC	Member (on call)
11.	Chief Resident Engineer-EPC/DBO Contractor	Member (on call)

Table 8.2 Composition- LAR Coordination Committee

1.	Deputy Commissioner (District Land Acquisition Collector)	Chair of the Committee
2.	Additional Deputy Commissioner (land acquisition)	Deputy Chair, will preside over meetings when Chair is unable to attend
3.	Managing Director-Lahore WASA	Member
4.	Land Acquisition Collector of LWASA/LDA	Member (also act as secretary of the committee
5.	Tehsildar Acquisition (Shalimar Tehsil)	Member
6.	Assistant Land Acquisition Collector of LWASA	Member
7.	Environment and Social Staff-PMU	Member
8.	Chief Resident Engineer-Design and Supervision Consultants	Member (on-call)
9.	Staff of concerned departments	Member (on-call)



9.5 Functions of GRC and LCC:

- Ensure effective implementation of the Grievance Redressal Mechanism on the issues that fall under their jurisdiction;
- Ensure an easy access to GRM having provision to file grievances verbally or by phone, in writing or via web-based provision including the option of submitting grievances anonymously;
- GRC and LCC will look into all referred grievances and effectively address and resolve them within 15 days from the receipt of the grievances, in a timely and impartial manner;
- The GRC and LCC will deal promptly with any issue relating to land acquisition, resettlement, compensation or resettlement assistance that is brought before it;
- The GRC and LCC will take decisions on the basis of consensus or majority of votes;
- When required, the GRC and LCC would seek the assistance of other persons/institutions;

- Speaking orders/decisions of the committee on the grievances shall be recorded and replied to aggrieved parties/persons with a copy kept as record;
- In case aggrieved is not satisfied by the decision of the GRC and LCC, s/he can prefer an appeal within 5 days of the receipt of decision, the GRC could refer the case to the appropriate forum after examining the appeal;
- In the event that a grievance cannot be resolved by GRC, the displaced person can seek alternative redress through the city government, court of law or as appropriate.

9.6 Grievance Redressal Mechanism as per Land Acquisition Act

587. A grievance mechanism is also available under the Land Acquisition Act (LAA) to allow the AP appealing regarding the land acquisition and compensation. The Land Acquisition Act 1894 contains provisions pertaining to objections and hearing of affected people of land and associated assets. The objections are heard by the Land Acquisition Collector at different stages. The persons interested are also entitled to file reference before the Civil Court. Against the decision of the Civil Court, they can seek their remedy before the High Court and then the Supreme Court. Further, right to writ petition under Article 199 of the Constitution exists which empowers the interested person to challenge the acquisition itself on several grounds.

588. As finances will move differently for land and other affected assets associated with land and the resettlement and rehabilitation assistance (in the first case funds will move from LWASA through the LAC Office to the AP, while in the second funds will go directly from LWASA to the APs through the Project Director), Complaint & Grievances will be addressed through two different processes as described in **Table 9.3** below:

Table 8.3 Grievance Redressal Mechanism as per Land Acquisition Act

Land Acquisition and Compensation Issues- Hearing of objections	Resettlement and Income Restoration Assistance
Section 5-A. **(1)** Any person interested in any land which has been notified under section 5 as being needed for a public purpose or for a Company may, within thirty days after the issue of the notification, object to the acquisition of the land or of any land in the locality, as the case may be. **(2)** Every objection under sub-section (1) shall be made to the Collector in writing, and the Collector shall give the objector an opportunity of being heard either in person or by pleader and shall, after hearing all such objections and after making such further inquiry, if any, as he thinks necessary, submit the case for the decision of the [Commissioner] together with the record of the proceedings held by him/her and a report containing his recommendations on the objections. The decision of the [Commissioner] on the objections shall be final; **(3)** Where land is needed for a Company, the Collector shall, after making such enquiries as he deems necessary, also make his recommendations to the [Commissioner] with regard to the area that in his opinion is reasonable for the purpose; **(4)** For the purpose of this section, a person shall be deemed to be interested in land that would be entitled to claim an interest in compensation if the land were acquired under this Act.	**(1)** First, grievance resolution will be attempted at local/village level through informal mediation with the involvement of the APC, ESS staff of PMU, PMC and EPC/DBO Contractor. **(2)** If still unsettled, s/he will lodge the grievance(s) with the Project Director of the PMU in writing, with documents supporting his/her claim. The PD has 15 days to decide on the case. **(3)** If still unsettled, a grievance can be lodged to the GRC, the GRC will provide decision within 15 days of registering the complaint. The GRC decision must be in compliance with the RP provisions. **(4)** Should the grievance redress system fail to satisfy the AP, he/she/they can further submit their case to the higher administrative authority or appropriate court of law.
Section 9. Notice to persons interested: **(1)** The Collector shall then cause public notice to be given at convenient places on or near the land to be taken, stating that the Government intends to take possession of the land, and that claims to compensation for all interests in such land may be made to him/her. **(2)** Such notice shall state the particulars of the land so needed, and shall require all persons interested in the land to appear personally or by agent before the Collector at a time and place therein mentioned (such time not being earlier than fifteen days after the date of publication of the notice), and to state the nature of their respective interests in the land and the amount and particulars of their claims to compensation for such interests and their objections (if any) to the measurements made under section 8. The Collector may in any case require such statement to be made in writing and signed by the party or his agent. **(3)** The Collector shall also serve notice to the same effect on the occupier (if any) of such land and on all such persons known or believed to be interested therein, or to be entitled to act for persons so interested, as reside or have agents authorized to receive service on their behalf, within the revenue district in which the land is situate.	

Land Acquisition and Compensation Issues- Hearing of objections	**Resettlement and Income Restoration Assistance**
(4) In case any person so interested resides elsewhere, and has no such agent, the notice shall be sent to him/her by post in a letter addressed to him/her at his last known residence, address or place of business and registered under Part III of the Indian Post Office Act, 1866. **(5)** The Collector shall also serve notice of the enquiry to be held under section 11 (such notice not being less than fifteen days prior to the date fixed under sub-section (2) for determination of claims and objections) on the Department of Government, local authority or Company, as the case may be, for which land is being acquired, and require it to depute a duly authorized representative to attend the enquiry on its behalf for the purpose of making objections (if any) to the measurement of the land, claims to any interest in the land or the amount of any compensation. Such authorized representative shall be a party to the proceedings].	
Section 11. Enquiry and award by Collector: On the day so fixed, or on any other day to which the enquiry has been adjourned, the Collector shall proceed to enquire into the objections (if any) which any person interested [and a Department of Government, a local authority, or a Company, as the case may be], has stated pursuant to a notice given under section 9 to the measurements made under section 8, and into the value of the land [at the date of the publication of the notification under section 4, sub-section (1)], and into the respective interests of the persons claiming the compensation and shall make an award under his hand of–the true area of the land; he compensation which in his opinion should be allowed for the land; and the apportionment of the said compensation among all the persons known or believed to be interested in the land, of whom, or of whose claims, he has information, whether or not they have respectively appeared before him/her.	
Post Award: In cases where LAC announced the award and AHH/AP has received the compensation amount for loss of assets, LAC cannot make any decisions or revise its previous decisions. Such cases will be decided as per Section-18 of the LAA by the Court under Section-20 of the LAA, if AHH/AP has filed the appeal within due date/time, as given below for the awareness of the APs	

Land Acquisition and Compensation Issues- Hearing of objections	**Resettlement and Income Restoration Assistance**
Reference to Court and Procedure Thereon: **Section 18. Reference to Court:** (1) Any person interested who has not accepted the award may submit written application to the Collector, require that the matter be referred by the Collector for the determination of the Court, whether his objection be to the measurement of the land, the amount of the compensation, the persons to whom it is payable, or the apportionment of the compensation among the persons interested; amount or costs allowed'. (2) The application shall state grounds on which objection to the award is taken: Provided that every such application shall be made, - (a) if the person making it was present or represented before the Collector at the time when he made his award, within six weeks from the date of the Collector's award; (b) in other cases, within six weeks of the receipt of the notice from the Collector under Section 12, sub-section (2) or within six months from the date of the Collector's award, whichever period shall first expire. (3) Notwithstanding anything to the contrary contained in section 21, the Provincial Government may, if it has not accepted the award, refer the matter to the Court within a period of six months from the date of announcement of the award; provided that the Court shall not entertain the reference unless in its opinion there is a prima facie case for inquiry into and determination of the objection against the award]. **Section 19. Collector's statement to the Court.–** (1) In making the reference, the Collector shall state for the information of the Court, in writing under his hand, (a) the situation and extent of the land, with particulars of any trees, building or standing crops thereon; (b) the names of the persons whom he has reason to think interested in such land; (c) the amount awarded for damages and paid or tendered under sections 5 and 17, or either of them and the amount of compensation awarded under section 11; and (d) if the objection be to the amount of the compensation, ground on which the amount of compensation was determined.	

Land Acquisition and Compensation Issues- Hearing of objections	Resettlement and Income Restoration Assistance
(2) To the said statement shall be attached a schedule giving the particulars of the notices served upon, and of the statements in writing made or delivered by the parties interested respectively. **Section 20. Service of notice:** The Court shall thereupon cause a notice specifying the day on which the Court will proceed to determine the objection, and directing their appearance before the Court on that day, to be served on the following persons, namely: - **(a)** the applicant: **(b)** all persons interested in the objection, except such (if any) of them as have consented without protest to receive payment of the compensation awarded; and **(c)** if the objection is in regard to the area of the land or to the amount of the compensation, the Collector [and the Department of Government, local authority or Company, as the case may be, for which land is being acquired]. **Section 21. Restriction on scope of proceedings.–** The scope of the inquiry in every such proceeding shall be restricted to a consideration of the interests of the persons affected by the objection. **Section 22. Proceedings in open Court.–** Every such proceeding shall take place in open Court, and all persons entitled to practice in any Civil Court in the province shall be entitled to appear, plead and act (as the case may be) in such proceeding. [**22-A.** Cross objection.– The Provincial Government, or a local authority or a Company for which land is being acquired, may lodge a cross objection to the objection made by any person interested and the Court may reduce the amount awarded by the Collector if it considers it just and proper].	

9.7 Grievance Redressal Mechanism under Punjab Environment Protection Act 1997 (PEPA Act 1997, Amended 2012)

589. PEPA Act 1997 (Amended 2012), does not relate directly to Grievance Redressal system, however gives right to the aggrieved person to complaint to the Director General EPA (Section 6 (2)) against any pollution causing grievance to him/her or to the owned property. Simultaneously the aggrieved person may file a complaint in the environmental tribunal (Section 21 and Section 24 of PEPA Act 1997, Amended 2012)

9.8 Role of Land Acquisition and Resettlement Coordination Committee

590. LAR Coordination Committee (LCC) will play the role of Grievance Redress Committee to redress the grievances related to land acquisition and compensation issues. The ESS staff of PIU with the assistance of ESS of PMC will fully inform the AP of their rights and of the procedures under the LAA for addressing complaints both verbally or in writing during the process of land acquisition and compensation. Care will always be taken to prevent grievances rather than going through a redress process. This can only be obtained through careful implementation of the RP, by ensuring full participation and consultation with the AP, and by establishing extensive communication and coordination between the affected people, the PMU, the LAC and local government.

591. The LCC will serve a due diligence function on land acquisition, It will meet once in a month. It will review the progress of the land acquisition and compensation process of the project, seek reports from the LAC, the Project Director and APC, take cognizance of delays and anomalies in the process, suggest remedial measures and, if necessary, bring them to the notice of the DC Lahore and Punjab Board of Revenue.

9.9 Record Keeping

592. All concerns and grievances will be logged using the Grievance and Grievance logging and Response forms and registers, examples provided in **Annexure-AA**. This includes details of the concerns and grievances, the aggrieved, and the steps taken to resolve the grievances. Hard copies of the form are to be kept at the project sites, whilst soft copies will be saved on the PLWWMP server. Any accompanying documentation e.g. written statements, investigation reports and photographic evidence are to be filed along with the grievance log both in hard and soft copies. A master database will be maintained by the ESS of PMU to record and track management of all concerns and grievances, and audited by the external monitor. This will serve to help monitor and improve performance of the GRM.

9.10 Comment Response and, Grievance Mechanism Log

593. A sample format for logging summary details of each concern and grievance response is provided in **Annexure-AA**. As noted above hard and soft copies should be kept on file. Note:

- If it is a concern, the stakeholder will receive a copy if s/he requests one;
- If it is a Grievance, the aggrieved shall always receive a copy once registered for their records.

9.11 Initial Response Template

594. The template in **Annexure-AA** is an example for providing the initial response to the aggrieved in the case of Grievances; this response must be sent within 3 days of the grievance being entered into the logbook.

9.12 Monitoring and Review

595. It is vitally important to monitor the effectiveness of the GRM. Appropriate measures/[53]KPIs for this include monthly reporting on the number of grievances received, resolved and outstanding. This will be undertaken by the ESS of PUM/PMC and reported to the Project Director, GRC and AIIB in periodic progress reports. As part of the annual review/report, analysing the trends and time taken for grievance resolution will help to evaluate the efficacy of the GRM. As part of stakeholder engagement and consultation, involving the views of the stakeholders for whom the GRM is designed. The monitoring and review will help to improve effectiveness and stakeholder acceptance.

9.12.1 Roles and Responsibilities:

596. All the PMU and LWASA employees, PMC, EPC/DBO Contractor and all other contractors, sub-contractors and service providers are responsible for reporting any comment, concern, complaints and grievance to the ESS of the PMU. The ESS is responsible for logging and initial response and ensuring that they are correctly documented and presented to appropriate tier of GRM. The ESS is the main point of contact for AP and other stakeholders and will be responsible for maintaining clear communications and updating the aggrieved in line with time frames. The ESS will coordinate the investigation and response to grievances. The ESS of PMC is responsible for on-going monitoring and review of the effectiveness and efficacy of the GRM.

[53] Key Performance Indicator

9.12.2 Complaints Management Register

597. The environment and social (ES) staff of PMU will maintain a Complaint Management Register (CMR) to record grievances brought forward by AP and general public and ensure that these are appropriately addressed. The complaint register will provide: the date and particulars of the complaint; description of the grievance; follow–up action required; name of person responsible for implementing the action; a target date for redressal and up-dated status/final action with date. The ES staff will be supported by the PMC and EPC/DBO Contractor staff for this purpose. The actual measures taken to mitigate the concerns will also be recorded in the register. The complainant's views on the remedial action taken will also be documented in the Register. All complaints received verbally or in writing will be properly documented and recorded/written in the CMR. In addition to this an easy to access web based GRM will be designed on the same pattern, which will have updated status of each complaint to be used by complainants to get an update on their complaints. The updated register of grievances and complaints will be available to the public at the PMU office, construction camps of contractors and other key public offices along the project corridor (offices of the city district government and district administration), and at accessible and visible places of village information center established at SWTP site. And along the corridor of Transmission Main. Should the grievance remain unresolved it will be escalated to the second tier.

10 ANNEXURE

Sr. No.	Annexure	Title
1.	Annexure-A	NOC From Irrigation Department
2.	Annexure-B	Construction Activities and Materials
3.	Annexure-C	Summary of Population Projections
4.	Annexure-D (1)	Punjab Environmental Quality Standards for Municipal and Liquid Industrial Effluents
5.	Annexure-D (2)	Punjab Environmental Quality Standards for Motor Vehicles Exhaust and Noise
6.	Annexure-D (3)	Punjab Environmental Quality Standards for Ambient Air
7.	Annexure-D (4)	Punjab Environmental Quality Standards for Noise
8.	Annexure-D (5)	Punjab Environmental Quality Standards for Treatment of Liquid and Disposal of Bio-Medical Waste
9.	Annexure-E	Gap Analysis and Requirements for Statutory Clearances
10.	Annexure-E (1)	Comparison Between IFC/AIIB and PEQS for Noise
11.	Annexure-F	Traffic Count
12.	Annexure-G	Package 03 - Lab Reports
13.	Annexure-H	Package 04 - Lab Reports
14.	Annexure-I	Environmental Monitoring of Package 03
15.	Annexure-J	Environmental Monitoring of Package 04
16.	Annexure-K	Pictorial Profile of Flora and Fauna Package 03 and 04
17.	Annexure-L	Pictorial Profile of Industrial Survey of Package 03 and 04
18.	Annexure-M	Pictorial Profile OF Public Consultation
19.	Annexure-N	Public Consultation Feedback Forms
20.	Annexure-O	Pictorial Profile of Consultation with Government Officials and Responsible Authorities
21.	Annexure-P	Feedback Forms of Consultation with Government Officials and Responsible Authorities

Sr. No.	Annexure	Title
22.	Annexure-Q	Pictorial Profile of Consultation with Experts
23.	Annexure-R	Feedback Form of Consultation with Experts
24.	Annexure-S	Pictorial Profile of Stakeholder Engagement Workshop
25.	Annexure-T	Attendance Sheet of Stakeholder Engagement Workshop
26.	Annexure-U	Calculations for Power Requirement
27.	Annexure-V	Labour Camp Management Plan
28.	Annexure-W	GHG Emissions Inventory
29.	Annexure-X	Occupational Health and Safety Management Plan
30.	Annexure-Y	Chance Find Procedure
31.	Annexure-Z	Social Framework Agreement (SFA)
32.	Annexure-AA	Emergency Response Plan
33.	Annexure-BB	Environmental Tracking Report
34.	Annexure-CC	Sample: Grievance Logging and Initial Response Form
35.	Annexure-DD	Tools for Conducting ESIA (Packages 03 And 04)
36.	Annexure-EE	Composition of The ESIA Team
37.	Annexure-FF	References