Initial Environmental Examination

April 2017

PAK: Punjab Intermediate Cities Improvement Investment Project
Sahiwal City

Prepared by the Saaf Consult B.V., Netherlands, Joint Venture with Dev-Consult, Pakistan and NEC Consultants Private Limited, Pakistan, and M J Edge for the Asian Development Bank.

Initial Environmental Examination

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PAK: Punjab Intermediate Cities Improvement Investment Program (PICIIP)

Sahiwal City

i) Water Supply Improvement
ii) Sewerage and Drainage Improvement
iii) Transport Routes Improvement
iv) Sewage Treatment Plant (STP)
v) Green Spaces Development

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ABBREVIATIONS

µg/m^3	Microgram per Cubic Meter
AC	Asbestos Cement
ADB	Asian Development Bank
ADWF	Average Dry Weather Flow
AP	Affected Person
BOD	Biochemical Oxygen Demand
CAP	Corrective Action Plan
CCMR	Community Complaint Management Register
CDIA	Cities Development Initiative for Asia
CI	Cast Iron
CO	Carbon monoxide gas
CO_2	Carbon dioxide gas
COD	Chemical Oxygen Demand
CPEMP	Construction Phase Environmental Mitigation Plan
DEO	District Environment Officer
DG	Director General
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPD	Environmental Protection Department
FGD	Focal Group Discussion
GI	Galvanized Iron
GoP	Government of Pakistan
GoPb	Government of Punjab
GRS	Grievance Redress System
GRC	Grievance Redress Cell
GRS	Grievance Redress System
GT	Grand Trunk
H_2S	Hydrogen Sulfide Gas
ha	Hectare
HDPE	High Density Polyethylene
IEE	Initial Environmental Examination
km	Kilometer
LARP	Land Acquisition and Resettlement Plan
LBD	Lower Bari Doab
LED	Light Emitting Diode
LFG	Landfill gas
LGO	Local Government Ordinance
LMQ	Lahore Multan Quetta
m^3/d	Cubic meter per day
MCU	Motor Control Unit
MFF	Multi-Tranche Financing Facility
mg/l	Milligram per liter
MGD	Million Gallon per Day
MICS	Multiple Indicator Cluster Survey
mm	Millimeter
MSW	Municipal Solid Waste
N_2	Nitrogen Gas
N5	National Highway 5
NEQS	National Environmental Quality Standards
NGO	Non Government Organization
NH_3	Ammonia Gas

NO	Nitrogen Oxide Gas
NO_2	Nitrogen Dioxide Gas
NOC	No Objection Certificate
NOx	Oxides of Nitrogen
O&M	Operation and Maintenance
^oC	Celsius Centigrade
OHR	Over Head Reservoir
OHS	Occupational Health and Safety
Pak	Pakistan
PC	Public Consultation
PEPA	Pakistan Environmental Protection Act
PEQS	Punjab Environmental Quality Standard
PEQSAA	Punjab Environmental Quality Standard for Ambient Air
PICIIP	Punjab Intermediate Cities Improvement Investment Program
PK	Pakistan
PM_{10}	Particulate Matter (Particle Size 10 micron)
$PM_{2.5}$	Particulate Matter (Particle Size 2.5 micron)
PMU	Project Management Unit
PPE	Personal Protective Equipment
PTA	Provincial Transport Authority
PVC	Poly Vinyl Alcohol
REA	Rapid Environmental Assessment
RH	Relative Humidity
RTA	Rapid Transit Authority
SCADA	Supervisory Control And Data Acquisition
SLCCI	Sahiwal Chamber of Commerce and Industry
SO_2	Sulfur Dioxide Gas
SPS	Safeguard Policy Statement
STP	Sewage Treatment Plant
SWD	Solid Waste Disposal
SWMC	Sahiwal Waste management Company
SWSC	Sahiwal Water and Sanitation Company
TDS	Total Dissolved Solids
TMA	Tehsil Municipal Authority
TMO	Tehsil Municipal Officer
TO	Tehsil Officer
TOC	Total Organic Compound
TSS	Total Suspended Solids
UC	Union Council
VLDP	Very Low Density Polyethylene

Local Terminology

Chak:	Village
Koel:	Cuckoo
Nullah:	Natural water body, drain

Units

1 Marla	= 225 square feet	= 0.005165 acres
1 Square foot	= 0.0929 square metres	
1 Acre	= 43,560 square feet	= 0.404685642 hectares

1 Square metre	= 10.76391 square feet	= 0.0002471 acres
1 Hectare	= 2.4710538 acres	= 10,000 square metres
1 Inch	= 25.4 mm	= 2.54 cm
1 Mile	= 5,280 feet	= 1.609344 kilometres
1 Kilometre	= 0.62137 miles	= 3,280.84 feet
1 Gallon (Imperial)	= 4.54609 litres	= 0.0045461 cubic metres
1 Cubic metre	= 1,000 litres	= 219.96925 gallon (imperial)
1 Cubic metre/second	= 3,600 cubic metres/hour	= 35.31467 cusec
1 Cusec	= 101.941 cubic metres/hour	

I. INTRODUCTION

A. The Subprojects

1. The Asian Development Bank (ADB) and the Cities Development Initiative for Asia (CDIA) are partnering with the Government of Punjab Province (GoPP), to undertake the Punjab Intermediate Cities Improvement Program (PICIIP). The PICIIP aims to improve the quality of urban services available in selected cities in Punjab Province (city populations between 250,000 and 1,000,000). Urban infrastructure development is an important component of the PICIIP. The duration of the program will be six years. Funding will be accessed in phases. The PICIIP's overall budget is US$500 million, to be disbursed in phases. The first phase will fund investments in the intermediate cities of Sialkot and Sahiwal. Major projects planned for Sahiwal city are water supply improvement; sewerage and drainage improvement, sewage treatment plant, green spaces development and transport routes improvement.

B. Subprojects Types Identified for Implementation

2. A pre-feasibility study for Sahiwal city was carried out under the PICIIP in April 2016. It identified subprojects in the following four sectors: transport; water supply; sewerage; and, green spaces development. These projects are outlined below and in Table 1.1.

i. Water Supply Improvement Project: Rehabilitation of water supply tube wells, overhead reservoirs and water distribution pipelines will be carried out in designated parts of the city. These projects will improve water quality and the water supply situation in the city. In some places, new water supply infrastructure will also be laid. Implementation of the Supervisory Control and Data Acquisition (SCADA) system and bulk metering of the water supply will also be the part of water supply improvement project.

ii. Sewerage and Drainage Improvement Project: Rehabilitation of the sewerage and drainage network and disposal stations will be carried out in different parts of the city. In some places, the sewerage system will be extended and a trunk sewer will be constructed. The construction of a Sewage Treatment Plant (STP) will also be part of the sewerage and drainage improvement project. The purpose of the STP is to protect the environment and the health of the people by treating the wastewater, of Sahiwal city, at a combined effluent treatment plant prior to its disposal into the area's natural water bodies.

iii. Transport Routes Improvement Project: Improvements and upgrades to 3 KM Railway Road and two general bus stands will be carried out under this part of the project.

iv. Green Spaces Development: Rehabilitation of existing parks and development of green belts at different parts of the city will be the green spaces development projects.

C. Environmental Assessment

3. The ADB requires the consideration of environmental issues in all aspects of the Bank's operations. The requirements for environmental assessment are described in the ADB's Safeguard Policy Statement (SPS), 2009. This Initial Environmental Examination (IEE) study was carried out based on a prefeasibility study and detailed engineering design of the STP and the solid waste management facility. The IEE was prepared during the project feasibility stage and may be updated during the implementation stage to reflect any required changes related to the latest sub-project designs.

Table-1.1: Subprojects for Sahiwal under PICIIP

Sector	Projects
Transport Routes	3 KM Railway Road improvement/upgrades
	General bus stands improvement (02)
Water Supply	Rehabilitation of existing (10) and construction of new (12) overhead reservoirs (OHRs)
	Efficiency improvement of tube wells (27)
	Installation of new tube wells (08)
	Rehabilitation of existing tube wells (19)
	Replacement of water supply pipelines (78 KM)
	Provision of disinfection units at tube wells and OHRs
	Supervisory Control and Data Acquisition (SCADA), bulk metering and distribution network improvement
	Development of DNI zones
Sewerage and Drainage	Replacement of sewers (12.87 KM)
	Construction of trunk main from four major disposal stations to STP through gravity
	Provision of accessories for sewerage improvement and health and safety equipment for municipal corporation staff
	Construction of sewage treatment plant (STP)
	Rehabilitation of four major and six minor disposal stations
Green Spaces Development	Rehabilitation of existing parks (06)
	Green belting along canal (9 L)

4. An environmental assessment was conducted, using the ADB's Rapid Environmental Assessment (REA) checklist for urban development, water supply, and sewage treatment plant (see Annexure 1). The results of the assessment show that the subprojects are unlikely to cause significant adverse impacts. These projects are classified as environmental category B as per the ADB SPS. This IEE was prepared in accordance with the ADB's SPS requirements for environment category B projects. It provides mitigation and monitoring measures to ensure that the subprojects cause no significant impacts.

5. The environmental assessment requirements of the Punjab environmental Protection Act, 1997 (Amended 2012) for the combined effluent treatment plant are different from those of the ADB. The Government of Punjab's environmental regulations categorize development projects into two schedules, according to their anticipated potential environmental impact. The proponents of the projects with the potential for more adverse environmental impacts (see Schedule II) are required to submit an Environmental Impact Assessment (EIA). While, for the proponents of projects with the potential for less environmental impact (see Schedule I), must submit an IEE with the respective environmental protection agency (EPA). For the STP, the Government of

Punjab demands that an EIA be prepared, while the ADB only requires an IEE for category B projects.

6. The field studies were undertaken by a team with experience of environmental assessment for development projects in Pakistan. This team conducted the preliminary scoping, survey and assessment activities, and public consultations, and it coordinated the field sampling and analysis.

7. The study process began with the scoping and field reconnaissance, during which a REA was carried out to establish the categorization of project activities and the potential impacts. The environmental impacts and concerns that required further study, in the environmental assessment, were then identified. The methodology of the IEE study was then elaborated in order to address all the interests. Subsequently, both primary and secondary baseline environmental data were collected from the proposed works, and the intensity and likely location of impacts were identified with relation to the sensitive receiving environment, and based on the work expected to be carried out. The significance of the potential impacts from the construction and operation of the projects was then assessed and, for those impacts requiring mitigation, measures were proposed to reduce impacts to within acceptable limits.

8. Many Public Consultations (PCs) were carried out during prefeasibility and feasibility stages in line with ADB guidelines. Under ADB requirements the environmental assessment process must also include meaningful public consultation during the completion of the draft IEE. The PC process included verbal disclosure of the subproject as a vehicle for discussion. Interviews were conducted with local families and communities. The results of these PCs have been incorporated in this report.

D. Executing Agency

9. The Sahiwal Municipal Corporation (SMC), under local government, will be the executing agency of the proposed projects. The executive branch of SMC is divided into five departments and a Municipal Officer (MO) heads each of the departments (Finance, Planning and Coordination, Regulation, Infrastructure and Services) to carry out its functions. The MO Infrastructure and MO Services are responsible for water, sewerage, drainage, sanitation, roads, streets and street lighting, firefighting and park services.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

10. Several statutes contain direct legislation on environmental protection, namely the Pakistan Environmental Protection Act (1997), the Punjab Environmental Protection (Amendment) Act (2012, the Forest Act (1927), and the Punjab Wildlife Act (1974). In addition, the Land Acquisition Act (1894) also provides powers in respect of land acquisition for public purposes. There are also several other items of legislation and regulations that have an indirect bearing on the sub-project or general environmental measures.

A. Statutory Framework

11. The Constitution of Pakistan distributes legislative powers between the federal and provincial governments through two 'lists' that are attached to the Constitution as Schedules. The Federal List covers the jurisdictions over which the federal government has exclusive legislative power, while the Concurrent List contains jurisdictions over which both the federal and provincial governments can enact laws. "Environmental pollution and ecology" is included in the concurrent list; hence, both the federal and the provincial governments can enact laws in this jurisdiction. However, to date, after the 18th Constitutional Amendment, the Federal Ministry of Environment was dissolved and the provincial governments are now authorized to formulate environmental laws and regulations. The key environmental laws affecting the subprojects are discussed below.

i. Pakistan Environmental Protection Act, 1997

12. The Pakistan Environmental Protection Act, 1997, is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The act is applicable to a wide range of issues and extends to air, water, soil, marine, and noise pollution, and to the handling of hazardous wastes. The key features of the law, in as far as it has a direct bearing on the proposed subprojects, relate to the requirement for an IEE and an EIA for development subprojects. Section 12 (1) requires that: "No proponent of a sub-project shall commence construction or operation unless he has filed with the Federal Agency an Initial Environmental Examination [IEE] or, where the subproject is likely to cause an adverse environmental effect, an Environmental Impact Assessment [EIA], and has obtained from the Federal Agency approval in respect thereof." The Pakistan Environmental Protection Agency has delegated the power of review and approval of environmental assessments to the provincial environmental protection agencies, in this case the Punjab EPA.

ii. Punjab Environmental Protection (Amendment) Act, 2012

13. After the 18th Constitutional Amendment in the Constitution of Pakistan, the Federal Ministry of Environment was dissolved and the provinces were accorded jurisdiction over the environment. The EPA Punjab has formulated its own Act, the major content of which is the same as the PEPA, 1997. Minor amendments/changes have been made, as follows:

a. The name of the Act has been changed to "Punjab Environmental Protection (Amendment) Act, 2012".
b. For the words "Federal Government", wherever they occur, the word "Government" shall be substituted; For the words "Federal Agency", wherever they occur, the words "Provincial Agency" shall be substituted; and
c. For the word "National", wherever it occurs, the word "Punjab" shall be substituted.
d. All the other clauses, sub-clauses, sections and sub-sections are almost identical. Since this sub-project falls within Punjab province, approval from Punjab province will be required.

iii. Punjab Environmental Protection Agency Review of IEE and EIA Regulations

14. The Punjab Environmental Protection Act, provides for two types of environmental assessments: IEEs and EIAs. EIAs are carried out for subprojects that have the potential for 'significant' environmental impacts, whereas IEEs are conducted for relatively smaller sub-projects with relatively less potential for significant impacts. The Punjab Environmental Protection Agency Review of the IEE and EIA Regulations categorizes the subprojects that require an IEE and an EIA. Schedules I and II, attached to the Regulations, list these types of subprojects.

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

a. To determine whether a sub-project is categorized as requiring an IEE or EIA, use the two schedules attached to the Regulations.

b. An EIA or IEE is conducted as per the requirements outlined in the Pak-EPA guidelines.

c. If the project is located in the provinces, then the EIA or IEE is submitted to the concerned provincial EPA; if it is located in Islamabad and federally administrated areas, then it is submitted to the Pak-EPA. The Fee (depending on the cost of the sub-project and type of report) is submitted along with the EIA or IEE document.

d. The IEE/EIA is also accompanied by an application in the format prescribed in Schedule IV of the Regulations.

e. The EPA conducts a preliminary review of the report and replies within 10 days of the submission. It either a) confirms completeness, or b) asks for additional information, if needed, or c) returns the report and asks for additional studies, if necessary.

f. If the issue is confirmation of completeness, then the EPA is required to make every effort to complete the IEE and EIA review process within 45 and 90 days, respectively.

g. The EPA accords their approval, subject to certain conditions:

   - ✓ Before commencing construction of the sub-project, the proponent is required to submit an undertaking accepting the conditions.
   - ✓ Before commencing operation of the sub-project, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of the IEE.

h. An Environmental Management Plan (EMP) is to be submitted with a request for obtaining confirmation of compliance.

i. The EPAs are required to issue confirmation of compliance within 15 days of receipt of the request and complete documentation.

j. The IEE/EIA approval is valid for three years from the date of operational phase NOC.

k. After completion of construction, a monitoring report is to be submitted to the EPA, followed by annual monitoring reports, during operations.

16. As per Punjab Environmental Protection Act for the EIA or IEE, the STP would fall under Schedule II (Review of IEE & EIA Regulations). Schedule II projects require an EIA, due to their anticipated adverse environmental impacts. Under provincial requirements, the water supply, sewerage and drainage, green spaces development and transport projects do not require either an EIA or an IEE.

iv. National Environmental Quality Standards (NEQS)

17. The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and were amended in 1995 and 2000. Standards for the following types of effluent and emissions are specified in the NEQS and may be relevant to the specified projects:

a. Municipal and liquid industrial effluent parameters (32) for discharge to inland waters, sewage treatment facilities, and the sea.
b. Industrial gaseous emissions (16) into the atmosphere.
c. Motor and vehicle exhaust and noise (3)
d. Ambient air quality (9)
e. Drinking water quality (33)
f. Noise for residential, commercial, industrial, and silence zones

v. Other Relevant Laws

18. A number of other federal and provincial laws are important in the context of environmental management. The main laws that potentially affect the sub-projects are listed below.

a. **The Punjab Wildlife Protection Ordinance, 1972,** empowers the government to declare certain areas to be reserved for the protection of wildlife and to control activities within in these areas. It also provides protection to endangered wildlife species. As no activities are planned in these areas, no provision of this law is applicable to the proposed sub-projects.

b. **The Forestry Act, 1927,** empowers the government to declare certain areas as reserved forests. As no reserved forests exist in the vicinity of the proposed sub-project, this law will not affect to the proposed sub-projects.

c. **The Antiquities Act of 1975** ensures the protection of Pakistan's cultural resources. The act defines 'antiquities' as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, and national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain articles of archaeological significance. This project site is not in the proximity of a protected antiquity.

d. **Safety Regulations** directly or indirectly govern occupational health and safety (OHS) issues during the currently studied production activities. These regulations mainly include three laws and regulations: (i) PEPA Laws, 2000; (ii) Labor Laws; and (iii) Electricity Rules, 1937.

B. ADB Requirements

19. ADB safeguard policies require that:

i) impacts are identified and assessed early in the project cycle;

ii) plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and

iii) affected people are informed and consulted during project preparation and implementation.

20. The policies apply to all ADB-financed projects, including private sector operations, and to all project components.

21. The implementation processes as follows:

i) screening and scoping of the main issues start as soon as potential projects for ADB financing are identified and continue throughout the project cycle;

ii) impacts are assessed, safeguard plans summarizing mitigation measures, monitoring program, and institutional arrangements are prepared, and arrangements are made to integrate safeguards into project design and implementation;

iii) affected people are consulted during project preparation and implementation and information is disclosed in a form, manner, and language accessible to them; and

iv) safeguard plans are disclosed to the general public and the information is updated at various stages in the project cycle.

22. ADB's safeguard policies require that both ADB's and developing member countries' (DMCs') safeguard requirements are complied with.

23. Applicable standards for air emissions for general application, ambient air condition at property boundary for general purpose, limits for process wastewater, domestic sewage and contaminated storm water discharges to surface water and ambient noise levels are given below, and are based on the standards described in the World Bank Group (IFC) Environmental, Health and Safety Guidelines (EHS Guidelines). The Punjab Environmental Quality Standard (PEQS) values are also given against each value for the comparison with local requirement.

Air Emissions Limits for General Application
(milligrams per normal cubic meter)

Pollutant or Parameter	Limit	PEQS
PM	50 for units with >□50 MWe input	300 -500
	100 for units with < 50 MWe input	
Nitrogen Oxides as NO_2		Oxides of Nitrogen
Coal fired	750	1,200
Oil fired	460	600
Gas fired	320	400
Sulfur dioxide	Not to exceed 2,000	Sulfur Oxides 1,700

MWe Megawatts Electricity

Ambient Air Conditions at Property Boundary, for General Application
(micrograms per cubic meter)

Pollutant	Concentration	PEQS
Particulate Matter		
Annual Arithmetic Mean	50	360
Maximum 24 hour Average	70	500
Nitrogen Oxides (Maximum 24 hr)	150	80
Sulfur dioxide		
Annual Arithmetic Mean	50	80
Maximum 24 hr Average	125	120

Limits for Process Wastewater, Domestic Sewage, and Contaminated Storm Water Discharged to Surface Waters, for General Application
(milligrams per liter, except for pH, bacteria, and temperature)

Pollutant or Parameter	Limit	PEQS
pH	6–9	6 -9
BOD	50	80
COD	250	150
Oil and grease	10	10
TSS	50	200
Metals Heavy metals, total	10	-
Arsenic	0.1	1.0
Cadmium	0.1	0.1
Chromium Hexavalent	0.1	-
Total	0.5	1.0
Copper	0.5	1.0
Iron	3.5	8.0
Lead	0.1	0.5
Mercury	0.01	0.01
Nickel	0.5	1.0
Selenium	0.1	0.5
Silver	0.5	1.0
Zinc	2.0	5.0
Cyanide Free	0.1	-
Total	1.0	1.0
Ammonia	10	40
Fluoride	20	10
Chlorine, total residual	0.2	1.0
Phenols	0.5	0.1
Phosphorus	2.0	-
Sulfide	1.0	1.0
Coliform bacteria	< 400 MPN/100 ml	-
Temperature increase	< 3°C[a]	< 3°C

Note: MPN, most probable number
a. The effluent should result in a temperature increase of no more than 3° C at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge.

Ambient Noise

Receptor	Maximum Allowable log equivalent (hourly measurements) in dBA		PEQS	
	Day (07:00 – 22:00)	Night (22:00 – 07:00)	Day	Night
Residential, Institutional, Educational	55	45	55	45
Industrial, Commercial	70	70	65- 75	55 - 65

C. Structure of the Report

20. This IEE reviews information on the existing environmental attributes of the study area. They include geological, hydrological and ecological features, air quality, noise, water quality, soils, social and economic aspects, and cultural resources. The report predicts the proposed sub-project's probable impacts on the environment. This IEE also proposes various environmental management measures. The report provides details of all background environmental quality, environmental impact/pollutant-generating activities, pollution sources, predicted environmental quality and related aspects. References are presented at the end of the report. This report follows ADB guidelines and includes:

a. Executive Summary
b. Introduction
c. Policy, Legal and Administrative Framework
d. Description of the Subprojects
e. Environmental and Social Baseline Conditions
f. Assessment of Environmental Impacts and Mitigation Measures
g. Environmental Management Plan
h. Public Consultation and Information Disclosure
i. Conclusion and Recommendations

III. DESCRIPTION OF THE SUBPROJECTS

A. Water Supply Improvement Projects

i. Current Status

21. Water for the Sahiwal Water Supply system is obtained from deep tube wells with depths below 152 m. Currently, there are 54 tube wells in the service area, 44 of which are operational. The rated capacity of all 54 tube wells is 63 cusecs (6,426 m^3/hr), but the current operating installed capacity is 53.5 cusecs (5,457 m^3/hr). The water table is between 12 and 15 m below ground level, but it has been reported to be dropping by about 0.3 m per year or by from 4.6 to 5.5 m over the past 10 to 15 years. Data from the Irrigation Department confirms this drop in the water table. The source of natural recharge for the tube wells is the Ravi River and Lower Bari Doab canal.

22. The tube wells either pump directly into the distribution system or fill the overhead reservoirs. Based on the average number of pumping hours per day of between 8 and 13, the current operation's installed production is about 15 million gallons per day (MGD), which is only about 75% of current demand (including water loss).

23. An initial assessment of the condition of the tube wells suggests that eight are non-functional, five operate inefficiently, the motors and pumps of 14 need either replacement or repair, 26 need new Motor Control Units, and 14 pump houses need to be repaired.

24. Based on the information to date, the following conclusions can be reached:

a. It is likely that the actual discharge from the tube wells is significantly less than the rated capacity as the pumps are old and apparently in poor condition. The water table is reported to have dropped over the past years such that the requirements of the pumping heads will have increased.
b. The tube well installations pump both directly into the overhead storage reservoirs and the distribution system, with a fixed daily operation. The pumps are operated at certain times to fill the tanks and, at times, they are switched off, while the tanks supply the distribution system. This a manual operation, based on fixed timings.
c. The sites lack an integrated control system, such as a SCADA, for the tube well installations or pressure gauges at the sites, which would enable some pumps to be switched off when not required.

25. Chlorination facilities at the tube wells are currently out of order, so the water is not purified before it is distributed to the consumers. Given the reported contamination of the water supplies from sewage, due to the water supply being proximal to sewerage pipes and, at times, due to negative pressure in the water pipes, this clearly represents a health risk.

26. According to the information collected during the survey, there are twelve overhead storage reservoirs within the water distribution network, eight of which are operational. The total storage capacity is reported to be 480,000 gallons, of which 320,000 gallons is functional storage. This represents 0.72 hours at current demand and 0.47 hours at the projected demand for 2035. The reservoirs are an important element of the operational strategy of the water supply system, with specific times being allocated to filling the reservoirs so they can meet the demand for water during peak demand periods.

27. In addition to the dysfunctional reservoirs, a number of the functional reservoirs are also in poor condition and require repairs. There are currently 13 existing water supply zones, in

Sahiwal (within the current MC boundary), eight of which contain overhead reservoirs. Even within these eight zones, there is still direct pumping from MC tube wells into the distribution system. This indicates the inadequate capacity of the available reservoirs, such that direct pumping is required to cater to demand and to maintain pressure during supply. The remaining five zones are entirely dependent on direct pumping because they have no overhead reservoir.

28. With reference to the water distribution network, the pipe materials used in the distribution system are cast iron, galvanized iron, asbestos cement, and PVC. Pipe diameters range from 76 to 406 mm, and the total length of the network is 153 km. This includes about 89 km of asbestos cement pipe work. The rate of coverage of the distribution network, within the municipal boundary, is almost 90%, but the pipe network is poor and outdated, and sewage intrusion occurs during non-supply hours, when the system is not pressurized. Currently, there are 14,734 active connections out of a total of 41,209 households, suggesting that much of the population either has an illegal connection or a private well. However, given the low water tariff of PKR 400 per annum, there seems to be little benefit in having a private well. As a result, revenue is low and this has an impact on operations, maintenance and system rehabilitation.

29. The system is operated intermittently (8 hours per day), with times allocated to filling the reservoirs and other times to supplying consumers from the reservoirs, during which the tube wells are kept running until the supply cycle is completed. There are no valves within the system, so supply is regulated by opening and closing the tube well pumps.

30. There are twelve filtration stations located around the town that supply consumers with drinking quality water. People tend to not drink water supplied through the distribution network, but rather they obtain bottled water or water from the filtration plants.

ii. Proposed Projects

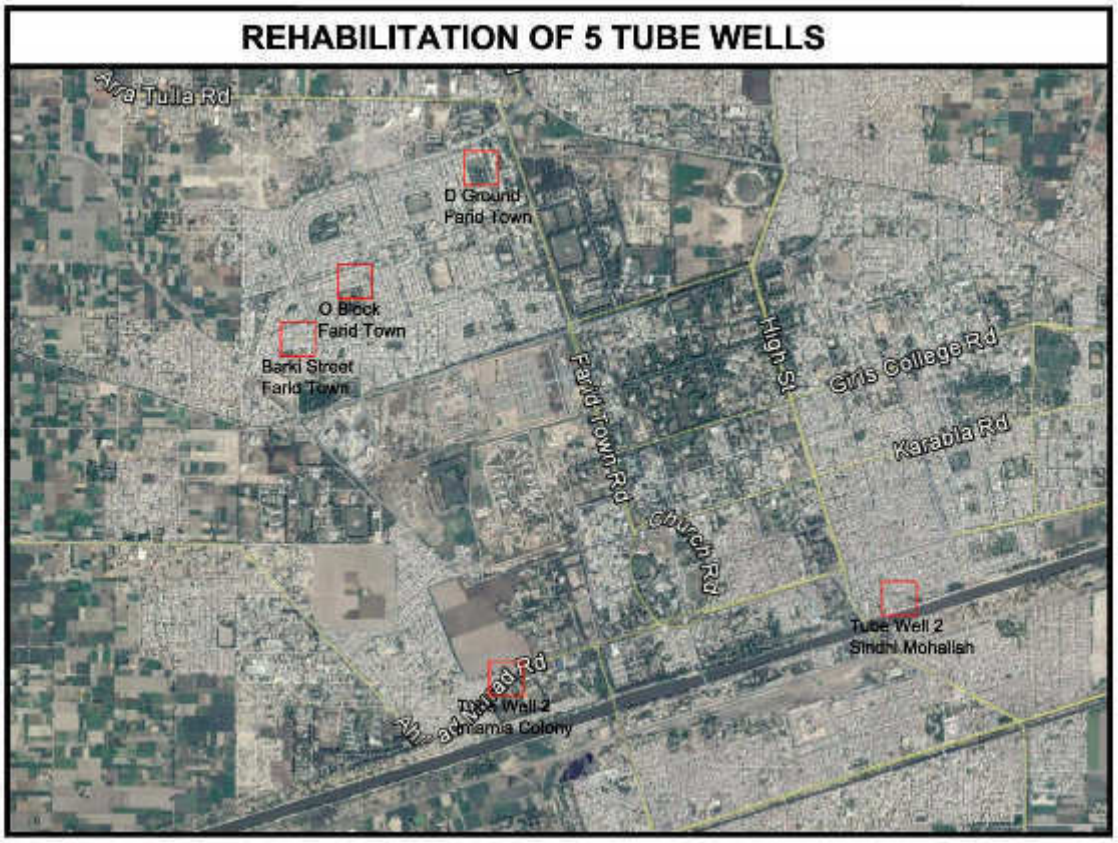
a. Rehabilitation of Production Facilities

31. The objective of this sub-component is to restore the 54 tube wells to their original design rating such that a total capacity of 62.5 cusecs (6,375 m^3/hr) can be achieved. There are eight existing tube wells in the city whose bores have been clogged and not producing sufficient water. Eight new bores (203 mm) will be developed and new tube wells are required to be installed. There are 19 tube wells whose civil, electrical and mechanical condition is not good. These 19 tube wells are required to be rehabilitated to improve their electrical, mechanical and civil condition. There are 27 tube wells whose efficiency is low due to which either water discharge is low or consuming higher energy. These 27 tube wells need efficiency improvement which includes either replacement of motor/pump or impeller adjustment/repair and maintenance. In addition, chlorination facilities need to be provided at all tube wells and OHRs to ensure sufficient water quality is provided to consumers. The outcome of this sub-component is that the 54 tube wells will be able to provide sufficient water to meet 2035 water demands within the existing service area. Instrumentation will be in place to enable central control of the production facilities resulting in more efficient operation and cost savings.

The intervention location of tube wells is shown below:

EIGHT (08) NEW BORES FOR TUBE WELL

CIVIL REPAIR OF 14 FUNCTIONAL TUBE WELLS

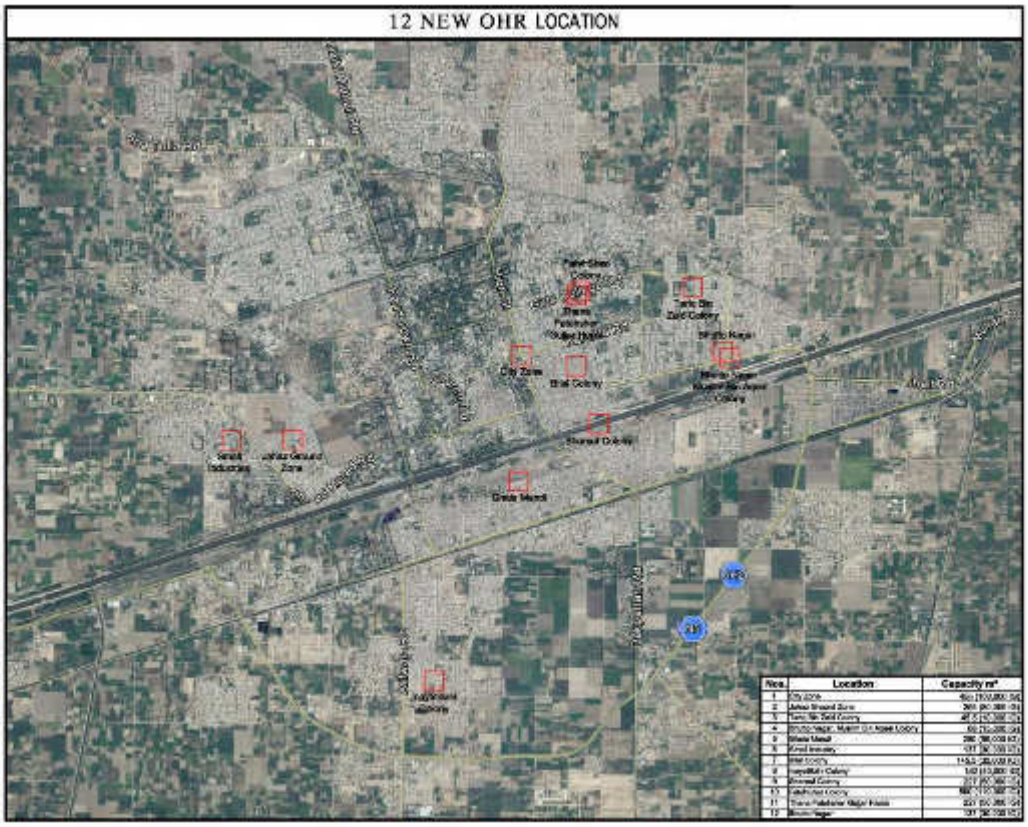


b. Rehabilitation and Provision of Storage Reservoirs

32. The objective of this component is to provide three hours' storage in all zones of the distribution system of the water distribution system to allow for diurnal variations in water demand and provide some security during load shedding periods. This will provide for more efficient operation of the distribution system and reduced pumping costs by eliminating direct pumping into the distribution system. The works to be undertaken under this component are:

i. Rehabilitation of three non-functional OHRs of 130,000 gallon capacity, including replacement of filling pipes, distribution main pipes and overflow pipes, replacement of valves and civil repairs. The three reservoirs to be rehabilitated are Tariq bin Ziyad Colony, Scheme 2 Farid Town and Ghala Mandi.
ii. Repair of all remaining seven OHRs, including replacement of valves & pipe sections and civil repairs (Total 10 OHRs rehabilitation).
iii. Provision of 520,000 gallons additional, through 10 new OHRs as shown in Table-3.1. The 10 new OHRs will be constructed and 02 already existing OHR will be demolished and constructed again (Total 12 new OHRs).

The intervention location of OHRs is shown below:


12 NEW OHR LOCATION

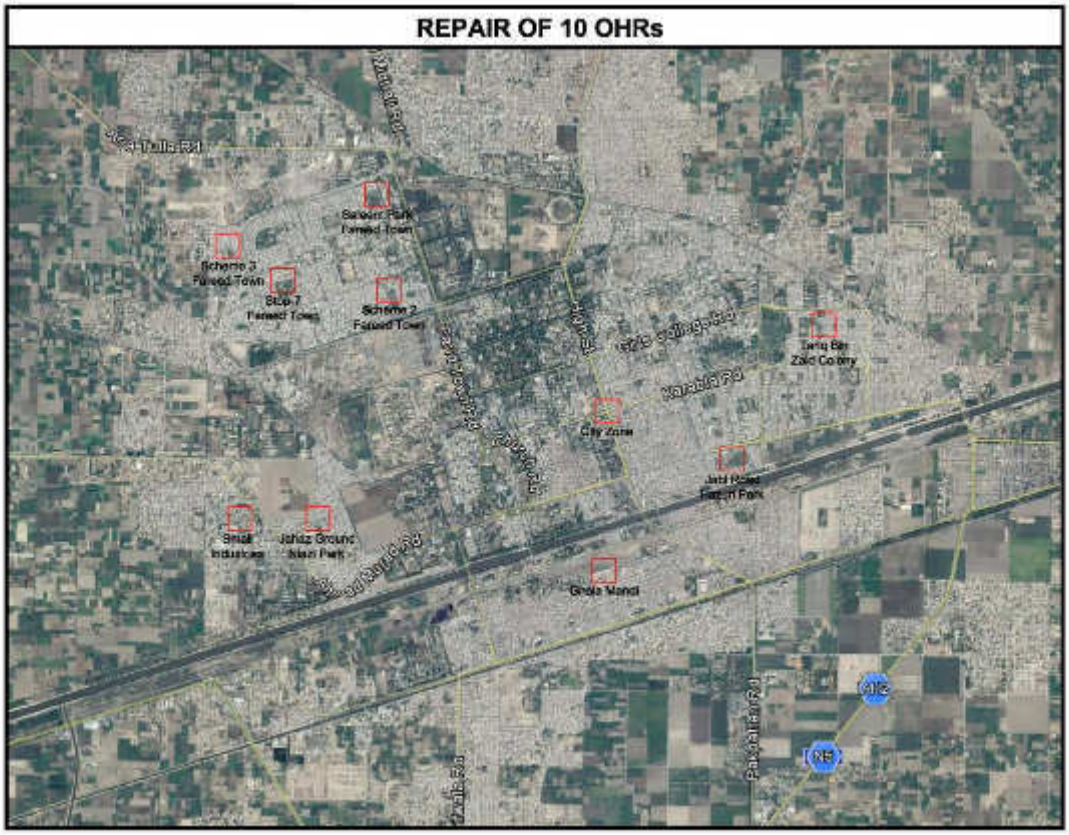


Table-3.1: New Overhead Reservoirs to be Constructed

Zone	Additional Storage Capacity Required (gallons)
City Zone	100,000
Jahaz Ground Zone	80,000
Tariq Bin Ziad Colony	10,000
Bhutto Nagar, Muslim Bin Aqeel Colony	15,000
Ghala Mandi	55,000
Small Industry	30,000
Bilal Colony	32,000
Inayat Illahi Colony	40,000
Shareef Colony	50,000
Fateh Sher Colony	110,000
Thana Fateh Shair Gujjar Haata	50,000
Bhutto Nagar	30,000
Total	**602,000**

c. Rehabilitation of Water Distribution System

33. The objective of this component is to replace the damaged/rusted pipes that are resulting in excess leakage as well as all asbestos cement pipes, which are now considered as a health hazard. This will improve service delivery through maintaining adequate pressures, reducing water losses and the risk of contamination from sewage when the pipes are not pressurized. The reduction in water losses resulting from an improved condition of the piped network will reduce the stress on the aquifer that has resulted in

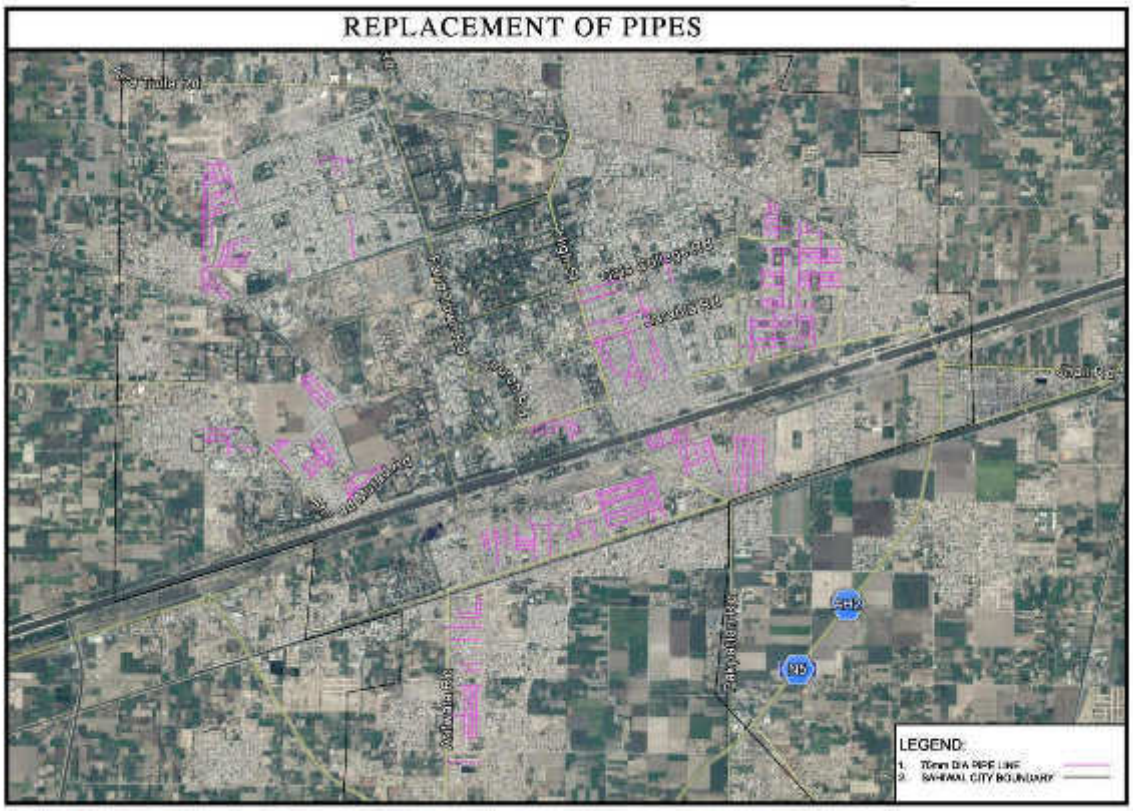
lowering of the water table through reducing the quantity of water being abstracted from the tube wells.

34. A total of approximately 54 KM of pipeline is required to be replaced by PE (Polyethylene) pipes of following diameter and lengths:

305 mm dia of 0.46 KM
254 mm dia of 0.86 KM
203 mm dia of 1.56 KM
152 mm dia of 11 KM
102 mm dia of 2 KM
76 mm dia of 38 KM

35. Replacement of 24 KM of Asbestos pipeline in phases.

The intervention location of pipe replacement is shown below:



d. Installation of SCADA System, Bulk Metering and Pressure Gauges

36. Supervisory Control and Data Acquisition (SCADA) will be installed to facilitate more efficient water supply system operation in DNI (Distribution Network Improvement) zones. It will allow automatic operation of tube well pumping stations based on the reservoir levels and system pressure. It will enable real time measurement of flows and pressures throughout the system, and will enable accurate assessment of water losses. SCADA is essentially a real-time industrial process control system used to centrally monitor and/or control remote or local industrial equipment such as valves, pumps, sensors, etc.

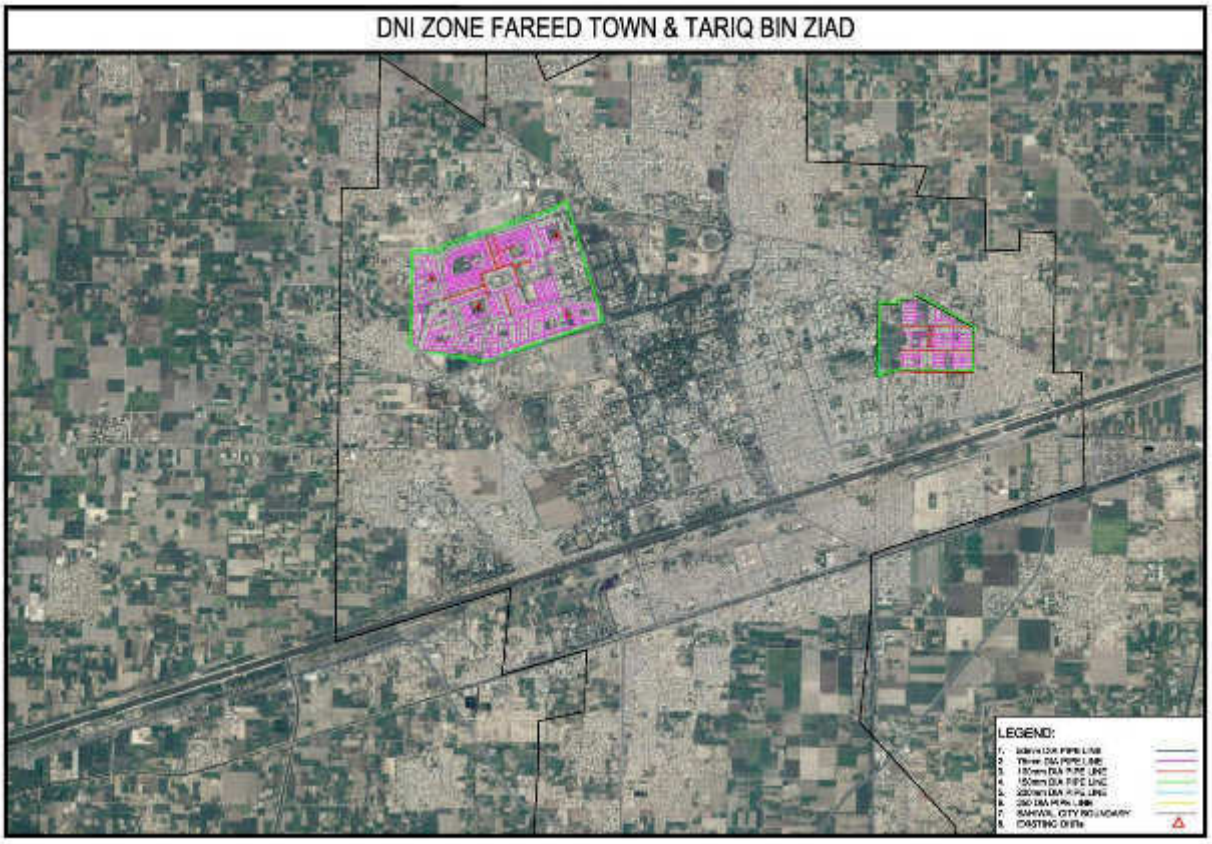
37. SCADA is a combination of telemetry and data acquisition, which will perform the functions of (i) data acquisition; (ii) networked data communication; and (iii) data presentation.

38. Bulk meters and pressure gauges will be installed at all the tube wells.

e. Development of DNI Zones

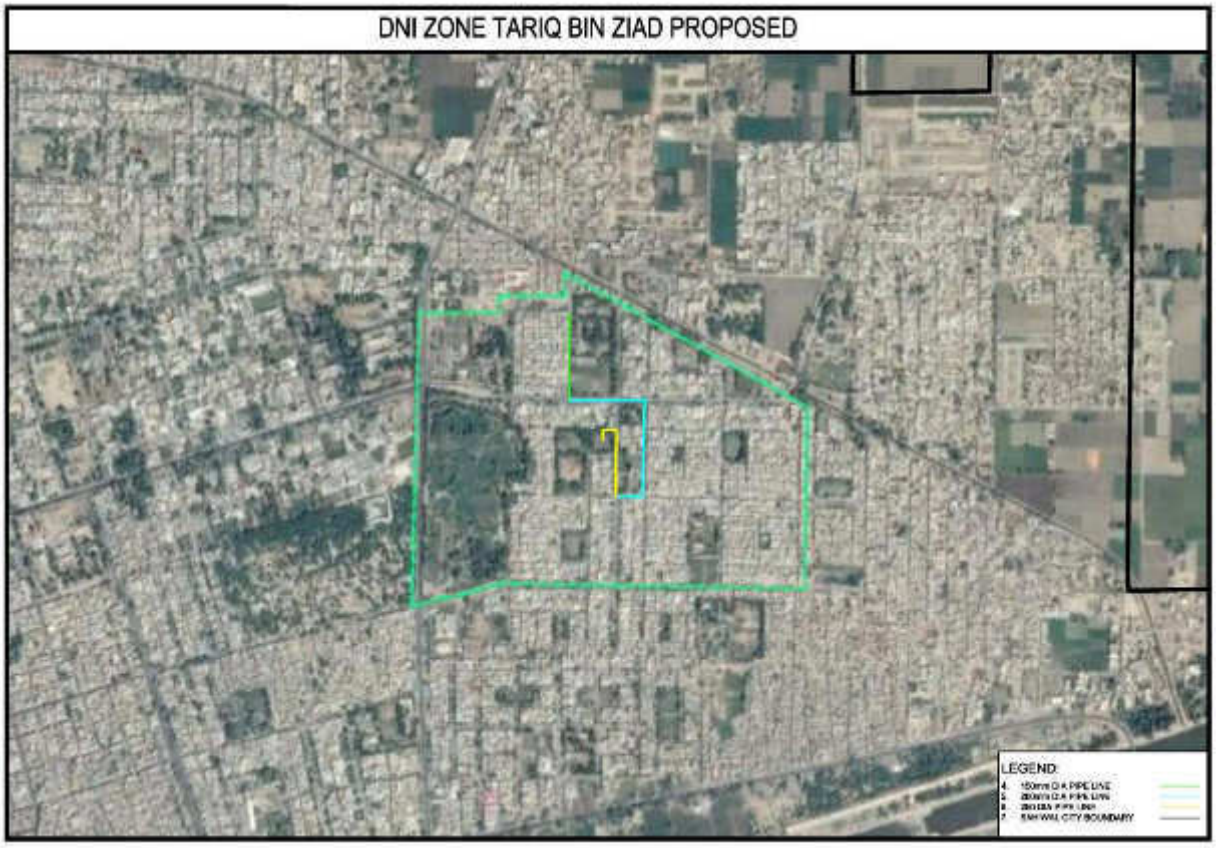
39. In Sahiwal city, water metering is not carried out at household level and not charged accordingly. It is being experimented that two Union Councils of Farid Town and Tariq Bin Zayd are declared as DNI (Distribution Network Improvement) Zones where water meters will be installed at all the households and charged bills accordingly. These two DNI zones will be supplied water for 24/7.

The existing pipe layout and intervention location for pipe replacement in two DNI zones is shown below:



DNI ZONE FAREED TOWN PROPOSED

DNI ZONE TARIQ BIN ZIAD PROPOSED



iii. Alternatives

Alternative water sources for Sahiwal city are discussed below:

40. Surface Water: Due to the depletion of the groundwater table and the high pumping costs from the tube wells, other options for a water source for Sahiwal such as rainwater harvesting and surface water might need to be considered in the future. In addition to other counter-measures for addressing the issue of depletion of ground water, there is the possibility of a surface water source for water supply through the Lower Bari Doab Canal. It is the perennial irrigation water distribution canal having a design discharge of 9,841 cusecs (1,003,782 $m^{3/}$hr), with 8,600 cusecs (877,200 m^3/hr) present carrying capacity in kharif season. The canal is passing across the city, and it is reported to be closed once a year for a month, for de-silting purposes.

41. There is an option to convert the groundwater source to a surface water source by taking raw water from the Lower Bari Doab Canal, and construction of an 18 MGD Rapid Sand Gravity Filters Water Treatment Plant in the city with provision of expansion in future for catering demands in 2035. This 18 MGD Water Treatment Plant will meet the demands up to 2020, and the subsequent expansion by provision of additional filter beds and mechanical equipment will serve the purposes compatible with 2035 demand.

42. Alternatively, a smaller surface water system of up to 9 MGD could be installed such that water would be supplied partially by groundwater and partially by surface water. This would reduce the demand on the groundwater and redress the water table depletion and at the same time possibly make some saving on power costs (although there will be additional chemical costs for the surface water treatment plant). But by retaining the tube well operations, it will ensure the tube wells are in operating conditions and can be pumped for additional hours during the one-month closure of the LBDC Canal.

43. Rainwater Harvesting: Another option for meeting water demands is rainwater harvesting. Since the annual rainfall in Sahiwal is only about 200 mm per year and it experiences long dry periods every year, the option of rainwater harvesting for reducing dependence on ground water is unlikely to have a significant impact. However, rainwater harvesting is being practiced in Islamabad where the average annual rainfall exceeds 1,100 mm. If a household level project is considered, it will require space to be available at the household for storage of rainwater. Moreover, roofs in most households are generally flat and not always in good condition so often there is not a suitable surface to harvest rainfall for potable use. It may be more feasible in areas such as Fareed Town and Tariq Bin Ziad Colony, but in these high income areas people have installed their domestic bores for emergency and surplus use of water, thus they will not need to go for rain water harvesting. If there is a limited demand for rainwater harvesting, public money cannot be invested in a project, which will be operated at the level of individual households. Thus for these reasons, rainwater harvesting options do not seem viable in Sahiwal. At best an incentive program might be considered whereby people would be provided with subsidies for installing a rainwater harvesting facility since it would result in water conservation.

44. There are two options for water supply i.e. pressurized supply through continuous running of water turbines and filling of OHR and supply through it with intermittent running of tube wells. OHR option is considered energy efficient as compared with continuous pressurized water supply.

45. Liquid chlorine is used as disinfectant universally. It is considered useful at water supply facilities without considering any other alternative.

B. Sewerage Improvement Projects

i. Current Status

46. The sewerage collection system for Sahiwal comprises of 250 km of 229 mm to 1,219 mm diameter sewers. This system serves 90% of the city population and covers 80% of the city area. This is a combined system carrying both storm water and wastewater and there are no separate major drains inside the city boundaries. Despite the reported high coverage, there are only 15,406 sewerage connections from 41,209 households, with other wastewater and storm water being conveyed through open drains into the sewerage system or through manholes, which are opened during heavy rain to assist in relieving local flooding. The pipe network is reported to be old, in poor condition and suffers from frequent blockages and collapsed sewers. There is reported to be contamination of the water supply system from sewage due to the poor condition of both the water and sewerage network, the proximity of the water supply and sewerage pipes, and since the water supply pipelines are at times not pressurized.

47. Current domestic wastewater generation from Sahiwal city is about 48 million gallon per day – (MGD) (Peak Wet Weather Flow). The wastewater is conveyed from the city through six minor and four major disposal stations, located at different locations of the city. It is ultimately disposed either into the Nullahs (natural wastewater drains) or is used by farmers to irrigate their crops. In one case, the wastewater from a major disposal station is directly discharged into the canal (L-9) that passes along the Grand Trunk Road. The EPA has already filed a case against the Sahiwal MC for discharging untreated wastewater from the Manzoor Colony Disposal Station to the L-9 canal. In another case, wastewater is discharged into a scarp drain. The wastewater is conveyed from the city through six minor and four major disposal stations, located at different locations of the city.

48. Since Sahiwal is not as industrialized as many other intermediate cities in Punjab, industrial effluent is not a serious issue in the present context. However, in the future, Sahiwal is expected to become the hub of the main trade route coming from the Economic Corridor with China. Industrialization in Sahiwal can be foreseen, however, it is not possible to predict the scale of its future industrialization and the nature of its future industries. At present, a minor quantity of industrial effluent is mixed with domestic wastewater, due to the presence of few small-to-medium-sized industries in the city. This is the untreated wastewater. There is no wastewater treatment plant at the city to treat both domestic and industrial effluent.

49. At present, Sahiwal has no separate storm water drainage infrastructure to deal with rainfall runoff. However, given that rainfall is minimal for 9 to 10 months of the year, the MC administration does not believe that a separate storm water drainage system is required. The pre-feasibility study, carried out by the ADB, under the “Punjab Intermediate Cities Improvement Investment Program (PICIIP),” recommends the construction of a sewage treatment plant for the treatment of city wastewater prior to its disposal into the canal. The STP site has been selected and the design is being carried out under the feasibility study.

ii. Proposed Projects

a. Sewerage Network Improvement

50. The sewerage collection system requires sewer replacements (12.87 KM) in areas where leakages or settlement of the sewer line has been experienced. These areas of sewer replacement are shown in Table-3.2:

Table-3.2: Proposed Sewer Replacement Requirements

#	From	To	Diameter (mm)	Length (KM)
1	Jogi Town	Mission Hospital	600	1.50
2	Mazdoor Pulli	Dr. Daud Chowk	450	1.00
3	Ghausia Colony		229	1.66
4	New Mohalla Fareed Gunj		229	2.36
5	Muslim Bin Aqeel Colony & Labour Colony		229	6.35

The intervention location of sewers replacement is shown below:

b. Rehabilitation of Sewage Disposal Stations

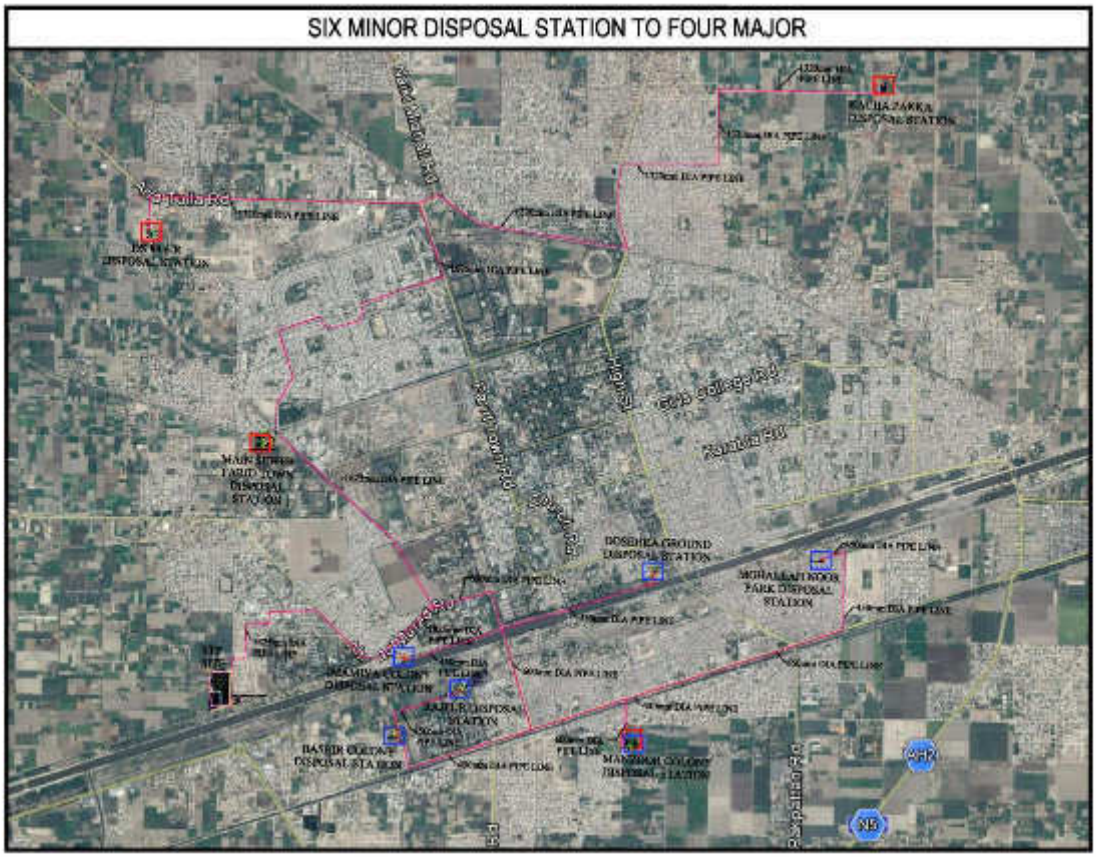
51. The four major disposal stations, 89/6R, Fareed Town, Manzoor Colony and Kacha Pacca Noor Shah will be converted into pumping stations and sewage will be conveyed from these pumping stations through trunk mains to a centralized wastewater treatment plant.

52. Minor Disposal Stations will be rehabilitated to act as overflows in case of emergency, but will be taken out of service for normal operation. Improvement and renovation of minor disposal stations (6 in numbers) including provision of new pump, motors and MCUs and civil repair of rooms will be carried out to act as a standby setup for emergency. The sewerage conveyance system will be modified to enable sewage to flow to the four main Disposal Stations (Pumping Stations) and only in emergencies flow to the minor Disposal Stations.

c. Trunk Main from Four Major Disposal Stations to STP and Gravity Lines from Six Minor Disposal Stations to Four Major Disposal Stations

53. At present there are four major and six minor disposal stations which dispose sewage of Sahiwal city. It is proposed and designed that the pumping system of six minor disposal stations will remain intact and only used in case of emergency. In routine, these six minor disposal stations will be connected with four major disposal stations through gravity sewers. Trunk main will be laid down from four major disposal stations to STP for the conveyance of wastewater of Sahiwal city to STP for treatment.

Intervention location of six minor and four major disposal stations and trunk main from four major disposal stations to STP is shown below:



d. Proposed Sewage Treatment Plant

54. Location: The proposed project site is located towards southwest outskirts of the Sahiwal city, where sewage from the existing town boundary will be conveyed. The existing disposal stations will be converted into pumping stations to pump sewage from the collection system into the trunk mains conveying sewage to the treatment facilities. It is about 500 meter away from newly developing residential scheme called Three Marla Scheme of MC Sahiwal (East Side of the site). After surveys and consideration of alternatives, government selected parcel of land in Chak No. 95/6-R. This plant is being constructed on agriculture land. Total land area is 4.5 ha (45,621 m^2).

55. Three sides of the site are surrounded with agricultural land (East, West, North) and one side is along the unpaved passage adjacent to the right bank of canal (South) i.e. Lower Bari Doab (LBD). The Three Marla Housing Scheme is located at about 500 meter away from the

site at eastern side whereas two villages 95/6-R and 94/6-R are located at northern side of the site at about 1 KM distance.

56. Designed Flow: The average design flow of STP is 20 – 27 MGD (90,909 – 123,636 m^3/day). The peak flow will be 40 MGD (181,182 m3/day).

57. The design characteristic of sewage of Sahiwal city which shall be treated in STP is given in Table-3.3.

Figure-3.1: View of Proposed STP Site

View of Three Marla Housing Scheme at Back Side (Eastern Side)

Table-3.3: Adopted Sewage Design Characteristics

Parameter	Unit	Design Value
Total Suspended Solids (TSS)	mg/L	200
5-Day Biochemical Oxygen Demand, BOD_5	mg/L	250
Chemical Oxygen Demand, COD	mg/L	500
Total Dissolved Solids (TDS)	mg/L	1,100

Source: STP Design Report

58. The influent and effluent characteristics of STP are given in Table-3.4.

Table-3.4: Raw and Treated Wastewater Characteristics

Parameter	PEQS	Design Concentration		Required Efficiency (%)
		Influent	Effluent	
BOD_5 @ 20°C (mg/L)	80	250	50	80
COD (mg/L)	150	500	150	70
TSS (mg/L)	200	200	100	50

Source: STP Design Report

59. After comparing all the suitable treatment technologies (Comparison of alternative technologies is provided in section D), it is evident that only Trickling Filter with Primary Settling is the most efficient biological process in STP conditions and thus selected.

Tricking Filter Process: In this process, the settled wastewater is allowed to trickle down over a circular deep bed of coarse aggregates filter or plastic media filter. The microbial film, developed on the surface of filter media over time, treats the wastewater. A part of this film, washed away by the hydraulic action of trickling wastewater, is separated in secondary clarifier, in form of humus sludge, disposed of after sludge treatment, or returned for digestion into the UASB reactor, if applicable.

60. Following are the key components of treatment system and facilities proposed for STP.

Water Line

- Wastewater Screen Chamber (Coarse)
- Wastewater Pumping Station
- Wastewater Screen Chamber (Fine)
- Grit Chamber
- Primary Sedimentation Tank
- Primary Sludge Pumping Station
- Trickling Filters
- Secondary Sewage Pumping Station
- Secondary Sedimentation Tank
- Secondary Sludge Pumping Station

Sludge Line

- Sludge Thickening in Combined Sludge Thickeners
- Thickened Sludge Pumping Station
- Sludge Digester
- Digested Sludge Pumping Station
- Sludge Dewatering (Conventional Sand Drying Beds)

61. The Figure 3.2 and 3.3 is the process flow diagram and proposed lay out plan of STP respectively.

62. Sludge Production, treatment and Disposal: In STP, the sludge will be generated from the primary and secondary sedimentation tanks. Primary and secondary sludge will be thickened in Combined Sludge Thickeners. The thickened sludge would then need to be digested in Anaerobic Sludge Digester, in order to stabilize sludge, i.e. minimize microbial activity. Digested sludge would then be dewatered, in order to reduce its volume and to render it suitable for transportation for disposal or land application, as the case may be. The most appropriate method of sludge dewatering and drying, under local conditions, is Sludge Drying Beds. Same is adopted for the project. About 7.9 ton dry sludge will be produced daily.

iii. Alternatives

63. Treatment Options: In prefeasibility study two options are discussed for sewage treatment. Option-1 is considered for four small decentralized sewage treatment plants at four major disposal stations. Option-2 is considered for one centralized treatment plant. Option-1 is a short term, primary treatment option only due to shortage of land availability. Option-2 is considered long term for complete treatment with sufficient land availability.

64. Alternative Treatment Technologies: Comparison of alternative technologies for STP design is given in Table-3.5 and 3.6.

65. Trunk main and other sewers routing is carried out in a way manner to use the most of the existing sewers and avoid laying new sewer lines

Figure-3.2: Process Flow Diagram of STP

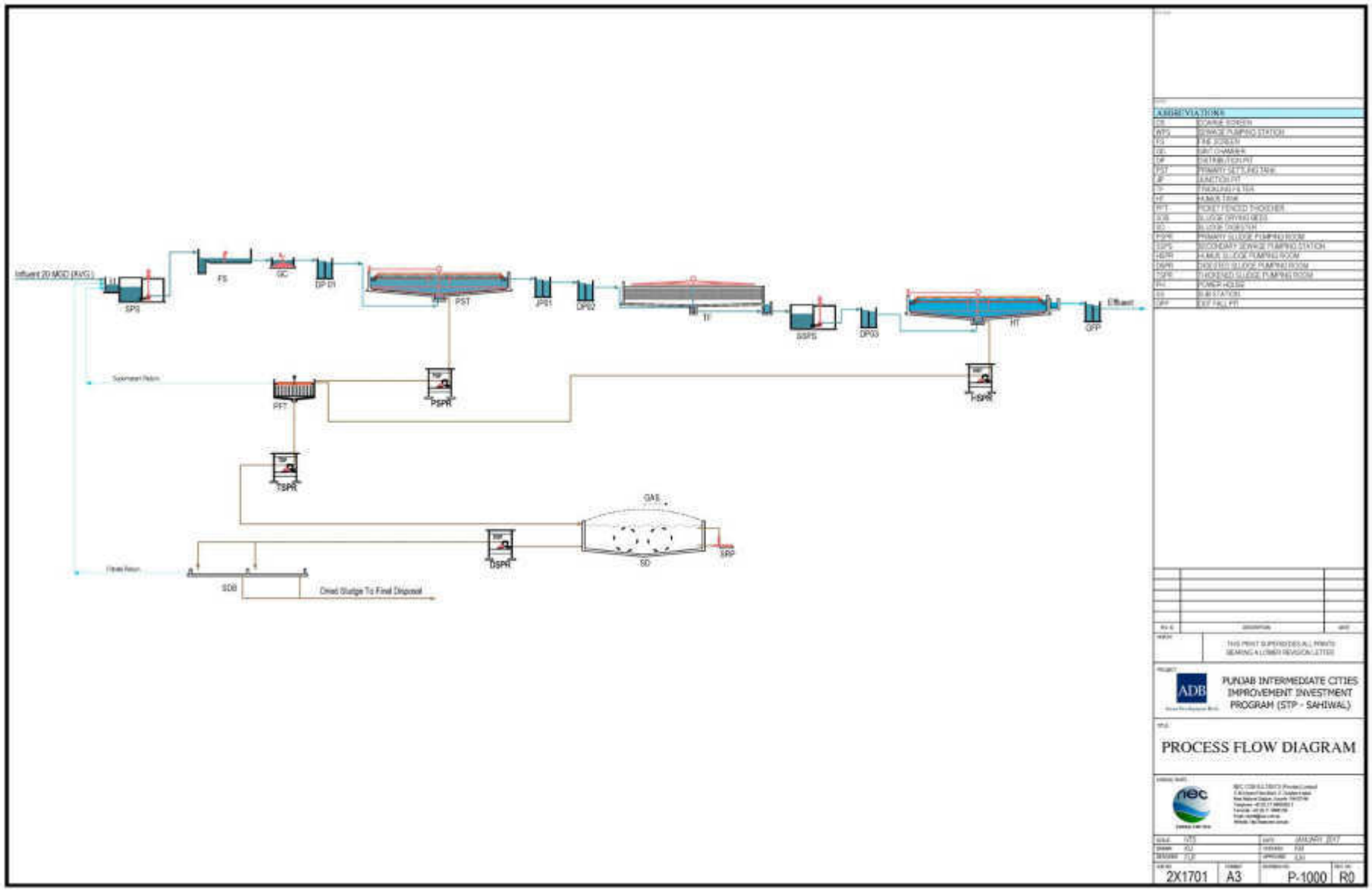


Figure-3.3: Proposed Layout Plan of STP

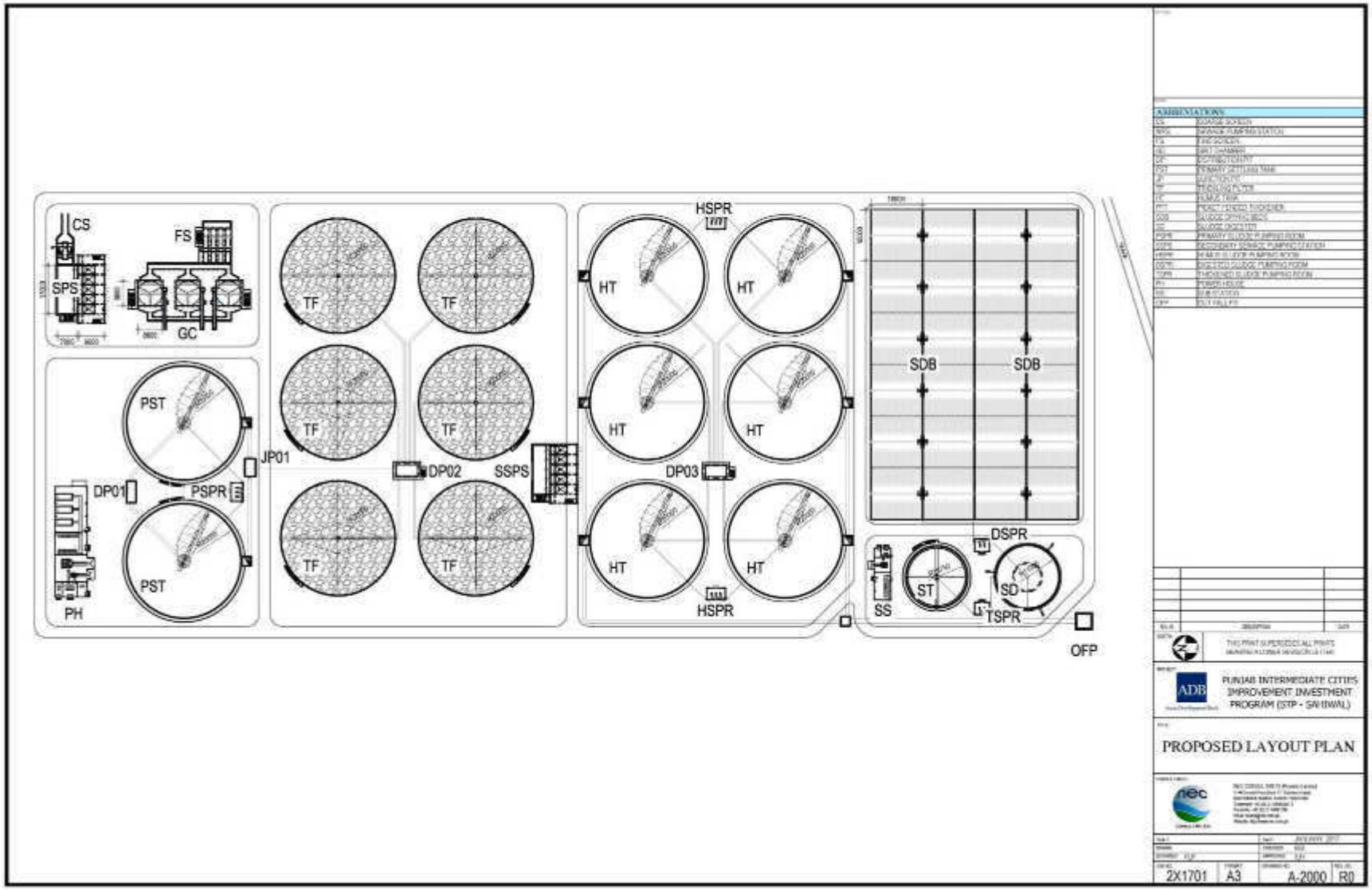


Table-3.5: Comparative Analysis of Alternate Treatment Processes

Facultative Pond (FP)	- Simple construction, operation and maintenance - Low operating cost - No equipment - Practically no energy requirement - Satisfactory resistance to load variations - Sludge removal only necessary after periods of 20 years	- 85% BOD removal - High land requirement (650 acres) - Difficulty in satisfying restrictive discharge standards - Possible algal removal requirement from effluent - Variable performance with climatic conditions (temp and sunlight) - Possible insect & vegetation growth in ponds
Flow Through Complete Mix Aerated Lagoon (CMAL)	- Sufficient nutrient removal - Lowest land requirement among pond systems - Reliable process as long as it is properly supervised - Reduced possibility of odor, insects and worms	- 85% BOD removal - Land requirement still very high (130 acres excluding sedimentation tanks) - High energy consumption - Require complete sludge management - Noise and aerosol problem
Sequencing Batch Reactor (SBR)	- > 95% BOD removal - Satisfactory nutrient removal - Low land requirement (but higher than UASB) - Reliable process as long as it is properly supervised - Reduced possibility of odor, insects and worms - Operational flexibility	- High construction and operational cost - Requires equalization tank - High energy consumption, higher than other activated sludge systems - Highly sophisticated operation & controls - Higher level of maintenance associated with more sophisticated controls, automated switches, and automated valves - Require complete sludge management - Possible noise and aerosol problem
High Rate Trickling Filter (HRTF)	- > 90% BOD removal - Low land and energy requirement - Conceptually simpler than AS - Operation flexibility - Better resistance to load variations - Reduced possibility of bad odor - Better sludge thickening than AS	- High construction cost - Relative dependence on air temperature - Sensitive to shock loading - Complete sludge management is required - High head loss - Possibility of flies and mosquitoes
Rotating Biological	- 90% BOD removal	- High construction and operation cost

Contactors (RBC)	- Frequent nitrification achieved - Very low land requirement - Conceptually simpler than AS - Reduced possibility of bad odor - Reduced head loss	- Possibility of dead zones and solid accumulation - Usually the discs need to be covered - Relative dependence on air temperature - Complete sludge management is required - System is inconsistent and unreliable
Anaerobic Pond (AP)	- Simple construction, operation and maintenance - Low construction and operation costs - No equipment - Practically no energy consumption - Rapid startup after periods of no use - very low and stabilized sludge production - sludge only require dewatering	- 70% BOD removal - Difficulty in complying with quality standards & needs post treatment - Practically no N and P removal - Relatively sensitive to load variations and toxicity - Highly pH and temperature dependent - Possibility of generation of bad odor (H_2S) - Need for periodic removal of sludge - Need for a safe distance from surrounding dwellings - Possible insect growth
Upflow Anaerobic Sludge Blanket (UASB)	- Tolerance to influent high organic concentrations - Low land requirement - Low construction and operation costs - Practically no energy consumption - possibility of energy use of the biogas - very low and stabilized sludge production - sludge only require dewatering - Rapid startup after periods of no use	- 70% BOD removal - Difficulty in complying with quality standards - Usually need post treatment - Influent variation can upset balance between methanogenesis and acid formation - Highly pH and temperature dependant - Practically no N and P removal - Possibility of generation of odorous and corrosive gas (H_2S) - Initial startup is generally slow, (6 months) - Relatively sensitive to load variations and toxicity - SRT cannot be maintained at low TSS concentrations

Table-3.6: Comparison of Various Treatment Technologies under STP Sahiwal Conditions

Facultative Ponds	High Rate Trickling Filter	Complete-mix Aerated Lagoon	Sequencing Batch Reactor	Rotating Biological Contactors	Anaerobic Ponds	Up-flow Anaerobic Sludge Blanket
Maximum BOD_5 Removal (%)[a]						
85	90	85	> 95	90	70	70
Area Requirement (acres)						
90 – 120	2.5 – 3.5	25 – 35	3.4 – 4.5	2.25 – 3.0	9.5 – 12.5	1.3 – 1.8
Resistance to Shock Loadings & Reliability of Results						
high	moderate to high	moderate to high	Moderate	less to moderate	less	Less
Equipment & Energy Requirement						
none	moderate	high	high	high	none	less to none
Operational & Maintenance Ease						
high	moderate	moderate	less	less	high	moderate
Aesthetic (Nuisance)						
moderate odor & insect issues	moderate insect issues	sever noise & aerosols issues	sever noise & varying aerosol issues	moderate insect issues	sever odor, color & insect issues	sever odor and color issues
Compatibility to Current and Future Conditions						
less	high	high	high	moderate	less	less
Sludge Production and Management Requirement						
Low	moderate	high	high	moderate	low	low

[a] BOD_5 removal is at temperature ≥ 30°C

C. Transport Routes Improvement Projects

i. Current Status

66. Sahiwal is traversed by the railway line and the Lower Bari Doab canal, running parallel in the east-west direction. The road network is well laid out in a grid-iron pattern. The inter-city roads are wide enough with sufficient right of ways; however, some of the laterals have marginal widths and pose problems of congestion in the presence of rough driver behavior, diverging traffic mix, poor traffic supervision and road space management issues.

67. The following is the general roads situation in the city of Sahiwal:

I. The length of the roads in the city is around 40 KM.
II. The length of the provincial roads in the city is around 10 KM.
III. About 12 roads have a good condition and accessibility.
IV. Around 30% of roads in the city have a poor condition and accessibility.
V. The roads are done patchwork by the MC, otherwise for the bigger roads projects; provincial assistance is sought.
VI. There are only two traffic signals on the High Street.

68. All arterial/primary roads with the exception of a few and some of the secondary roads which carry significant traffic volumes are made dual carriageways with substantial road width, narrow central medians and footways. The footways usually are encroached; remain occupied by the roadside merchandise and rarely available for the pedestrian to walk. The substantial carriageway widths with the marginal indication for the roadside parking and absence of traffic management/control measures, coupled with complex traffic mix lead to traffic confusion and delays.

69. The road network in the older parts of the city, where major commercial activity takes place is congested; traffic management is non-existent and suffers from vehicular pedestrian conflicts. The vehicle population in the district and within the city has shown high growth, partly because of the industrial growth in the city; higher usage and ownership of vehicles; and because of increased consumption spending by a bourgeoning middle-class.

70. Most of primary roads are developed as duel carriageways. Medians provided are narrow and in many cases only dividers are provided to act as medians. With a few exceptions, footways are missing. Junctions and crossings are left open and without any control. In many cases where relatively new works are undertaken, junctions' details remain missing. So is the case with respect to application of traffic control devices and road markings/signage.

71. Vehicle registration in Sahiwal shows an average annual growth rate of 10%, during the last three years. Currently more than 230,000 vehicles are registered in the district. The majority of these, nearly a quarter of a million vehicles, are operating within the confines of the city. Road space has not kept pace with the increased reliance on automobiles, and this has resulted in congestion and a lack of adherence to rules and regulations. This has also created congestion on the city streets and has put pressure for investments on road infrastructure improvements.

72. Congestion on city roads is not due to excessive traffic volumes but is a result of the irrational use of the road space, poor roadway management, absence of clear delineation for roadside parking and enforcement.

73. There is no urban / intra-city transport for the city of Sahiwal. There are no affordable wagons and buses for the inhabitants of the city, and this has a detrimental impact on the

economic productivity of the population. There is no scope for privately financed public transport systems for Sahiwal, as the majority of routes have not proved to be commercially viable without some form of cross-subsidy.

74. Most of the city operations are through informal modes, namely two stroke, three wheelers/Chingchi and rickshaws. These are not documented. Urban public transport is infested with un-regulated operators creating excessive traffic hazards.

75. Public transport at present is dismal and poorly regulated. It requires improved management on a prudent and financially sensible basis. This is likely to require an additional move towards utilization of two-wheeled vehicles over other forms of motorized transport. There is a sufficient demand to organize bus operations to reduce road congestion and help improve to urban transport services.

76. There are two, inter-city bus terminals within Sahiwal: The C-Class as well as the General Bus Stands on the G. T. Road and also near the Railway Station. The MC is responsible for the maintenance of these C-Class stands. There are 18 D-class stands in the district, managed by a private provider. The Rapid Transit Authority (RTA) from January 2015 through July 2015, issued/renewed around 2,194 route permits for inter-city buses.

77. The Daewoo Bus service has only an inter-city halt-over point in Sahiwal, and there could be significant opportunities to expand these at some point in the not-too-distant future.

78. The terminal operation is also poorly managed. The layout of the terminal areas in general is not conducive to high levels of utilization. There is excessive noise and environmental pollution, it is unclean and unhygienic, and there is considerable encroachment of other traffic in the area, causing congestion and poor vehicular circulation.

79. The SMC has a responsibility for planning and development activities, but is constrained to improve delivery because of lack of competency and non-availability of the technical manpower. Public transport regulatory control is managed by the Provincial Transport Authority (PTA) and the District Regional Transport Authority (RTA). The PTA and RTA need reforms for improved and efficient service delivery.

ii. Proposed Projects

a. Road Improvement/Upgrade

80. It is proposed that Railway Road in 3 KM length will be improved/upgraded with following interventions:

i. Road pavement
ii. Intersections improvement
iii. Traffic signals
iv. Storm water drainage
v. Walkways
vi. Regulatory signage
vii. Markings and cat eyes
viii. Curbstones
ix. Bicycle track
x. Parking
xi. Bus stops
xii. Street furniture
xiii. Face uplifting of buildings

b. General Bus Stand/Terminals, Improvement / Upgrade

81. Two bus terminals are operating in the city. The General Bus Stand/terminal is situated on the N-5 (G. T. Road) on the eastern side at the Arif Wala Chowk for long distance operations and is spread over an area of 1 acre (4,047 m^2). Another terminal is located in the city center on Railway Road which provides services to smaller Mandi Towns situated around the city.

82. The following items have been proposed for the improvement/up-gradation of the General Bus Stands; such as:

i. Upgrade of bus terminals/sheds,
ii. Bus bays,
iii. Security cameras,
iv. Lighting (LED/solar panel),
v. Regulatory signage, marking,
vi. Commercial area
vii. Cat eyes, curbstone,
viii. Yellow/black paint on curbstone.

Figure- 3.4 and 3.5 show proposed layout of two bus stands i.e. Multan Road and Railway Road.

iii. Alternatives

83. The Local Government considers Railway Road, being the main city road, to be considered for up-gradation.

84. There are only two main bus stands in the city, therefore up-gradation is proposed for these bus stands only.

D. Green Spaces Development Projects Improvement Projects

i. Current Status

85. There is lack of green spaces in Sahiwal city. The existing parks are not well maintained.

ii. Proposed Projects

86. The canal that crosses through the city of Sihawal provides an excellent opportunity to develop a multi-functional green wedge in the middle of the city that can provide ample green and recreational facilities for the inhabitants. However, presently the canal borders have been left unattended and they have become an area avoided by the public. The canal borders will be developed into a multi-functional green open area with pedestrian ways, running routes, and sporting facilities in combination with commercial activities such as small scale shops and cafes.

87. About six parks will be rehabilitated in Sahiwal city. These include Chamanzar, Majeed Amjad, Fareedia, Stop No-10, Fateh Shair Colony and Exchange Park.

iii. Alternatives

88. Green belting is proposed at entrance point of the city to create positive image of the city.

89. The existing four parks, located at different parts of the city, are not in good condition and need rehabilitation.

Figure-3.4: Proposed Layout of Multan Road Bus Stand

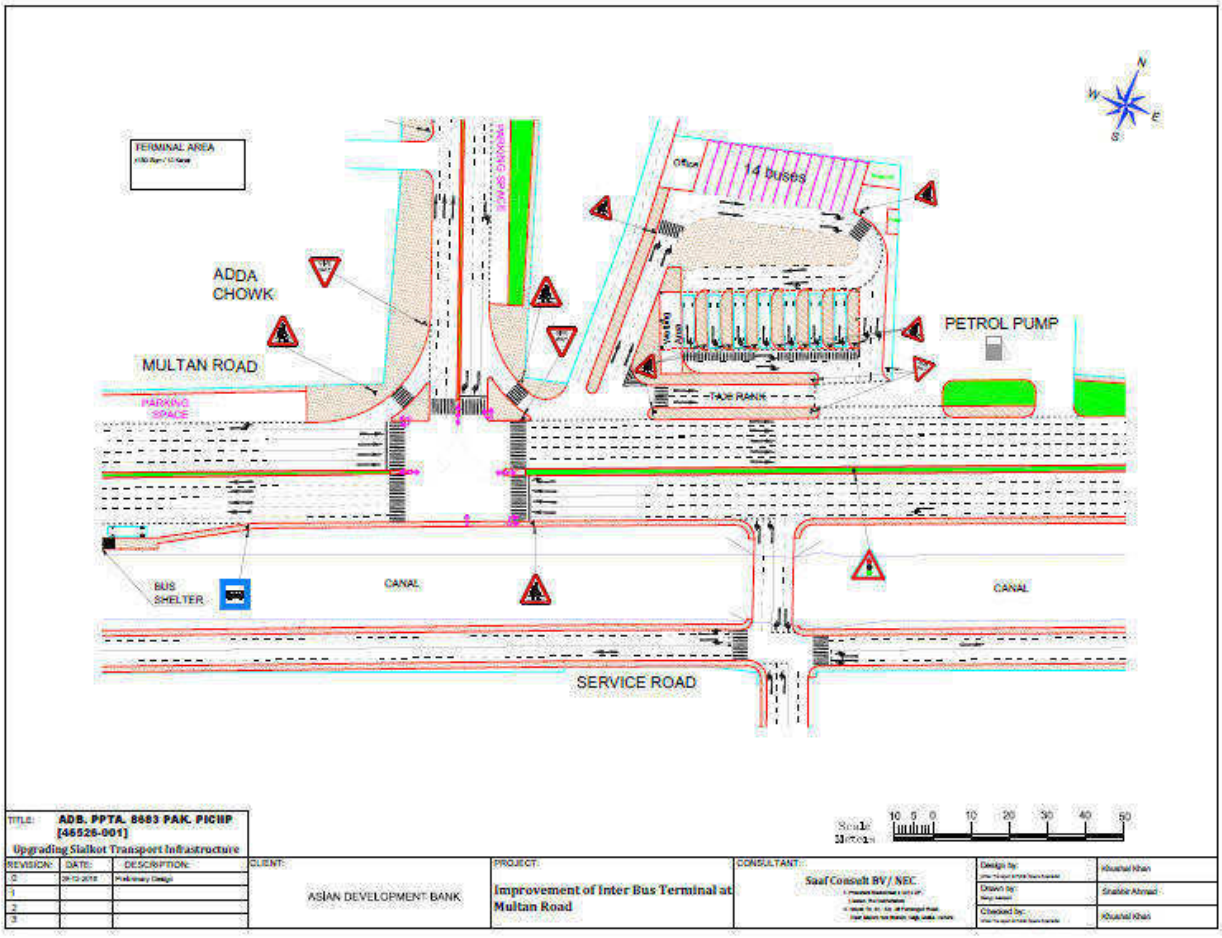
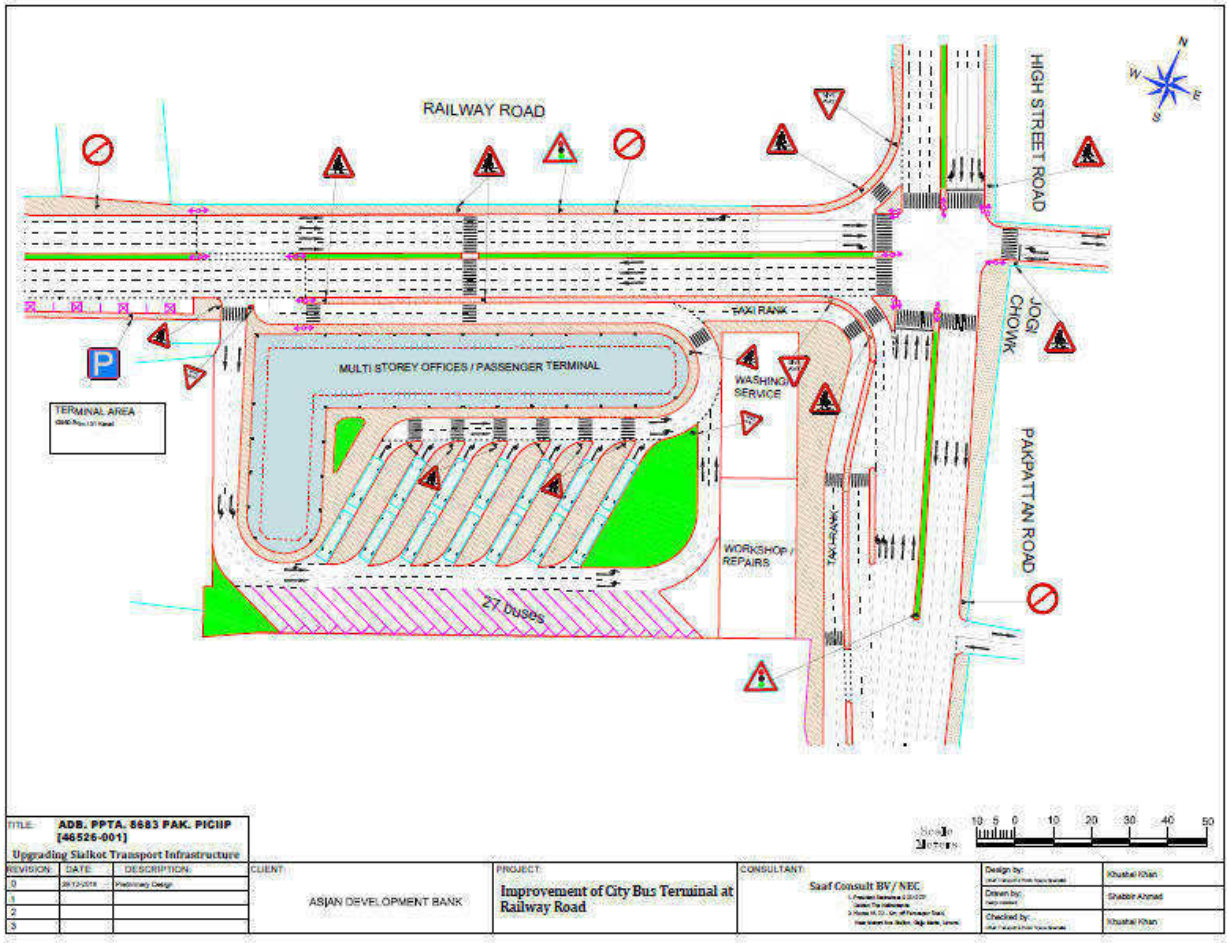


Figure-3.5: Proposed Layout of Railway Road Bus Stand



IV. ENVIRONMENTAL & SOCIAL BASELINE CONDITIONS

90. This chapter describes the baseline environmental and social conditions of the subproject sites. The site's environmental conditions will describe the various resources which could be affected by the economic development that takes place, i.e. physical resources (atmospheric conditions e.g. ambient air quality and climate, topography and soils, surface water and groundwater quality), ecological resources (fisheries, wildlife, forests, rare and endangered species, protected areas etc.), and social resources.

A. Physical Resources

i. Sahiwal City Geography

91. In 2014, the estimated population in Sahiwal District was 2.37 million. Of this 2.37 million, an estimated 1 million (42 percent) was urban. And at an average provincial fertility rate of 1.93 percent, the district's projected population to 2035 is 3.5 million.

92. Sahiwal town is situated about 29 KM from the left bank of the river Ravi, 187 KM west of Lahore, and 200 KM east of Multan. The Grand Trunk Road and the main railway line pass through the town; they also connect Peshawar and Lahore with Karachi. The Lower Bari Doab Canal separates the town into two parts. Its approximate height is 152 m above sea level. Sahiwal lies 30°39'52.16" N latitude and 73°6'30.54" E longitude.

93. Geologically, the area does not have any outstanding features. Saltpeter, which is made from saline earth called kallar, is found when the water table is high. In the east of the town, there can be found common salt mixed with a lesser quantity of sulfate of soda and a very small quantity of lime and magnesium salt.

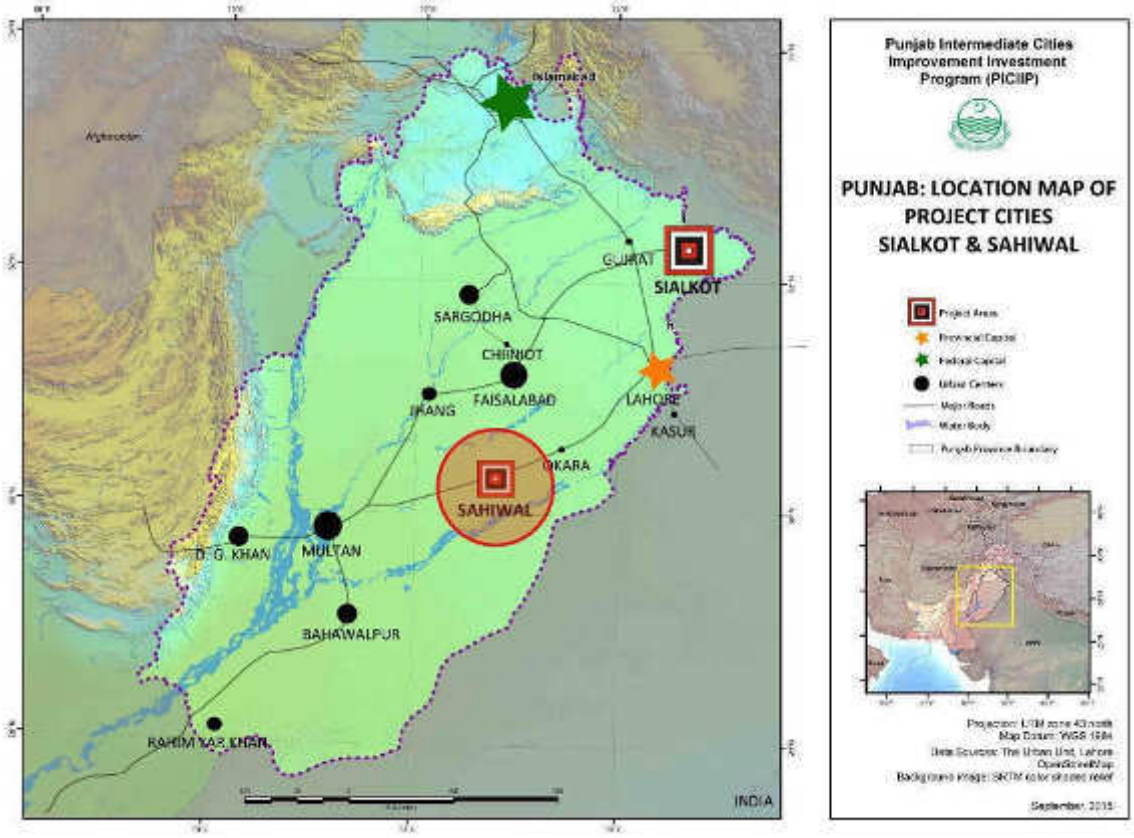
94. The topography of Sahiwal is one of a flat semi-arid plain that is fertilized through the use of its extensive irrigation canal. The Lower Bari Doab is the main source of irrigation in the area and it is fed by a link from the Chenab River. From a topographical point of view, the semi-arid plain is remarkably homogeneous. The only noticeable relief is that of the flood plain bluffs and the belts of ravines and bad land that were formed by gully erosion along the Lower Bari Doab and its distributaries. Generally, the natural slope runs northeast to southwest. On the whole, the area is flat.

ii. Natural and Climate Conditions of Sahiwal

95. In general, Sahiwal has the same basic natural and climatic conditions that prevail in Punjab. The climate in most of the area is arid to semi-arid, characterized by four district seasons in a year: winter from mid-November to February; spring from mid-March and April; summer from May to mid-September; and autumn from mid-September to mid-November.

96. Punjab's terrain is one of relatively low lying plains, with several rivers that traverse the area from the northeast to the southwest and feed into the Indus River. The Ravi River is closest to Sahiwal, but it is still a distance of nearly 20 KM. There is no history of the city being threatened by floods. The most challenging weather phenomenon in Sahiwal is the winds called 'Loo', which blow during the day in the predominately hot and dry summer.

Figure-4.1: Location Map of Sahiwal



97. The dust from the dry parched earth rises, the air becomes laden with it, and out-door work is difficult. Trees shed their leaves to avoid the loss of moisture and where there is no canal or well, the countryside presents a very dreary aspect. Occasionally, the hot weather is broken by thunderstorms and dust storms. The heavy rainfall, which the thunderstorms bring, and light rain, which follows the dust storm, produces a slight decrease in temperature. This temporary relief from the excessive heat is welcomed.

98. June is the hottest month with a mean daily maximum temperature of 42.4 ^{o}C. January is the coldest month with the mean daily minimum temperature of 4.4 ^{o}C. Table 4.1 shows the mean daily maximum and minimum temperatures of Sahiwal district.

a. Rainfall

99. Average annual rainfall ranges between 97 mm and 261 mm. The maximum rainfall (about 60 percent of the total annual rainfall) occurs during the monsoon season (July, August and September), while the period of minimum rainfall or drier period is October and November. Table 4.2 shows the mean monthly rainfall data for Sahiwal district.

b. Humidity

100. July, August and September are the most humid months in the area. May and June are the least humid. Table 4.3 shows the average monthly relative humidity in Multan District (close to Sahiwal District).

Table-4.1: Mean Monthly Maximum and Minimum Temperature of Sahiwal District

Month	Mean Monthly Maximum (°C)	Mean Monthly Minimum Temperature (°C)
January	19.7	5.4
February	22.8	8.4
March	28.3	13.5
April	35.2	19.2
May	40.4	24.4
June	41.4	27.7
July	38.4	28.1
August	37.8	27.2
September	36.2	24.4
October	34.6	18.1
November	28.6	10.8
December	22.4	6.4
Annual	**32.2**	**17.8**

Source: Initial Environmental Examination, Pak: MFF Power Transmission Enhancement Investment Program Tranche 4

Table-4.2: Meteorological Data, Mean Monthly Precipitation of Sahiwal District

Month	Mean Monthly Precipitation (mm)
January	12.0
February	12.0
March	17.0
April	6.0
May	7.0
June	23.0
July	74.0
August	75.0
September	25.0
October	1.0
November	2.0
December	7.0
Annual	**261.0**

Source: Initial Environmental Examination, Pak: MFF Power Transmission Enhancement Investment Program Tranche 4

c. Wind Direction

101. Sahiwal is situated in southwest Punjab and is influenced by monsoon winds throughout the year. In winter, the wind blows from the north and heads east. In summer, the wind direction is southwest. However, these wind directions are usually disturbed by cyclones, which cause the temperature to drop and low-pressure systems to set in. This situation prevails in autumn. Wind rose for Sahiwal city is given in Annexure-2.

iii. Ambient Air Quality

a. Sewage Treatment Plant Site

102. Ambient air quality was continuously monitored for 24 hours, within the sewage treatment plant site, to find the present concentrations of the following parameters:

a. CO
b. SO_2
c. NO
d. NO_2
e. Particulate Matter (PM_{10})
f. Particulate Matter ($PM_{2.5}$)

103. Table 4.4 shows the average concentrations of the tested parameters of ambient air quality.

Table-4.3: Meteorological Data, Mean Monthly Relative Humidity of Multan District

Month	Mean Monthly Relative Humidity (%)
January	62.3
February	56.3
March	51.6
April	40.0
May	33.2
June	39.9
July	56.0
August	59.7
September	56.3
October	51.6
November	61.4
December	66.6
Annual	**52.9**

Source: Initial Environmental Examination, Pak: MFF Power Transmission Enhancement Investment Program Tranche 4

Table-4.4: Average Concentrations of Tested Parameters

Parameter	Unit	Monitoring Duration	Average Concentration	PEQSAA
Nitrogen Oxide (NO)	$\mu g/m^3$	24 Hours	7.95	40 $\mu g/m^3$ (For 24 Hours)
Nitrogen Dioxide (NO_2)	$\mu g/m^3$	24 Hours	11.4	80 $\mu g/m^3$ (For 24 Hours)
Nitrogen Oxides (NOx), $NO+NO_2$	$\mu g/m^3$	24 Hours	19.35	120 $\mu g/m^3$ (For 24 Hours)
Sulfur Dioxide (SO_2)	$\mu g/m^3$	24 Hours	14.4	120 $\mu g/m^3$ (For 24 Hours)
Carbon Monoxide (CO)	$\mu g/m^3$	24 Hours	2.33	05 mg/m^3 (For 08 Hours)
Particulate Matter (PM_{10})	$\mu g/m^3$	24 Hours	291.3	150 $\mu g/m^3$ (For 24 Hours)
Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	24 Hours	27.8	35 $\mu g/m^3$ (For 24 Hours)

PEQSAA Punjab Environmental Quality Standards for Ambient Air, 2010

104. Results of the ambient air quality data, when compared with Punjab Environmental Quality Standards for Ambient Air, show that the area's ambient air quality is generally good as,

except for PM10, all the concentration values of the pollutants are below the recommended values.

iv. Baseline Noise at Sewage Treatment Plant Site

105. Noise monitoring was carried out for proposed STP site at seven locations. The result of noise monitoring is given in Table-4.5.

Table-4.5: Noise Monitoring at STP Site

Location	Noise (dBA)
East-South Side (Facing Canal Side)	51.3 – 66.0
East-North Side (Facing 95/6-R Village)	52.4 – 63.0
West-South Side (Facing Agriculture Fields)	49.8 – 63.0
West-North Side (Facing Agriculture Fields)	49.4 – 62.5
Centre Point	48.5 – 63.6
Near Village 95/6-R	50.2 – 62.5
Near Three Marla Housing Scheme	51.3 – 66.7

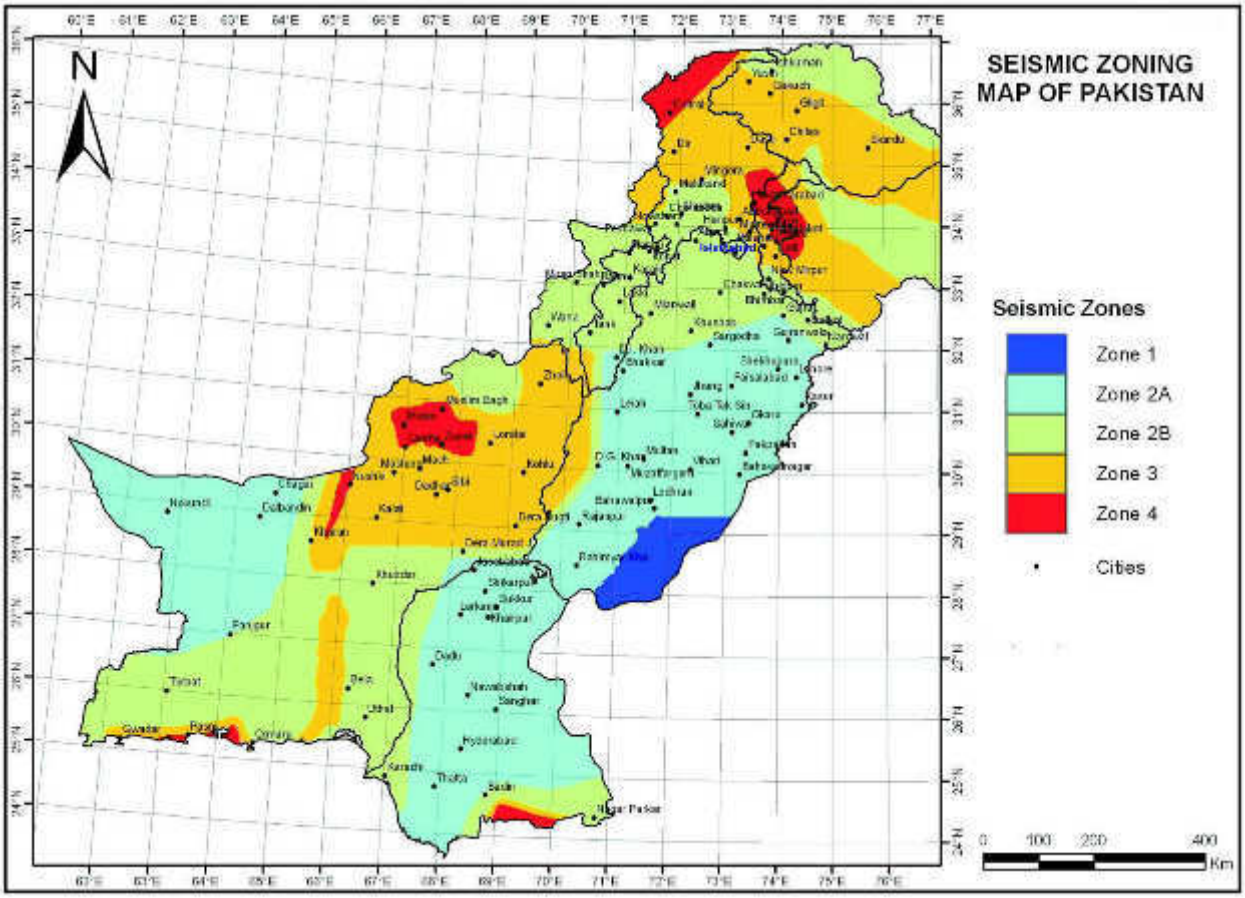
Source: Test Report of Laboratory of Environmental Sciences, February 2017

106. The sewage treatment plant site's baseline noise condition is considered to be quiet. The daytime noise levels, at the project site, are in the range of 48.5 to 66.7 dBA. As per the PEQS, the surrounding area noises for residential, commercial, industrial and silence zones are 55, 65, 75 and 50 respectively.

v. Seismicity

107. Pakistan lies in a seismically active zone. Seismic observations indicate that hundreds of shocks occur in the region every year. According to the seismic zoning map of Pakistan, included in Pakistan Building Code Seismic Provisions (2007), the project area falls under seismic zone 2A, with a peak horizontal ground acceleration of from 0.08 to 0.16. The seismic zoning map of Pakistan is given as Figure-4.2.

Figure-4.2: Seismic Zoning Map of Pakistan



vi. Groundwater

108. Groundwater is the sole source of potable water exploited in Sahiwal. The water table averages about 12 to 15 m below ground level and the upper levels produce limited quantities of mineralized water. At a depth of between 137 and 152 meter, greater quantities of good quality groundwater are available and this is where the city's supplies are abstracted from. In recent years, the water table has been dropping at a rate of 0.30 meter per year. This is because of pumping, and decreased rainfall and recharge. It is not clear whether the aquifer is being overexploited but, in view of the wide dispersal of the tube wells, this is unlikely at the present level of abstraction.

109. The quality of groundwater of Sahiwal city is shown in Table 4.6.

Table-4.6: Groundwater Quality Analysis of Sahiwal City

Parameter	Value	National Standard
pH	7.98 – 8.20	6.5 – 8.5
Turbidity, NTU	0.4 – 9.5	< 5
Total Dissolved Solids (TDs), mg/l	175 - 610	< 1,000
Fluoride, mg/l	0.06 – 0.49	≤ 1.5
Nitrate, mg/l	0.9 – 2.1	≤ 50
Arsenic, mg/l	0.025	≤ 0.05
Total Coliform, MPN/100 ml	5.1 – 16	Nil
Fecal Coliform, MPN/100 ml	5.1 -12	Nil

Source: PICIIP Feasibility Study Report, 2016

Most of the physical and chemical parameters comply with national standard except turbidity. The drinking water is contaminated with fecal coliform.

110. The quality of groundwater at sewage treatment plant site is shown in Table 4.7.

Table-4.7: Groundwater Quality Analysis at STP Site

Parameter	Value				National Standard (Drinking Water)
	Agri Tube Well (76 m)	Deep Well Turbine (107 m)	Hand Pump (30 m)	Hand Pump (21 m)	
pH		7.59	7.66	8.12	6.5 – 8.5
Color (PtCo)		13	82	191	≤ 15 TCU
Turbidity (NTU)		84	64	14.8	< 5
Taste		Tasteless	Tasteless	Tasteless	None
Odor		Odorless	Odorless	Odorless	None
Total Hardness (mg/l)		356	212	220	< 500
Conductivity (µs/cm)	751				-
Bicarbonate (mg/l)	284				-
Calcium (mg/l)	48				-
Magnesium (mg/l)	35				-
Chloride (mg/l)	50	164	84	118	<250
Total Suspended Solids (mg/l)	4	2	3	2	-
Total Dissolved Solids (mg/l)	520	1,380	1360	1,110	<1,000
Nitrate (mg/l)	3.4	0.7	1.5	0.7	≤ 50
Nitrite (mg/l)		0.013	0.004	0.002	≤ 3
Sulfate (mg/l)	145				-
Fluoride (mg/l)		0.04	0.42	0.08	≤ 1.5
Copper (mg/l)		0.03	0.04	0.05	2
Chlorine (mg/l)		0.05	0.04	0.06	-
Iron (mg/l)		0.06	0.62	2.28	-
Arsenic (mg/l)		0.01	BDL	BDL	≤ 0.05
Lead (mg/l)		0.012	0.015	0.023	
Total Coliform (MPN/100 ml)	>23	2.2	<1.1	>23	Nil
Fecal Coliform (MPN/100 ml)	5.1	2.2	<1.1	9.2	Nil

Source: Testing Report of Laboratory of Environmental Sciences

vii. Surface Water Quality

111. Lower Bari Doab canal passes close to the STP project site at a distance of about 300 meter. The quality of canal water is shown in Table-4.8.

Table-4.8: Surface Quality Analysis

Parameter	Value		
	11:00 am	2:00 pm	5:00 pm
pH	7.36	7.65	7.60
Biochemical Oxygen Demand (BOD_5)- mg/l	6.0	6.0	6.0
Chemical Oxygen Demand (COD)-mg/l	14	12	12
Total Suspended Solids (TSS)-mg/l	70	90	60
Total Dissolved Solids (TDS)-mg/l	240	280	200
Copper-mg/l	0.06	0.09	0.15
Chromium Total-mg/l	0.02	0.03	0.02
Chloride-mg/l	38	36	32
Fluoride-mg/l	0.02	0.04	0.03
Sulfate-mg/l	34	40	33
Sulfide-mg/l	0.018	0.013	0.001
Oil & Grease-mg/l	7	6	3
Lead-mg/l	0.03	0.02	0.02
Arsenic-mg/l	BDL	BDL	BDL
Chlorine-mg/l	0.07	0.16	0.15
Total Iron-mg/l	0.08	0.06	0.03
Total Coliform-MPN/100 ml	9,200	16,000	16,000
Fecal Coliform-MPN/100 ml	3,500	9,200	2,400
Ammonia	1.4	1.31	1.52
Cadmuim	BDL	BDL	BDL
Mercury	BDL	BDL	BDL
Zinc	0.37	0.08	0.025

Source: Laboratory Report (Laboratory of Environmental Sciences, February 2017)
BDL (Below Detection Limit) for Arsenic is <0.01 mg/l

a. Wastewater Quality

112. The quality of the wastewater flowing in the Sahiwal sewerage system is shown in Table-4.9:

Table-4.9: Wastewater Quality Analysis

Parameter	Value
pH	
Biochemical Oxygen Demand (BOD_5)- mg/l	111 – 334
Chemical Oxygen Demand (COD)-mg/l	212 - 782
Total Suspended Solids (TSS)-mg/l	70 - 460
Total Dissolved Solids (TDS)-mg/l	900 – 1,380
Oil & Grease-mg/l	4 - 20

Source: PICIIP Feasibility Study Report, November 2016

B. Ecological Resources

i. Flora of the Area

113. In Sahiwal district, the most important species of trees are Kikar (Acacia Arabica); Shisham or Tahli (Delbergia sissoo); Beri (Zizyphus jujube); Toot (Morus alba); Sharin (Albizzia lebbek); Dherek (Melia azeharach); Phulai (Acacia modesta); Pipal (Ficus religiosa); and Bohr (Ficus bengalansis), which are planted for shade. The trees in Rakhs

mainly consist of three species: Jand (Prosopis spicigera); Karir (Capparis aphylla); and Wan (Salvadora oleoides). Occasionally, Rero (Acacia ieucophhloea) and Farash (Tamarix articulata) are also found. The Pilchhi (Tamarix dioica) is found on moist sandy soils along riverbanks and is used for wicker work, and basket making, etc. Mesquite bushes and some Eucalyptus trees grow wild in the areas along the canals, roads and barren land, but natural forest cover has been significantly reduced.

114. Sahiwal is a green and fertile town with 11,522 forested acres. The area's main crops are wheat, cotton, sugarcane, maize, sorghum forage and rice. Main fruits grown are citrus, mangoes and guava.

ii. Fauna of the Area

115. Most of the Punjab is under intensive irrigated cultivation. Livestock rearing is also extensively practiced, and milk animals are common. The use of chemical fertilizers and pesticides is also very common. Several species of wildlife have adapted to the changed habitat. These include, the jackal; jungle cat; Bengal fox; small Indian mongoose; shrew; hog deer; ravine deer; black buck; blue bull; wild hare; and rodent pests, including porcupine; fruit bats; and wild boar. The avifauna that has survived the modified habitat include doves; black partridge; cuckoos; koel; woodpeckers; parakeets; bulbuls; babblers; black drongo; bee eaters; finches; owls; hawks; and house sparrow. The reptilian species of this modified habitat include krait; cobra; saw scaled viper; rat snake; and monitor lizard.

116. In these modified habitats, due to the extensive use of pesticides in these areas, the winter bird species from the Himalayas have been reduced, since these species feed on the insects. These birds play an important role in controlling insects, particularly in the forests.

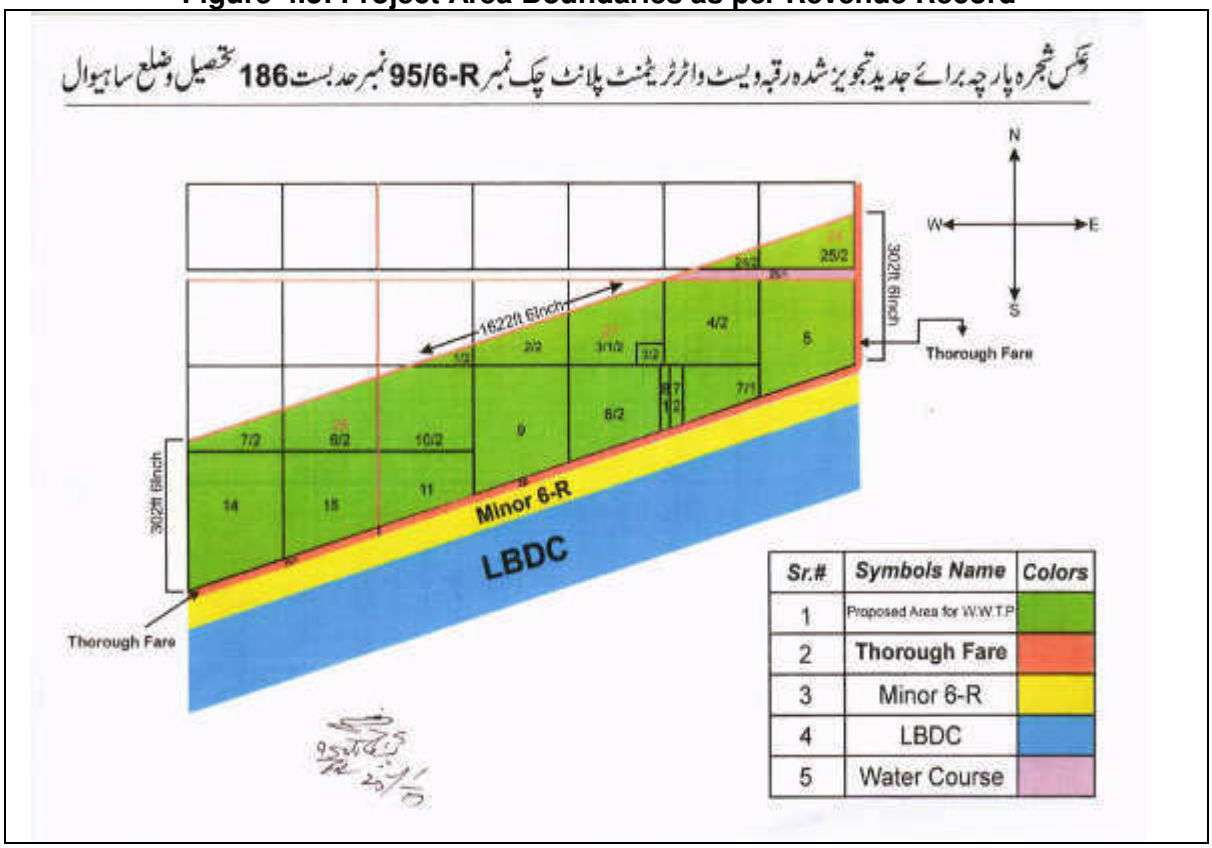
117. Scavengers, such as, jackals are attracted to garbage dumps and human feces for food. House sparrows breed in houses. Bank mynas and cattle egrets feed on grasshoppers that are present in the rangelands that also support cattle and buffalos. Banyan and peepal trees still grow in the villages. Green pigeons and barbets feed in these trees.

118. Some of the oldest trees still stand in the old British-era colonies. Some rare species of birds, such as hornbills, green pigeons, and barbets still live on these trees. Large populations of pigeons breed in urban houses. Kites, crows, mynas, house sparrows and alexandrine parakeets breed in urban areas. Shisham and acacia trees are usually planted along the roads and canals. Doves mainly breed on these types of trees.

119. Ecological Environment of STP Site: Ecological study of the STP site area has been conducted using standard ecological assessment technique based on primary and secondary information. Additional information collected during site visit through discussion with locals living in and around project area coupled with expert visual observations, was also included. The project site primarily falls within revenue jurisdiction of Chak No. 95/6-R, Tehsil and District Sahiwal, on the left hand side of Lower Bari Doab Canal (LBDC). Project area spreads over about 12 acres of land with its length stretching along Canal direction with an elevation of about 152 meters (500 feet) above sea level. The land is fertile with alluvial deposits and is under agriculture use by utilizing LBDC and tube well water.

120. The proposed project area is shown in Figure-4.3.

Figure-4.3: Project Area Boundaries as per Revenue Record



121. Flora at STP Site: Sahiwal District of Indus basin plain, falls under Tropical Thorn Forest type and has a hot semi-arid climate intermediating between Desert climate and Humid climate in ecological characteristics with agricultural potential. The climate tends to have hot, sometimes extremely hot, summers and mild warm winters. The soil and climatic characteristics support short or scrubby vegetation which can be termed as open and pronouncedly of xerophytic nature in which thorny leguminous species predominate. However, commonly found vegetation (Trees, Shrubs, Grasses) of project as well as study area include species given in the following Tables.

Table-4.10: Name of Trees found in STP Area

S. No.	Common Name	Scientific Name	IUCN Status
1	Kikar	*Acacia nilotica*	NA
2	Shisham	*Dalbergia sisso*	NA
3	Simal	*Bombax ceiba,*	NA
4	Sufeda	*Eucalyptus species*	NA
5	Frash	*Tamarix articulate*	NA
6	Neem	*Azedarachta indica*	NA
7	Jaman	*Syzygium cumini*	NA
8	Bakain	*Melia azedarach*	NA
9	Ber	*Zyziphus mauritiana*	NA
10	Toot	*Morus alba*	NA
11	Lasura	*Cordia myxa*	NA
12.	Sukh Chaen	*Pongamia glabra*	LC
13.	Mesquite	*Prosopis juliflora*	NA
14.	Date Palm	*Phoenix dactylifera*	NA

NA= Not Assessed LC= Least Concern

Table-4.11: Name of Shrubs and Herbs in STP Area

S. No.	Common Name	Scientific Name	IUCN Status
1	Akk	*Calotropis procera*	NA
2.	Phog	*Calligonum polygonoides*	NA
3	Jantar	*Sesbania aculeate*	NA
4	Bathu	*Chenopodium botrys*	NA
5	Lana	*Suaeda fruticosa*	NA
6	Arind	*Ricinus communis*	NA
7	Piazi	*Asphodelus tenuifolius*	NA

NA= Not Assessed

Table-4.12: Name of Grasses found in STP Area

S. No.	Common Name	Scientific Name	IUCN Status
1	Khabbal	*Cynodon dactylon*	NA
2	Dab	*Desmotachya bipinnata*	NA
3	Khawi	*Cymbopogan jwarancusa*	NA
4	Kana	*Saccharum munja*	NA
5	Gorkha	*Elionorus hirsutus*	NA
6	Kai	*Saccharum spontaneum*	LC

NA= Not Assessed, LC= Least Concern

122. Existing Trees at STP Site: The Project area is flat agricultural land which supports trees of various species on the boundary of agricultural fields as well as individually scattered growth. Trees (girth 61 cm and above) and pole crop (girth 20 to 58 cm) standing within the project area were enumerated along with their kind of species. The detail of trees present in the project area is given in Table-4.13.

Table-4.13: Species Wise Tree Distribution at STP Site

Sr. No.	Species	No. of Trees		
		Poles (girth 20 to 58 cm)	Trees (girth 61 cm and above)	Total
1	Kikar	5	12	17
2	Shisham	8	10	18
3	Toot	7	13	20
4	Miscellaneous	5	7	12
	Total	**25**	**42**	**67**

Miscellaneous includes Sukh Chaen, Lasura, Jaman, Neem, Date Palm

123. Fauna at STP Site: The extent of fauna presence is related to the availability of vegetative cover in an area. Since the project area is basically agricultural supporting chunk of land without any dense forested area nearby, it lacks richness in natural fauna.

No conspicuous wildlife was observed in the area during field visit However, mammals and birds reported in the project area, are given in following tables.

Table-4.14: Names of Mammals at STP Site

S. No.	Common Name	Scientific Name	IUCN Status
1	Jackal	*Canis aureus*	LC
2	Fox	*Vulpus bengalensis*	NA
3	Porcupine	*Hystrix indica*	LC
4	Squirrel with strips	*Funambulus pennanti*	NA
5	Mouse	*Mus musculus*	LC
6	Mongoose	*Herpestes auropunctatus*	NA
7	Indian Hare	*Lepus nigricollis*	LC

NA= Not Assessed, LC= Least Concern

Table-4.15: Names of Reptiles at STP Site

S. No.	Common Name	Scientific Name	IUCN Status
1	Cobra	*Naja naja*	NA
2	Spiny tailed Lizard	*Uromastyx hardwickii*	NA
3	Fringed Toed Lizard	*Acanthodactylus cantoris*	LC
4	Indian Krait	*Bungarus caeruleus*	NA

Table-4.16: Names of Amphibians at STP Site

S. No.	Common Name	Scientific Name	IUCN Status
1	Common Frog	*Rana tigrina*	LC
2	Common Toad	*Bufo bufo*	LC

124. The area is comparatively dry and does not support wide variety of birds. The common species found in the project area are enlisted in Table-4.17.

Table-4.17: Names of Birds at STP Site

S. No.	Common Name	Scientific Name	IUCN Status
1	House Sparrow	*Passer domesticus*	LC
2	Mynah	*Acridotheres tristis*	LC
3	House Crow	*Corvus splendens*	LC
4	Pigeon	*Columba livia*	LC

5	Koel	*Eudynamys scolopacea*	LC
6	Red-Wattled Lapwing	*Vanellus indicus*	LC
7	Gray Partridge	*Francolinus Pondicerianus*	LC
8	Quail	*Coturnix coturnix*	LC
9	Red Vented Bulbul	*Pycnonotus cafer humayuni*	NA
10	Little Bittern	*Ixobrychus minutus*	LC
11	Hoopoe	*Upupa epops*	LC
12	Ring Necked Dove	*Streptopelia decaocto*	LC
13	Little Egret	*Egretta garzetta*	LC

125. On account of anthropogenic interventions mainly agriculture, no habitat is left to support much of wildlife in the STP area. None of the existing species of plants or animals, therefore, are of endangered category.

126. Fisheries: Fishery sector is not rich in District Sahiwal on account of precious fertile land for agriculture production. No much variety of fish is found in the LBDC and other nearby water bodies, except Gulfam fish (*Cyprinus carpio*) which is basically cold water species, but has adapted to harsh conditions. However, dependency of local people on fish as economic activity is very limited, because of the non-existence of large fish farms in the area.

127. Agriculture: Agriculture is the main source of income of the inhabitants of the project area. District Sahiwal being the land of three rivers is considered as one of the most fertile land zones of the Punjab. Therefore, due to the most sophisticated canal irrigation system and supporting ecological and climate characteristics, this area has a good potential for producing almost all kinds of food commodities. The area has a diverse cropping pattern because of its heterogeneity in agro-climatic conditions. The main agricultural crops, fruit trees and vegetables grown by the farmers of the area are given below:

128. Main Crops: Sugarcane, wheat, rice, maize and cotton are the main crops grown in the area. Besides guar seed, bajra, moong, mash, masoor, jawar, oil seeds are also grown in minor quantities in Sahiwal area. Average yield of important crops in the area of study is given as under:

Table-4.18: Average Yield of Agricultural Crops

Sr. No.	Crop Name	Average Yield/Acre (kg)
1	Cotton	1,000
2	Sugarcane	20,600
3	Maize (Spring)	3,400
4	Maize (Autumn)	2,800
5	Rice	800
6	Wheat	1,400
7	Potato	9,600

129. Fruits: Citrus, guavas and mangoes are the main fruits grown in the district. Besides, pomegranate, litchi, falsa and banana are also raised on minor scale.

130. Vegetables: Potatoes, onion, cauliflower, tomato and turnip are main vegetables grown in the area. Besides, peas, garlic, chilies and lady finger arerown on g smaller scale.

iii. Protected areas / National Sanctuaries

131. In Pakistan, there are several areas where land is devoted to the preservation of biodiversity, through the dedication of national parks and wildlife sanctuaries. There is no protected area or national sanctuary near the area of where work will take place on the project and sub-project.

C. Economic Development

132. Before the introduction of the canal system, Sahiwal was an area of barren land. However, owing to irrigation it has become very fertile. The real achievement occurred when the Lower Bari Doab canal was constructed in 1913. Later, the Deepalpur and Pakpattan canals brought almost the entire district under irrigation. Now, the district is one of the most fertile areas of the province and a leading grower of cotton.

133. In the early days, the town had been declared a congested area. Due to an influx of refugees from India and also to recent industrialization, it has attracted a considerable number of people. Consequently, two new sub-towns have cropped up beside the old part of the town.

134. There is a new Abadi on the eastern side of the old town and also a modern satellite town, known as Farid Town, on the northwestern corner. At the time of its establishment, the area of the original town of Sahiwal was small. However, it grew with the passage of the time, and is now its total area is about 19 square kilometer. The city's major growth took place during the post-1947 period. However, the trend of this growth, even during this period, has largely been in a northerly direction. The city could not grow to the south, perhaps due to the obstruction of Railway line, and the Lower Bari Doab Canal and its distributaries. The city has also spread out toward the east in what appears to have been the result of forced development.

135. Because of this industrial development and the land's fertility the city began to flourish and emerged as a place that attracted in-migration. In short, Sahiwal became a place where people wanted to reside. During the decades of 1911-1921, and 1921-1931, the city attracted the highest ever percentage of people. During these decades, the population growth rate was 79.7 percent and 79.3 percent, respectively.

136. The city also became important from a business point of view. It is situated at the point from where all types of communication are available to connect it and its people with the rest of the province and with the larger country as well. A great change has occurred in its economic structure, as it transitioned from an agricultural to an industrial economy. The town is now a commercial one, with a shopping center that caters to both the town people and also to those living in nearby localities.

i. Land Use and Settlements Pattern

137. Land use includes residential, commercial, industrial, recreational, and institutional activities, among others. A suitable arrangement of the physical elements of land use

ensures that a town offers convenience, health and a better quality of life. The city comprises buildings, transportation channels, utilities, social services, and also vacant land, which may be used for agricultural purposes.

138. In August, 1972, the Punjab's Housing and Physical Planning Department began a land-use study of Sahiwal city, which it completed in September the same year. Out of the total area surveyed, the largest portion of the city consisted of undeveloped area that accounted for 41.70 percent of the total area surveyed. The scattered pockets of development exist within the built up areas and also in open strips of land that were situated between various built-up belts of development that ultimately abutted the agricultural land around the city. Since the undeveloped area made up a substantial percentage of the city's surveyed area, it was considered desirable to not take this percentage into account when calculating the percentage of area given to various land uses in the city. Consequently, the survey only included the built up area, revealing that 31.31 percent was for residential use. The transportation system was second largest user of land, occupying 18.58 percent of the total built up area. Other uses include, industry (occupying 3.85 percent); open spaces (8.54 percent); commerce (1.76 percent), and health (0.74 percent). Other important users of land are canals, distributaries, transport terminals, and Government buildings, which occupy 9.64%, 7.07% and 5.28% of the built up area, respectively.

139. As for the land use pattern, originally the city was designed to be a planned colony town, covering an area of only about 307 acres (1,242,429 m^2). The city was designed with the oval as the main focal point. The road network radiated from its center toward a city space that consisted of a mixture of residential and commercial uses. Major bazaars and residences were established in the small streets that ran off the major arteries. Functions, such as administration, education, and transportation, were situated around the commercial and residential parts of the old town. After independence, the city further developed and emerged into a major administrative industrial and commercial town. Since no comprehensive plan was devised, land in the town was given to various uses, irrespective of its suitability. These uses were mostly based on expediency rather than the principals of the land development. As a consequence, the present day city is a mixture of various and, quite often, incompatible uses. Except for the new planned colony, there has been an intensive mixing of land use, particularly among small-scale cotton factories, etc. However, for an overall pattern of land use, the city can be divided into following major zones:

a. Zone of Central Commercial Activities

140. This is limited to the old city and is surrounded by High Street, Railway Road, Hall Road, Masood Shaheed Road, the Deepalpur Bazar, and the few scattered roads that join this area. Development in this area of is of a ribbon type, along with its major bazaars, i.e., Pakpattan , Sadder , Deepalpur Sori Galli, and Sua Bazars, and is further extended up to Jinnah Chowk. The development of the commercial activities within this area is mainly due to historical reasons rather than to any planned effort.

141. A variety of commercial activities take place here, namely wholesale, and large specialized retail, etc., which cater to the needs of the entire city and the surrounding rural and urban areas that are concentrated in this zone. The shops usually have residential quarters, either attached to or above them, where the owner might be living. There is hardly any exception to this practice. The areas between the main streets form pockets that are filled with residential uses but, even here, it is common to see small shopping facilities scattered here and there. These bazars have developed, over the years, into their present form and will also retain this form in the future.

b. Zone of Mixed Land

142. The vegetable and fruit markets are also located in this area. They cause the usual nuisance to the residents and make it unattractive for living. The other uses are for restaurants, hotels, bus stands, and commercial offices. Among these, the bus stands, which cater to the needs of the city and the adjoining chaks (villages), create hindrances and chaos in the area.

c. Zone of Industrial Complexes

143. This zone as unlike those in the other cities of the Punjab, and is located on and across the Lahore Multan Quetta (LMQ) road. The majority of the large industrial units are found in this zone, however, a few small units are also scattered throughout the city. The reasons for setting up large-scale industry here, between the railway line and the LMQ road and across the LMQ Road, are neither deliberate nor due to any planning criteria. It is the result of the cheap rates for the land and the cheap communications that serve it. However, this development is also ribbon-like, similar to the development along the LMQ road, starting from chowk Pakpattan up to the Arifwala Chowk, and further up to new powerhouse and the grid station. The presence of a 9L water distributary has further helped this area develop for industrial purposes.

d. Zone of Administrative and Educational Buildings

144. This zone comprises the civil lines areas, the canal colony, the Government Boys College complex and the hospital. It further extends up to the Batala School and the Government Girls College. From its beginning, the civil-lines area is at the center of the administrative functions of the city, the district and the region. It extends up to the Boy's Degree College, and the canal colony, and covers a substantial part of the built up area of the entire city. In addition to being the center of administrative functions (almost all of the government offices are situated in this area), the city's main open spaces are situated in this zone, i.e., the stadium and the race course.

e. Zone of Planned Colonies

145. The zone of the planned colonies comprises the area of the satellite town known as "Farid Town." Its land-use character is very distinct and different from the old city. Comparatively, its residential density is very low. Both the planned colony and the canal colony were situated in their present locations due to the availability of government land.

146. To sum up, the land use of the city, as a whole, can be described as having developed out of sprawl and without any preconceived plan that could have coordinated the land of one area with that of another or with the transportation system. The result is the prevalence of chaos and unpleasant living conditions. Table 4.19 presents the areas and proportions of various land uses in Sahiwal:

Table-4.19: Land Use Distribution in Sahiwal

#	Land Use	Area		% of Total Area
		Acre	Sq. Km.	
1	Residential	1,143.14	4.63	36.1
2	Commercial	139.97	0.57	4.4
3	Agricultural	520.35	2.11	16.4
4	Public Buildings	357.86	1.45	11.3
5	Religious	23.32	0.09	0.7
6	Education	416.14	1.68	13.1

7	Health	18.72	0.08	0.6
8	Industry	55.97	0.23	1.8
9	Graveyard	53.34	0.22	1.7
10	Parks/Open Spaces	160.46	0.65	5.1
11	Vacant Area	175.70	0.71	5.6
12	Mixed Land use	99.97	0.40	3.2
Total Area		**3,164.94**	**12.81**	**100**

Source: Urban Unit data

ii. Agriculture and Livestock

147. Agriculture is by far the main economic activity in the project area. The main crops, during Rabi, are wheat, gram, rapeseed, mustard, barley and oil seeds. During Kharif, crops include cotton, jawar, sugarcane, bajra, maize, and rice. In addition, there are subsidiary crops known as Zaid Rabi, such as Kharbooza, tobacco and potatoes, and also Zaid Kharif crops, such as potatoes and chilies. The main fruits grown are oranges, watermelon, muskmelon, guava, citrus, falsa, jaman, and pomegranate. When cultivation began, the inhabitants ate pilu and bair, the only wild fruits that grows, intermittently, in the region. With the introduction of canal irrigation, other fruits are now being grown on a commercial basis. However, wheat, cotton, sugarcane and rice remain the major crops.

148. The vegetables are grown in abundance, as the water and soil are suitable for cultivation. Crops include potatoes, carrots, ladyfingers, chilies, onions and cauliflower. Bitter gourd, turmeric and garlic are also grown to meet public demand. Other vegetables include radish, tinda (apple gourd), and bringal.

149. Livestock breeding is one of the main pursuits and means of livelihood among the rural and urban population in the project site. Common livestock are sheep, goats and cows, which serve as an important source of income.

iii. Power

150. As with the rest of the country, Sahiwal does not have an adequate, reliable and uninterrupted 24/7 power supply. Interruptions are frequent, forcing industries, other businesses, and many of the residents who can afford it to rely on back-up diesel generators and Uninterrupted Power Supply systems. These are costly, environmentally degrading and generally a poor second option. Power generation and primary distribution are generally beyond a single urban center's capacity, so it is necessary to rely on provincial and national government support. Any city with reliable power enjoys an immediate competitive advantage. Solar options for institutional and residential use are increasing in popularity, but the technology has not reached the stage where it can provide the major energy source for heavier industry.

iv. Industrial Activity

151. There are three industrial sites in Sahiwal District, and more than 200 industries. There is also a small industrial estate, developed by the Punjab Small Industrial Corporation. It consists of 188 plots situated on about 52 acres land. . Sahiwal is famous for its cotton ginning and pressing, its tannery, textiles, leather products, garments, pharmaceuticals, flourmills, and food industry. Sahiwal is also one of Pakistan's major multi-crop areas, and many pesticide companies do business here. Major industries include, Mitchell's Fruit Farms Limited; Engro Foods Limited; Beakers Land and Sweets Factory; Ittefaq Sugar Mills Limited; Baba Farid Sugar Mills Limited; Lackson Tobacco, Philip Morris Tobacco; Fauji Fertilizer Company; Habib Oil Mill; and Aziz Leather Craft, etc.

152. Most of the larger industries, such as Engro Food, Philips Morris Tobacco, dairy product plants, and other agro-based industries are situated along Multan Road, south of the canals, and along the ribbon developments outside the municipal limits.

153. The business community of Sahiwal District earnestly felt the need to establish a Chamber of Commerce & Industry, in Sahiwal. A group of traders and Industrialists succeeded in obtaining a license from the Government of Pakistan's Ministry of Commerce. After incorporation with Security Exchange Commission of Pakistan, under Companies Ordinance 1984, the Chamber became affiliated with the Federation of Pakistan Chambers of Commerce & Industry.

154. The primary objective in establishing the Sahiwal Chamber of Commerce & Industry (SLCCI) was to provide businessmen in the area with an opportunity to strengthen the economic growth of Sahiwal, in particular, and the country, in general. Industry growth will certainly reduce unemployment in the area.

155. The prime objective of the SLCCI is to serve its members to their utmost satisfaction. The SLCCI acts as a bridge between the government and the business community. It plays an important role in policy formulation by maintaining a constant interaction with the relevant authorities.

v. Water Supply Service

156. The water supply is obtained from ground water and 46 tube wells. The water supply network covers 90 percent of the town and serves 90 percent of the total population. The distribution system consists of eight overhead reservoirs with a 450,000-gallon capacity. The distribution consists of a looped network made of different types of materials, including asbestos concrete, PVC, MS, and duct Iron pipes. Pipe sizes vary from 76 to 305 mm in diameter.

vi. Sewerage System Service

157. The sewerage and drainage system covers 90 percent of the total area of Sahiwal through a 40 KM sewerage network. Wastewater is disposed of in a nearby sewer system, which pollutes the surrounding environment and causes waterborne diseases. The residential areas are rapidly expanding to the north side of the town, and slower expansion is taking place toward the east, reducing the coverage of the facility to between approximately 20 and 30 percent.

158. Municipal wastewater is being used for irrigation purposes, according to farmers' demand, and the remaining wastewater is disposed of into rivers through drains and nullahs.

vii. Solid Waste Management

159. The solid waste generation from Sahiwal city is overwhelmingly domestic and primarily organic in composition. Some industrial solid waste varies in different parts of the city. The main problems with refuse collection and disposal are old machinery, polythene bags, anti-social habits, lack of supervision, and the encroachment of open sewers.

160. Currently, there is no proper system of waste disposal in Sahiwal. Collected waste is dumped at designated dump sites, at Ratti Tibbi, without any environmental safeguards, such as segregating infectious hazardous waste produced by tanneries, slaughter houses, and hospitals. Presently, only 32 percent of solid waste is being collected and disposed of.

However, with increasing economic activity in agriculture and manufacturing, the environmental and health situation will continue to worsen in the absence of proper disposal mechanisms.

161. The Sahiwal Municipal Corporation (SMC) manages Sahiwal's existing solid waste management system. The existing solid waste collection, in general, is divided into a primary and secondary system. Sahiwal city comprises ten union councils, each of which has its peculiar characteristics in terms of land use the composition of waste generated. The amount of waste generated and the extent of pollution varies from union council to union council. The allocation of sanitary staff in the union councils does not commensurate with the workload, thereby resulting in huge heaps of waste piling up on the streets and in open places.

162. There is no available data on the composition of the waste generated in the city and there is no concept of the segregation of infectious/noninfectious and hazardous/nonhazardous wastes produced by industries, slaughterhouses and hospitals.

163. The SMC has prepared a PC-1 "Integrated Solid Waste Management System in Sahiwal, the estimated cost of which is Rs 135.68 million. The aim of this project is environmental improvement by enhancing institutional capacity and improving the collection, transportation, and disposal of the city's solid waste, hospital waste, and slaughterhouse waste.

164. Presently, the SMC's primary waste collection is carried out by the use of handcarts and is taken to open places of heaps on roadsides, followed by secondary collection through tractor trolley, and final dumping at the Ratti Tibbi dump side. Under the present scenario, only 32 percent of solid waste is being collected, transported and disposed of.

viii. Transport

165. Sahiwal city has a total road length of 40 KM, of which the regional road/highway is 10 KM long. There are 12 KM of major roads and 18 KM of branch roads. In addition to that, there are numerous streets, which crisscross the city. Also there are about 11 important junctions in the network, out of which six are roundabouts and the remaining function as chowk.

166. Out of the total urban area of 1,652 hectares (16,515,870 m^2), 55 percent offer good vehicular accessibility, 25 percent are fair, and 20 percent offer poor vehicular accessibility. Since the city is basically a planned town, numerous roads in the network are fairly wide. About 9 percent of roads are 37 meter wide, 22 percent are 34 meter wide, 20 percent are 24 meter wide, and 49 percent are 18 meter wide or less.

167. The transport infrastructure in Sahiwal is generally adequate for its existing requirements; there are relatively few circumferential links. This results in extended journey times for many trips and the misuse of minor roads by through traffic. There is little provision for off-street car parking. There are no signals on any of the chowks and no available urban bus or van services. Mostly motorcycle rickshaws or auto rickshaws are being used as urban transport services on all roads.

b. Sahiwal in the Pak-China Economic Corridor

168. The Pakistan-China Economic Corridor (CPEC) is an ongoing mega project that aims to connect Gwadar Port in southwestern Pakistan to China's autonomous northwestern region of Xinjiang, via a network of highways, railways and pipelines that transport oil and

gas. Other than the transport infrastructure, the economic corridor will provide Pakistan with telecommunications and energy infrastructure.

169. Sahiwal lies within this corridor and, thus, would be a direct beneficiary. In this corridor, two coal power plants are to be built in Qadirabad, which is located on Multan Road (N5), around 19 KM from Sahiwal, in the direction of Lahore. Work on this project has already begun; it will generate 1,320 MW of electricity and be completed in 30 months, with China's assistance.

D. Social and Cultural Resources

170. Socio-economic and other relevant information is obtained from the Multiple Indicator Cluster Survey (MICS) 2007-08. One of the survey's main objectives was to establish a credible baseline for the socio-economic status of each district level and for Tehsil level.

171. Table 4.20 shows a summary of socio-economic indicators for Tehsil Sahiwal. No further segregated information is available from the Bureau of Statistics, Planning and Development Department, Punjab. The population's rural-urban ratio within Tehsil can help estimate the urban proportion of the region's population.

Table-4.20: Social Economic Indicators Summary

Social Indicators	Punjab	Tehsil Sahiwal
Children have had diarrhea within the last two weeks	7.8	10.6
Had acute respiratory infection	7.2	21.2
Water treatment methods have not been used in the household	93.8	97.2
Boiled water is used in the household	2.8	1.4
Piped water is the main source in the dwelling	16.5	2.5
Improved sanitation facility is available through a piped sewer system	20.9	32.2
Percentage of household population using improved sources of drinking water	96.8	99.6
Percentage of household population using sanitary means of sewage disposal	69.5	67
Percentage of household population using improved sources of drinking water and using sanitary means of sewage disposal	67.5	67
Solid waste disposal in open fields	78.1	69.3
Literacy rate (10 years and older)	59.3	57.9
Literacy rate (15 years and older)	55.6	53.6
Literacy rate (15-24 years)	73.3	68.6
Percentage of children aged 3-4 years currently attending preschool	13.5	10.8
Percentage of children of primary school entry age (5 years) currently attending grade 1	18.9	23.6
Percentage of children of primary school entry age (6 years) currently attending grade 1	38.4	38.5
Primary school gross attendance ratio (5-9 years)	97.2	103.6
Physical access to primary schools, Boys government school <2 KM	93	95.7
Physical access to primary schools, Girls government school <2 KM	91.4	91.1
Physical access to middle schools, Boys government school <2 KM	62.6	67.6
Physical access to middle schools, Girls government school <2 KM	62.8	74.5
Physical access to secondary schools, Boys government school <2 KM	50.6	48.9
Physical access to secondary schools, Girls government school <2 KM	46.9	47.9
Child labor, working outside of the household	5.1	12.4

Social Indicators	Punjab	Tehsil Sahiwal
Physical access to the nearest Government health facility	57.2	53.4
Employed	93.2	94.3
Unemployed and seeking work	6.8	5.7
Household Utilities		
Electricity	92.5	94.3
Gas	26.4	15.7
Radio	40	26.9
TV	63.2	63.0
Cable TV	20.8	14.4
Telephone	15.9	14.0
Mobile phone	71.0	-
Computer	8.5	7.7
Internet	4.8	5.7
Fridge/Freezer	40.3	32.6
Air conditioner	6.6	4.9
Washing machine	48.8	38.6
Cooler/ Fan	86.4	85.7
Cooking range/ microwave	6.0	4.9
Sewing machine	72.7	60.9
Iron	80.2	78.7
Water filter	3.4	1.9
Donkey pump or turbine	54.5	66.2
Household possessions, bicycle	53.9	64.4
Household possessions, motorcycle/scooter	26.9	24.7
Owned houses	84.2	81.9
Receiving remittance as Zakat	1.4	0

Source: Govt. of Punjab MICS Report, 2007-2008

i. Employment and Unemployment

a. Unemployment

172. The unemployment rate is measured as the ratio of those laid off and seeking employment, and the total number of unpaid family helpers to the total number of those employed among the economically active population. This number is generally represented as a percentage. In 1998, the unemployment rate in the district was 20.6 percent, which was mainly due to unemployment among males, which represented 20.9 percent, while the female unemployment rate was only 2.8 percent, because of the small number of women active in the labor force. The unemployment rate was slightly low in rural areas, as compared to urban areas, representing 20.2 percent and 22.5 percent, respectively

b. Employment Status

173. The last formal, detailed employment statistics for Sahiwal date to the 1998. The population census is quoted in several publications, including the Sahiwal Urban Profile, 2010. A number of related and more current employment figures that are indicative of Sahiwal's urban situation include:

a. The labor force participation in Punjab of 55.4 percent, which is the highest of all four provinces.
b. Industry engages 23.9 percent of the formally employed.
c. In 2013, there were 220 reported factories in Sahiwal District, employing approximately 8,200 workers.

d. Of these workers, 76.5 percent participated in the informal economy. Based on statistics of other employment sectors, this suggests that a proportion of those formally employed also engage in informal economic activity, a situation that is common in most emerging economies.
e. Approximately 26 percent were employed as service workers, in shops and as market sales workers.
f. Another 27 percent were employed as in crafts and related trades.
g. Approximately 14 percent were employed as unskilled workers.
h. Just over 6 percent were employed as professionals.
i. Another 6 percent were employed as plant machine operators.

174. The main source of formal employment is 220 factories, of varying size, located in Sahiwal and its environs. These provide some 8,200 jobs. Agro-related industry is of particular importance as an employment generator.

ii. Educational Services

175. Sahiwal has a number of higher post-secondary educational institutions, including:

a. Thirteen arts and science degree colleges have over 15,000 students enrolled, including the Sahiwal Medical College and the Government College of Technology
b. Four vocational institutes have over 500 students enrolled.
c. One technical/polytechnic institute has almost 3,000 students.
d. Six commercial training Institutes have over 3,000 students enrolled.

176. Additional institutes of higher education are always desired, particularly those directly targeting the employment needs of local industry. These also become important means of keeping youth from migrating to the major cities.

iii. Health Facilities

177. Sahiwal District has nine hospitals, but with a total number of beds of slightly under 1,300. In addition, there are six regional health centers and 42 basic health units. As in most secondary urban centers, is retaining qualified staff, in both the health and education sectors, is one of the challenges. Staff often migrates to a major city to take advantage of the amenities it offers. The better the overall urban environment, quality of life, and social and economic amenities, the more likely they are to stay.

iv. Harappa Archaeological Site as a Tourist Attraction

178. Harappa is one of the two main cities of the Indus culture, and is located about 20 KM west of Sahiwal. It is a major tourist attraction and contains ruins of a fortified Bronze Age city. The city is believed to have had as many as 23,500 people living there as early as 2,500 BC, which can be considered a large population for that time.

179. The Harappa civilization was rediscovered in the 1920s. It was found to have had its own script, urban centers, and a diversified social and economic system. In 1857, the archaeological site at Harappa was partially damaged. . Sadly, its current state is not satisfactory.

180. Harappa is generally characterized as having differentiated living quarters, flat-roofed brick houses, and fortified administrative or religious centers. Although copper and bronze were in use, iron was not yet employed. Cotton was woven and dyed for clothing; wheat, rice, and a

variety of vegetables and fruits were cultivated; and a number of animals were domesticated, including the humped camel.

v. Socioeconomic Condition at STP Site

181. This section covers the socio-economic conditions of the population that will be directly or indirectly affected by the project. The socio-economic profile focuses on the sources of livelihood, income levels, and accessibility to social services like health, education etc. The socioeconomic survey was divided into a settlement profile and a socio economic household survey. Residents were interviewed with the help of semi structured questionnaire.

a. Settlements Profile

182. There are four settlements namely 95/6R, 94/6R, 135/6L and Three Marla Housing Scheme within immediate surroundings of proposed project site. These settlements falls under the administrative jurisdiction of Union Council (UC) 11, 42, 24 and 11 respectively.

183. Settlement Pattern: The project site is predominantly an agricultural area interspersed with settlements inhabited by the local population. The population of the area resides in the villages of varying sizes. The basic information regarding infrastructural characteristics, total households and population of the village was collected from chairman of respective UC. Total population and households of four settlements is 32,000 and 5,460 respectively. Some parts of these settlement are located within one kilometer radius from STP site.

184. Social and Cultural Values: The existing community reflects rural culture with its characteristic norms and values. Women do all household work by themselves. Majority of the population follows Islamic tradition. Common food is wheat bread. Yogurt, Lassi and milk are also used. The common dress for males is Shalwar Qameez and for females Shalwar, Qameez and Dupatta/Chadar. Marriages are celebrated in traditional manners.

b. Conflict Resolution Mechanism

185. The people of the area were found to be loving, caring and hardworking. They reported that for petty conflicts resolution, they involve the influential people, Nazim or Naib Nazim or Councilor of the village, who after listening statements of both the parties, tries to reach to an unbiased decision which is acceptable to the aggrieved. Generally, the people accept the decisions of the influential.

c. Public Health

186. The major diseases that afflicted the residents of the village are seasonal. There are no adequate health care facilities in the surveyed settlements. Rural Health Centre and Basic Health Unit (BHU) are 4 to 5 KM away from settlement. There is no qualified doctor in the surveyed settlement. The only medical services in the village are provided by Lady Health Workers (LHW).

d. Sanitation and Drainage

187. There is no sewerage system in the village. Domestic wastewater is disposed of into the agricultural fields and stagnant water ponds through a network of open drains. Septic tanks are present in all the surveyed houses. All the sewage carrying drains of the area are concreted or kachcha (made of mud) but uncovered. The open drains, in addition to breeding sources of mosquito, insect and flies, also produce unpleasant odor. This situation may cause health hazards to the local community.

e. Educational Facilities

188. There are four government primary schools in the area. These include two middle schools, one each for boys and girls, and two primary schools, one each for boys and girls. Matric level education is also provided by the private coeducation schools. There are nine private Middle and Matric schools in the area, both for boys and girls. Students wishing to continue their study after matriculation go to Sahiwal and Faisalabad city. The village madrassas provide religious education to young male and female students.

f. Transport and Travel Mode

189. The modes of transport among the local villagers are buses and wagons, but this facility is available on the main roads. Personal transport includes bicycles, motor cycles and cars owned by the residents of the surveyed settlement. The proposed project site is located at 0.4 KM from National Highway N5. Public transport is easily available to access the site. Pakistan railway also connects the area with all parts of the country.

g. Civic Amenities

190. Potable Water Supply: There is no government water supply scheme in the area. Ground water is the only source of water for the area being used by the community for all domestic purposes. Inhabitants have installed the electric motors within their premises. No precautionary measures are undertaken before the consumption of water. Furthermore, there is no filtration plant available for the residents of the village.

191. Electricity Supply**:** Multan Electricity Supply Company provides electricity to the area. Inhabitants of the area face 8 hours/day load shedding of electricity.

192. Natural Gas Supply: Natural gas is only present in 135/9L. Other settlement including 95/6R, 94/6R and Three Marla Housing Scheme use LPG and woods as cooking and heating fuel in their houses.

193. Telecommunication Network: Majority of the residents however use cellular phone for communication.

194. Postal Services: The nearest post office facility is located at 3 KM from the area, where the residents of the settlement go for posting and receiving mail.

195. Other Services: The nearest police station is located in Farid Town about 3 KM away from the area.

h. Cultural and Religious Resources

196. Religious sites include shrine, mosques, graveyards and historical buildings. There are ten mosques, one shrine, five graveyard, four imam bargah and three church in the area. Mosque has been built in the recent past and has no historical or architectural significance. Shrine is regarded as a sacred place and receive devotion from the locals of nearby populations but is not well known outside the area.

i. Demographic Characteristics of the Study Area

197. Population and Family Size: Based on socioeconomic survey, the population of 147 households is calculated as 1,100 as given in the Table-4.21. Average household size is calculated as 7.0. The male and female proportion is about 54% and 46% respectively. Male to

female ratio is 1.18. The percentage of younger population (81%) is higher than above 40 years of age.

Table-4.21: Gender Wise Population

Gender	Number	Sex Ratio (Male to Female)	Household Size
Male	595	1.18	07
Female	505		
Total	**1,100**		

Source: Socio economic Survey, February 2017

198. Type of Family: According to the sample based socioeconomic survey, population of the area live under nuclear, joint and extended family system. The distribution of household with respect to the type of family is given in the Table-4.22.

Table-4.22: Type of Family

Type of Family	Distribution	Percentage (%)
Nuclear	85	58
Joint	62	42
Extended	-	-
Total	**147**	**100**

Source: Socio economic Survey, February 2017

199. The population of the village resides largely in nuclear families e.g., family unit consisting of parents and their dependent children.

j. Religion

200. The main religious groups in the area are Muslims and Christians. The population of the surveyed settlement is predominately Muslims i.e., 98% followed by Christians 2%.

k. Language Spoken

201. Punjabi is the most common language spoken by majority of population in the area. Urdu is spoken as secondary language.

l. Castes and Minority Groups

202. The project area is inhabited by the people of various castes including Bhutta, Bhatti, Mughal, Rajpoot, Araen, Rae, Sayyed, Malik, Dogar, Rajpoot, Rana, Jat, Rehmani and Chaudhry. Among all these, Araen is the dominant caste. Reportedly, lower castes associated with hereditary menial professions are also the part of the village population.

m. Educational Status

203. Educational facilities in any area predict the educational level and the interest of the people towards the education. Educational status of the respondents of surveyed village is shown in Table-4.23**.** Table shows that 149 children having age group of 1-3 have been excluded. Out of remaining, majority of the respondents had middle level education. It is also obvious from the table that the ratio of the masters is very low as compared to those having education up to primary, middle and matriculation.

Table-4.23: Educational Level of the Respondents

Education Level	Male	Female	Male (%)	Female (%)
Primary	115	103	21	25
Middle	130	127	24	31
Matriculation	118	24	22	6
Intermediate	51	22	9	5
Graduation	34	16	6	4
Masters	08	14	2	3
Deeni Taleem	04	08	1	2
Illiterate	78	99	15	24

Source: Socio economic Survey, February 2017

n. Economic Conditions of the Study Area

204. Occupations and Employment: Various income generating activities are practiced in the village. Apart from the categories of housework and students, which mainly pertains to the house wives and children, the major earning occupations are business and private servant. Residents of the village are also engaged with the small industries as skilled or unskilled labor.

205. Based on the sample-based socio-economic survey of the project area, Table-4.24 presents distribution of the household members by occupation.

Table-4.24: Distribution of Household Members by Occupation

Occupation/ Source of Income	Number	%age
Agriculture	33	03
Housewives	248	23
Domestic Work	33	03
Students	302	27
Wage labor	67	06
Business	77	07
Private Servant	69	06
Government Servant	62	06
Retired Servant	11	01
Unemployed	18	02
Overseas	37	03
None	11	01
Babies	132	12
Total	**1,100**	**100**

Source: Socio economic Survey, February 2017

206. Income Levels: Table-4.25 shows the distribution of households with respect to their reported average monthly household income. It is evident from the table that the income level of most of the respondents is reasonable and economic conditions are well off.

Table-4.25: Distribution of Households by Average Monthly Household Income

Income Group	Number	%age
<10,000	11	08
10,001-20,000	52	35
20,001-30,000	30	20
30,000+	54	37
Total	**147**	**100**

Source: Socio economic Census Survey, February 2017

207. Housing Characteristics: Housing condition is an important indicator for determining the economic conditions of the population as it reflects the financial position and living standards of the inhabitants. Most of the houses in the study area are built with cement and bricks and permanent roofing structures. All the respondents (100%) are living in their own houses and none was found to live in the rented house. Nature of the housing conditions of the study area is shown in Table-4.26.

Table-4.26: Housing Type

Categories	Number	%age
Pucca (bricks, cement)	127	86
Katcha (bricks, mud)	-	-
Semi Pucca (bricks, cement, mud)	20	14
Total	**147**	**100**

Source: Socio economic Survey, February 2017

208. Livestock: In the surveyed settlement, livestock is normally raised for food and farming purposes. Livestock has market potential and is sold at the time of need. Major livestock of the area are cows, buffalos, goats, sheep, donkeys and poultry birds. Poultry birds are only kept for meeting the household's eggs and meat requirements.

V. ASSESSMENT OF ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

209. The overall environmental impacts of the subprojects are positive since these are supposed to provide continuous safe water to the residents, dispose of sewage of the city in safe manner and improve roads and landscaping of the city. These projects shall prevent or alleviate the effects of pollutants on the human and natural environments.

210. This section describes the issues related to the project's construction and operation stages and their impacts on both the environment and public health. The impact significance is categorized according to the severity of risk on the environment and human health and probability of occurrence.

A. Assessment of Risk – Environmental Aspects

211. To assess the threat posed by a hazard (*i.e.* risk), the principal factors to be considered are:

a) the likelihood that the threat may be realised; and
b) in the event of realisation of the threat, the nature and extent of the consequences.

212. A qualitative risk assessment methodology has been adopted for this project, comprising the Likelihood and Consequence values detailed in Table-5.1 and Table-5.2.

Table-5.1: Qualitative Likelihood Values

Likelihood Indicator	Likelihood Description	
A	Almost Certain	Is expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Might occur at some time
D	Unlikely	Could occur at some time
E	Rare	May only occur in exceptional circumstances

Table-5.2: Qualitative Consequence Values

Consequence Indicator	Consequence Description	
1	Insignificant	Negligible, reversible, requires very minor or no remediation / minor injury with slight negative health impact
2	Minor	Reversible, requires minor remediation / major, non-fatal health impact to one or more individuals
3	Moderate	Reversible, short-term effect, requires moderate remediation / severe, non-fatal health impact to one or more individuals

Consequence Indicator	Consequence Description	
4	Major	Serious impact, medium term effect, requires significant remediation / single fatality or severe irreversible disability or impairment
5	Catastrophic	Disastrous impact, long term effect, requires major remediation / multiple fatalities, major permanent health impacts on a large number of individuals

213. On the basis of a likelihood and consequence matrix (Table-5.3), each hazard may be categorised into broad 'risk categories' and the required management approach for each risk category can be defined.

Table-5.3: Risk Matrix – Risk Categories and Management Response

		Consequence				
		1	**2**	**3**	**4**	**5**
Likelihood	**A**	M	M	H	H	H
	B	L	M	H	H	H
	C	L	L	M	H	H
	D	L	L	L	M	H
	E	L	L	L	M	M

H = High Risk – Proposed works methods not acceptable and must be altered.
M = Moderate Risk – Detailed management action plan to be prepared, including monitoring program.
L = Low Risk – Routine management procedures to be defined and monitoring requirements to be specified.

B. Anticipated Environmental Impacts

i. Anticipated Environmental Impacts due to Project Location

214. The environmental impacts related to location of the project are mostly in the areas of physical setting, socioeconomic setting, ecological setting and special areas (archaeological sites etc.). Detailed description of these settings is given in Chapter 3. Field evidences reveal that the impacts of the projects due to their locations are mostly in the category of 'insignificant'. No historical site is located in the vicinity or no displacement of inhabitants is involved. The most of the water supply, sewerage and drainage, green spaces development and transport routes improvement projects will be implemented within the city of Sahiwal. The proposed project site for the STP is located close to the newly developing residential scheme called the Three Marla Scheme, which is on agricultural land. Three sides of the site are surrounded with agricultural land (East, West, North) and one side is along the unpaved passage adjacent to the right bank of canal (South) i.e. Lower Bari Doab (LBD). The Three Marla Housing Scheme is located at about 500 meter away from the site at eastern side whereas two villages 95/6-R and 94/6-R are located at northern side of the site at about 1 KM distance.

215. The area required for the STP facility is relatively small. Consequently, the lifetime loss of agricultural land and produce linked to the land acquired for this project is assessed as 'Insignificant'.

216. The locations of the STP site was chosen as a mitigation measure, owing to its minimal environmental and socio-economic impacts. The plant site will not be noisy and it is not expected to create offensive odors; nevertheless, it is worthwhile to create a buffer zone (minimum 15 m, along with trees) on the periphery of the plant site to safeguard the community from the likely dispersion of odor and noise. This will also enhance the visual impact.

217. In the case of the STP, the residents of the Three Marla Scheme and two villages (the nearest community) will incur the least amount of disturbance due to vehicular movement to transport personnel and maintenance supplies, and for the removal of sludge, etc. because transport route is designed in such a way that it does not pass through these residential areas.

ii. Anticipated Environmental Aspects and Potential Hazards – Construction Phase

218. The potential hazards posed by construction activities are presented by environmental aspect in Table-5.4 to Table-5.10. Appropriate management actions for all of the potential environmental hazards shall be developed on the basis of the level of risk assessed to exist for each hazard identified. The potential hazards and assessment of risks are identified for following elements:

- Air quality;
- Noise;
- Traffic;
- Soil;
- Solid waste
- Sanitary wastewater
- Health & Safety

Table-5.4: Subprojects Activities, Potential Hazards and Assessment of Risk – Soil

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Temporary and localized soil contamination for short period of time at one place due to spillage of solvent/paint/chemicals on soil during repair and maintenance activities	B1 – Low
Construction of new OHRs (12) including demolishing existing 2 OHRs	Temporary and localized soil contamination for moderate period of time at one place due to spillage of solvent/paint/chemicals on soil during construction activities	B2 – Moderate
Replacement of rusted/damaged pipelines (54 KM)	Temporary and localized soil pollution for short period of time due to spillage of fuel/lubricant from construction camps and maintenance of vehicles and machines	C2 – Low

Subprojects/Activities	Potential Hazard	Assessment of Risk
Replacement of asbestos pipelines (24 KM)	Temporary and localized soil pollution for short period of time due to spillage of fuel/lubricant from construction camps and maintenance of vehicles and machines	C2 – Low
Sewerage		
Sewerage Pipes Replacement (12.87 km)	Temporary and localized soil pollution for short period of time due to spillage of fuel/lubricant from construction camps and maintenance of vehicles and machines	C2 – Low
Trunk main line to STP	Temporary and localized soil pollution for moderate period of time due to spillage of fuel/lubricant from construction camps and maintenance of vehicles and machines	B2 – Moderate
Sewage treatment plant (STP)	Temporary and localized soil pollution for moderate period of time due to spillage of fuel/lubricant from construction camps and maintenance of vehicles and machines	B2 – Moderate
Transport		
Improvement/up-gradation of bus stands (02)	Temporary and localized soil pollution for moderate period of time due to spillage of fuel/lubricant from construction camps, generators and maintenance of vehicles and machines	B2 – Moderate

Table-5.5: Subprojects Activities, Potential Hazards and Assessment of Risk – Air

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Temporary and localized dust emissions due to excavation and refilling activities for laying the pipelines for moderate period of time	B2 – Moderate
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Temporary and localized dust emissions due to repair and maintenance work for short period of time	B1 – Low
Construction of new OHRs (12) including demolishing existing 2 OHRs	Temporary and localized dust emissions due to construction activities for moderate period of time	B2 – Moderate
Replacement of rusted/damaged pipelines (54 KM)	Temporary and localized dust emission due to excavation and refilling activities for laying pipelines and movement of construction vehicles for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low

Subprojects/Activities	Potential Hazard	Assessment of Risk
Replacement of asbestos pipelines (25 KM)	Temporary and localized dust emission due to excavation and refilling activities for laying pipelines and movement of construction vehicles for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low
Sewerage		
Sewerage Pipes Replacement (12.87 KM)	Temporary and localized dust emission due to excavation and refilling activities for laying pipelines and movement of construction vehicles for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low
Trunk main line to STP	Temporary and localized dust emission due to excavation and refilling activities for laying pipelines and movement of construction vehicles for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low
Sewage treatment plant (STP)	Temporary and localized dust emission due to excavation, mixing of material and movement of construction vehicles and machines for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of construction material and accessories to the sites	B1 – Low
Transport		
Improvement of 3 KM Railway Road	Temporary and localized dust emission due to construction activities for short period of time	B1 – Low
Improvement/up-gradation of bus stands (02)	Temporary and localized dust emission due to construction activities (demolition of structures, mixing of material, movement of machines and vehicles) for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of construction material and disposal of construction debris	B1 – Low
	Localized and low intensity generator emissions	B1 – Low

Table- 5.6: Subprojects Activities, Potential Hazards and Assessment of Risk – Noise

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Rehabilitation of tube wells (19)	Low intensity localized noise generation due to dismantling and placement of pumps and motors activities under enclosed structures for short period of time	B1 – Low
Installation of new pumps (08)	Low intensity localized noise generation due to boring and installation of pumps and motors under enclosed structures for short period of time	B1 – Low
Improving efficiency of 27 tube wells (repair and maintenance of pumps and motors)	Low intensity localized noise generation due to repair and maintenance activities under enclosed strictures for short period of time	B1 – Low
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Low intensity localized noise due to movement of pipes and accessories carrying vehicles and pipe laying activities for short period of time	B1 – Low
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Low intensity localized noise generation due to repair and maintenance work for short period of time	B1 – Low
Construction of new OHRs (12)	Low intensity localized noise generation due to construction activities (excavation, mixing, movement of vehicles and machines, demolish of structures) for moderate period of time	B2 – Moderate
Replacement of rusted/damaged pipelines (54 KM)	Low intensity localized noise generation due to pipe laying activities and movement of vehicles and machineries for moderate period of time	B2 – Moderate
Replacement of asbestos pipelines (24 KM KM)	Low intensity localized noise generation due to pipe laying activities and movement of vehicles and machineries for moderate period of time	B2 – Moderate
Sewerage		
Sewerage Pipes Replacement (12.87 KM)	Low intensity localized noise generation due to pipe laying activities and movement of vehicles and machineries for moderate period of time	B2 – Moderate
Rehabilitation of Disposal Stations (10) (Replacement of pump and motor, improvement of electrical panels, repair and maintenance of pumps and	Low intensity localized noise generation due to repair and maintenance work at disposal station (enclosed structures) for short period of time	B1 – Low

Subprojects/Activities	Potential Hazard	Assessment of Risk
motors and civil work)		
Trunk main line to STP	Low intensity localized noise generation due to excavation, pipe laying activities and movement of vehicles and machineries for moderate period of time	B2 – Moderate
Sewage treatment plant (STP)	Low intensity localized noise generation due to excavation, construction activities and movement of vehicles and machineries for moderate period of time	B2 – Moderate
	Low intensity localized noise from generator for short period of time	B1– Low
Transport		
Improvement of 3 KM Railway Road	Low intensity localized noise generation due to construction activities for short period of time	B1 – Low
Improvement/up-gradation of bus stands (02)	Low intensity localized noise generation due to construction activities (demolition of structures, mixing of material, movement of machines and vehicles) for moderate period of time	B2 – Moderate
	Low intensity localized noise from generator for short period of time	B1– Low
Green Spaces		
Development of green belt canal	Low intensity localized noise generation due to movement of machines for short period of time	B1 – Low
Rehabilitation of parks (06)	Low intensity localized noise generation due to movement of machines for short period of time	B1 – Low

Table-5.7: Subprojects Activities, Potential Hazards and Assessment of Risk – Traffic

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Rehabilitation of tube wells (19)	Low traffic volume increase by the vehicles carrying pumps, motors and accessories	B1 – Low
Installation of new tube wells (08)	Low traffic volume increase by the vehicles carrying pumps, motors and accessories	B1 – Low
Improving efficiency of 27 tube wells (repair and maintenance of pumps and motors)	Low traffic volume increase by the vehicles carrying pumps, motors and accessories	B1 – Low
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Low traffic volume increase by the vehicles carrying pipes and accessories	B1 – Low

Subprojects/Activities	Potential Hazard	Assessment of Risk
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Low traffic volume increase by the vehicles carrying construction material and accessories	B1 – Low
Construction of new OHRs (12)	Low traffic volume increase by the vehicles carrying construction material and accessories	B1 – Low
Replacement of rusted/damaged pipelines (54 KM)	Low traffic volume increase due to transportation of construction material and accessories	B1 – Low
	Localized traffic congestion at pipe laying area for short period of time	B2 – Moderate
Replacement of asbestos pipelines (24 KM)	Low traffic volume increase due to transportation of construction material and accessories	B1– Low
	Localized traffic congestion at pipe laying area for short period of time	B2 – Moderate
Sewerage		
Sewerage Pipes Replacement (12.87 KM)	Low traffic volume increase due to transportation of pipes, construction material and accessories	B1 – Low
	Localized traffic congestion at pipe laying area for moderate period of time	B2 – Moderate
Trunk main line to STP	Low traffic volume increase due to transportation of pipes, construction material and accessories	B1 – Low
	Localized traffic congestion at pipe laying area for moderate period of time	B2 – Moderate
Sewage treatment plant (STP)	Low traffic volume increase due to transportation of construction material and accessories	B1 – Low
	Localized traffic congestion at STP site for moderate period of time	B1 – Low
Transport		
Improvement of 3 KM Railway Road	Localized traffic congestion due to construction and maintenance activities for short period of time	B1 – Low
Improvement/up-gradation of bus stands (02)	Low traffic volume increase due to transportation of construction material and accessories and disposal of debris	B2 – Moderate
	Localized traffic congestion for moderate period of time	B2 – Moderate

Table-5.8: Subprojects Activities, Potential Hazards and Assessment of Risk – Solid Waste

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Low volume localized generation of domestic solid waste from construction camps for short period of time	B1 – Low
Replacement of rusted/damaged pipelines (54 KM)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate
Replacement of asbestos pipelines (24 KM)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate
Construction of new OHRs (12)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate
Sewerage		
Sewerage Pipes Replacement (12.87 KM)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate
Trunk line to STP	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate
Sewage treatment plant (STP)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate
Transport		
Improvement/up-gradation of bus stands (02)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate
	Low volume generation of construction waste for moderate period of time	B2 – Moderate

Table-5.9: Subprojects Activities, Potential Hazards and Assessment of Risk – Sanitary Wastewater

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Low volume localized generation of sanitary wastewater from construction camps for short period of time	B1 – Low
Replacement of rusted/damaged pipelines (54 KM)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate

Subprojects/Activities	Potential Hazard	Assessment of Risk
Replacement of asbestos pipelines (24 KM)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Construction of new OHRs (12)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Sewerage		
Sewerage Pipes Replacement (12.87 KM)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Trunk main to STP	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Sewage treatment plant (STP)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Transport		
Improvement/up-gradation of bus stands (02)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate

Table-5.10: Subprojects Activities, Potential Hazards and Assessment of Risk – Health & Safety

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Minor nature health and safety concerns for the construction workers for short period of time	B1 – Low
Construction of new OHRs (12)	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Replacement of rusted/damaged pipelines (54 KM)	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Replacement of asbestos pipelines (24 KM)	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Sewerage		
Sewerage pipe replacement (12.87 KM)	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Trunk main to STP	Minor nature health and safety concerns for the construction workers for moderate	B2 – Moderate

Subprojects/Activities	Potential Hazard	Assessment of Risk
	period of time	
Sewage treatment plant (STP)	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Transport		
Improvement/up-gradation of bus stands (02)	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate

219. Most of the above mentioned subprojects and related project activities will generate environmental impacts during construction phase. The construction phase impacts are in the category of low to moderate risk. No construction phase impact is under high risk. Following section describes construction phase impacts and mitigation measures:

iii. Construction Phase Impacts and Mitigation Measures

220. It is an established fact that almost all major construction projects cause certain impacts on environmental resources. These impacts may create significant temporary hazards to the environmental resources of the project area during the project construction phase. The major construction phase impacts are listed below:

- Generation of dust due to excavation, transportation of construction material, mixing of building material and dumping of construction waste;
- Noise, vibration and air pollution due to construction and erection of electrical and mechanical equipment;
- Traffic volume in the area due to haulage of building material, equipment, construction machinery and transportation of workers at site;
- Soil pollution due to spillage and leakage of fuel and lubricants during cooking, fueling and maintenance activities
- Sanitary wastewater and solid waste generation from residences of construction crew; and
- Communicable disease hazard to workers from lack of sanitation facilities.

221. The construction activities affect the quality of local environment. Noise, fugitive dust emission due to construction and transportation, improper solid waste dumping are the sources of nuisance for the local community.

222. Mainly construction phase impacts are in the range of low to moderate risk. Most of these are not the major construction activities except for bus terminal and STP construction activities. Mostly construction activities impacts can be mitigated by taking certain administrative measures during construction phase as given below:

223. The main responsibilities for mitigation measures during the construction phase of the projects rest with contractors appointed to carry out the water supply, sewerage and drainage, green spaces development and transport routes improvement projects. The SMC Engineers will however, have the responsibility for monitoring the implementation of mitigation actions by the contractors and will need to implement their own system of internal checks to ensure that mitigation actions are carried out satisfactorily. In exceptional circumstances, the SMC may need to use its authority to call a halt to construction activity, if the contractors refuse to adhere to the requirements of the mitigation plan contained in the contract documents.

224. In order to avoid creation of misunderstandings regarding who is responsible for particular mitigation activities recommended for the construction phase, the Construction Phase Environmental Mitigation Plan (CPEMP) should be appended to tender documents. This will ensure that contractors include the cost of mitigation actions into their bids and will provide a reliable mechanism for enforcement. In fact, most of the recommended actions involve no or very little capital investment, but it depends on the contractor's management to adopt a responsible attitude to environmental protection; ensuring construction activity is properly planned and mitigation actions are correctly implemented. The mitigation actions recommended during the construction phase have the following principal objectives:

iv. Dust Suppression

225. Excavation of ground for laying pipelines and for foundations will generate dust. Regular water sprinkling is recommended at the dust generation points during the construction activities. In addition to this, proper protective equipment such as dust masks, goggles, hats, gloves and safety shoes should also be made available to the construction workers at the site to avoid potential health hazards and accidents.

v. Dumping of Construction Waste

226. At bust terminal revamping and demolishing of two OHRs activities, construction debris will be generated because of demolition of existing structures. The debris produced during construction should preferably be dumped at nearby depressions rather than throwing unattended. It should be ensured that the leftover material is not dumped into any of the storm water drain or water course, because such practices can clog these man-made and natural drainage systems and cause many other problems for the residents.

vi. Noise

227. Construction activities, movement of construction vehicles and machines, and demolishing of structures will generate noise and affect nearby communities and construction workers.

228. High noise levels result in various health impacts such as hearing loss and number of physiological and other effects.

229. To attenuate noise impacts on workers and nearby community, the following measures should be taken:

- Carry out regular inspection and maintenance of the construction vehicles and equipment;
- Timely replacement of worn and noise producing parts of the construction machinery;
- In case of severe noise, use of sound barriers to avoid dispersion of sound waves into the nearby community; and use of noise protection equipment by the workers, working in noisy area

vii. Traffic Management

230. Construction activities for laying pipelines and revamping of bus terminal will cause traffic issues. Traffic management measures should be implemented as a means of reducing road accidents, improving the residential living environment, and reducing the chance of collisions between vehicles, pedestrians and cyclists and traffic congestion.

231. The construction material carrying vehicles will be instructed to have reduced speed of about 30 km per hour at the residential areas with covering of the material from the top to avoid dispersion of dust in the surroundings. In case of large number of vehicles arriving

at the site, it should be planned in such a way that these vehicles arrive at the site in different timings of the day to avoid traffic jam issue and nuisance for the nearby community. As a measure to streamline heavy traffic in the area, proper road marking and signboard posting for safety and speed limit should also be done, particularly at nearby residential and commercial areas.

232. In case of digging of roads, the proper cordon off the digging site and traffic planning for moving traffic to alternate routes will be part of traffic management.

233. The vehicle drivers should be apprised of the local customs and values, and be advised to remain courteous to the local population. The construction material transport activities scheduling should be such that most of the tasks are executed in a manner so as not to cause traffic jams and congestion in the area.

viii. Disposal of Domestic Wastewater

234. During bus terminal revamping, construction of new OHRs, STP and pipe laying activities will take longer and construction crew will stay at campsite. These workers shall generate sanitary wastewater. Generally, during the construction phase, proper disposal of sanitary wastewater is not practiced. Sanitary wastewater should be disposed of into the nearby drain or sewers after passing through the septic tank. The management should plan to have a temporary septic tank for this purpose, for the construction crew.

235. Table-5.11 presents the typical characteristics of untreated domestic wastewater.

Table-5.11: Typical Characteristics of Untreated Domestic Wastewater

#	Contaminants	Concentration (Medium Strength)
1	Total Dissolved Solids (TDS) - mg/L	500
2	Total Suspended Solids (TSS) - mg/L	210
3	Biochemical Oxygen Demand (BOD_5) - mg/L	190
4	Chemical Oxygen Demand (COD) - mg/L	430
5	Chlorides – mg/L	50
6	Sulfate - mg/L	30
7	Oil & Grease - mg/L	90
8	Total Coliform - No./100 mL	10^7-10^9
9	pH	7

Source: Wastewater Engineering - Treatment and Reuse by Metcalf & Eddy, 2003

236. Table-5.12 presents impacts of wastewater on environment and human health.

Table-5.12: Environmental Impacts of Wastewater

Parameter	Impacts
pH	Growth inhibition of bacterial species (responsible for removing organic pollution) under highly acidic or alkaline conditions
	Corrosion of water carrying system and structures with acidic wastewaters having low pH
	Malfunctioning and impairment of certain physico-chemical treatment processes under highly acidic or alkaline conditions
Organic Pollutants	Depletion of dissolved oxygen (DO) levels, of the receiving

	water body, below limits necessary to maintain aquatic life (4-5 mg/l)
Suspended Solids	Sedimentation in the bottom of water bodies leaving adverse impact on flora and fauna
	Localized depletion of dissolved oxygen in the bottom layers of water bodies
	Reduced light penetration in natural waters and consequent reduction in photosynthesis
	Aesthetic nuisance
Oil and Grease	Reduced re-aeration in the natural surface bodies, because of floating oil and grease film and consequent depletion in dissolved oxygen levels
	Reduced light penetration in natural waters and consequent reduction in photosynthesis
	Aesthetic nuisance

ix. Domestic Solid Waste Management

237. Construction camp at bus terminal, new OHRs construction, STP and pipe laying sites will also generate domestic solid waste. It should be segregated, packed and disposed of at the designated municipal solid waste dumping site.

x. Occupational Health and Safety

238. The management should be responsible for provision of safe drinking water, maintenance of occupational health and safety equipment, maintenance of sanitation conditions, along with supply of hygienic food and sewerage system for the construction team at the site.

239. The major beneficial impact of the construction phase of the project is employment for local people during construction.

xi. Air Pollution

240. The sources of air pollution at construction sites are the construction vehicles and generators.

241. Generators: Diesel oil is used as fuel in the generators used for standby electricity generation. Diesel-based generators generally emit pollutants such as CO, NOx, SO_2 and particulate matter.

242. Vehicles: At construction sites, traffic will be increased. It will cause fugitive dust and vehicular emissions. The major pollutants present in emissions would be oxides of nitrogen and carbon, particulate matter and un-burnt hydrocarbons. For well-maintained vehicles, the air emission will remain within the PEQS. Table-5.13 presents impacts of air emission on environment (E) and human health (HL).

Table-5.13: Impacts of Air Pollutants on Environment and Human Health and Life

Carbon Monoxide	HL	Heart attack, by reducing the oxygen carrying capacity of blood
		Birth defects including mental retardation and impairment of fetus growth
		Dizziness, headache, and nausea
		Increase in reaction time of the drivers, a threat to the road safety
Oxides of Nitrogen	E	Formation of photochemical oxidants
		Damage to materials and property, by acid rains, resulting from oxidation of oxides of nitrogen to nitric acid, after reacting with water vapors
		Retardation of growth in plants
	HL	Reduction in oxygen carrying capacity of blood
		Impairment of olfactory sense and night vision
		Dryness and roughness of the throat
Particulate Matter	HL	Respiratory diseases
	E	Choking of plant leaves restricting photosynthesis process
		Global cooling of earth by reflecting back the solar radiations
		Impairment of atmospheric visibility affecting the transportation safety
		Deterioration of aesthetic quality of atmosphere, land and water
Oxides of Sulfur	HL	Respiratory diseases, eye and throat irritation
	E	Precursor for acid rain, damage of property, plant and soil
Carbon Dioxide	E	One of the major greenhouse gases, contributing to global warming

xii. Soil Pollution

243. Soil pollution can take place during cooking, fuelling, lubrication and maintenance of vehicles and machines. Following mitigation measures are recommended for soil pollution control:

- Placement of secondary containment under fuel/lubricant containers and generator fuel oil tank to collect spillage and leakage
- Placement of fuel/lubricant container on paved floor at enclosed place
- Properly collect and dispose waste lube oil/oily rags after maintenance
- Avoid spill and leaks of oil, lubricants on floor during maintenance activities
- Immediate cleaning the spillage and leakage from the ground with saw dust/cloth and dispose of as solid waste

xiii. Environmental Aspects and Potential Operational Phase Hazards

244. The potential hazards posed by operational activities are presented by environmental aspect in Table-5.14 to Table-5.15. Appropriate management actions for all of the

potential environmental hazards shall be developed on the basis of the level of risk assessed to exist for each hazard identified. The potential hazards and assessment of risks are identified for following elements:

- Noise;
- Health and safety
- Air quality
- Waste

Table-5.14: Subprojects Activities, Potential Hazards and Assessment of Risk – Noise

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Operation of tube wells	Low intensity localized noise generation due to operation of tube wells under enclosed structures	B1 – Low
Operation of OHRs (operation of tube wells)	Low intensity localized noise generation due to operation of tube wells under enclosed structures	B1 – Low
Sewerage		
Operation of disposal stations	Low intensity localized noise generation due to operation of disposal pumps under enclosed structures	B1 – Low
Sewage treatment plant (STP)	Medium intensity noise generation from operation of STP (pumps, compressors, vehicles). Most of the noise producing equipment will be under closed structures	B2 – Moderate

Table-5.15: Subprojects Activities, Potential Hazards and Assessment of Risk – Health & Safety

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Operation of chlorine facilities for disinfection at tube wells and OHRs	Medium level localized health and safety concerns associated with chlorine storage and handling facilities	B2 – Moderate
Algal growth in OHRs	Moderate impact on community health due to growth of algal in OHRs and contamination of water	B2 – Moderate
Sewage treatment plant (STP)	Minor nature health and safety concerns for the workers working at plant	B2 – Moderate
	Spreading of diseases die to breeding of mosquito, insects and flies at STP site	B2 – Moderate
	Health concerns for works due to aerosols from aeration tanks	B2 – Moderate

Table-5.16: Subprojects Activities, Potential Hazards and Assessment of Risk – Air

Subprojects/Activities	Potential Hazard	Assessment of Risk
Sewage treatment plant (STP)	Low intensity air emissions from generator for short period of time during electricity shut down	B1 – Low
	Low intensity vehicular emissions from staff and sludge carrying vehicles	B1 – Low
	Odor from sludge drying beds	B2 – Moderate
	Health concerns due to generation of gases of low concentration from biological tanks	B1 – Low

Table-5.17: Subprojects Activities, Potential Hazards and Assessment of Risk – Waste

Subprojects/Activities	Potential Hazard	Assessment of Risk
Sewage treatment plant (STP)	Low volume generation of domestic solid waste	B1 – Low
	Generation of sludge, trash and grit	B2 – Moderate
	Low volume generation of liquid waste (lube oil)	B1 – Low

245. Operational phase impacts are related with handling and storage of liquid chlorine solution (Sodium Hypochlorite) at tube wells and OHR facilities and algal growth in the OHRs.

246. Handling and Storage of Liquid Chlorine: Mishandling of liquid chlorine (Sodium hypochlorite) and its exposure to the tube well operators may cause burns to the mouth and throat, gastrointestinal irritation, nausea, vomiting and diarrhea. Inhalation and ocular exposure to chlorine gas, produced when sodium hypochlorite is mixed with acidic or alkaline solutions, results in burning of throat and lungs, eye and nose irritation, chest tightness, coughing and sore throat. Exposure to higher concentrations of chlorine may lead to tachypnoea, cyanosis, swelling of the airway and, in severe cases, pulmonary oedema and respiratory failure. Sodium hypochlorite is corrosive and may irritate the skin or cause burning pain, inflammation and blisters.

247. Safe handling and storage of liquid chlorine is proposed. It includes:
Transportation: Sealed containers of chlorine will be transported at site
Storage: Closed and locked storage of chlorine containers, placement of labels, precautions/instructions at storage place in Urdu language, secondary containment for chlorine container, use of spill kit and proper ventilation at storage place
Handling: Only authorized person for the dispensing of chlorine through pump under secondary containment, use of face mask, gloves and apron during chlorine handling activities. Strict monitoring is required from SMC for ensuring that the safe handling and storage practices are being adopted at water supply sites.

248. Algal Growth in Water Reservoirs: Algal growth takes place in the water reservoir with time which contaminates water changes its taste. It is proposed after every year, the reservoirs shall be cleaned and disinfected.

xiv. Operational Phase Impacts of Sewage Treatment Plant

249. The following types of environmental problems can occur during the operation of Sahiwal's STP:

a. Untreated sanitary wastewater;
b. Air pollution;
c. Solid waste;
d. Liquid waste;
e. Noise and vibration;
f. OHS issues;
g. Odor problem;
h. Mosquito/insects breeding and disease transmission;
i. Possible emergencies and plant failure;
j. Socioeconomic impacts;
k. Impacts of trunk sewer line;
l. Increase in roadside traffic of the area; and
m. Impact on ecology

a. Untreated Sanitary Wastewater

250. The administration building is the source of sanitary wastewater from the STP. This sanitary wastewater will be generated from the toilets installed in the STP administration building, such as in the laboratory, management building, and guardroom. This wastewater will be discharged directly to the STP. The total estimated quantity of sanitary and laboratory wastewater generated will be about 2.0 m^3/d. This is negligible when compared with the sewage coming from Sahiwal city to the STP (90,909–123,636 m^3/d) and it will not affect the concentration of the flow coming from the whole of Sahiwal city.

251. The impacts of sanitary wastewater generation from the STP office building are in the range of 'no impact' to 'insignificant'. Treating this wastewater in the existing STP will mitigate these impacts.

b. Air Pollution

252. Sources: The possible sources of air pollution of the STP include the following:

a. Generators
b. Biological tanks
c. Vehicles

252. Generators: Diesel oil is normally used as fuel in the generators used for standby electricity generation, but now gas-fired generators are also being used. The gas-fired generator is preferred for the STP because its emissions are quite clean. Diesel generators generally emit pollutants, such as CO, NO_x, SO_2 and particulate matter. However, due to the low frequency of operation of generators (only in case of electric shut down) the impact on air pollution generated from this source is practically 'insignificant'.

253. Aeration/Biological Tanks: Air emissions generated from the aeration tank/biological tanks for the activated sludge process will comprise inert gases, such as CO_2 and minor concentrations of N_2, NH_3 and H_2S. The environmental impacts of these gases are in the category of 'insignificant'. The low concentration and dilution effect will not cause any significant impact on workers.

254. Vehicles: With the commencement of the STP, traffic will increase, thereby causing dust emissions to escape and spread throughout the area. The traffic from the STP will mainly comprise office cars and trucks carrying sludge to the landfill site. The major pollutants present in the vehicular emissions will be oxides of nitrogen and carbon, particulate matter, and unburned hydrocarbons. For well-maintained vehicles, air emissions will remain within the PEQS. The environmental impacts of vehicular emissions in the area are in the category of 'insignificant'. The traffic volume will not be more as sludge will be carried away twice a week only (2-3 trucks after three days). The staff vehicles will not cause any impact as being only in 5-10 numbers.

255. The project site is rural agricultural area and currently has a very good standard of air quality. As there are very few existing traffic movements and few other air pollution sources nearby and given that the baseline levels of pollutants are low, the additional emissions from the STP are highly unlikely to raise the level of air pollutants to acute levels.

c. Solid Waste

256. The solid waste will generally comprise empty containers of lube oil and chemicals, scrap metal, discarded mechanical parts, and domestic solid waste. The other major solid waste streams are as follows:

a. Trash
b. Sludge and grit

257. a) Trash. A bar screen and an automatic fine screen will be installed before the lift station is installed at the site of the inlet of the STP wastewater. This will protect the pumps, valves, pipelines, and other parts and equipment from damage or clogging from rags and large objects, such as sticks, plastic bags and debris. This trash will be disposed along with the sludge.

258. b) Sludge and Grit. The proposed system for the STP includes primary and secondary treatment. The grit chamber is proposed for primary treatment; it will remove grit, such as sand and heavy particles of silt. The trickling filter as biological treatment process is proposed as a secondary treatment for compliance under the PEQS.

259. From the above-stated treatment process, grit will be produced at the primary level and sludge from the secondary treatment level. The quantity of dry sludge produced from the primary and secondary treatment system will be about 7.9 ton per day

260. The impact of solid waste, which includes trash, grit and sludge, is assessed in the range of 'Minor' to 'Significant'. For the treatment of the STP sludge, the following are promising technologies:

a. Reuse techniques
b. Product development
c. Disposal techniques

261. a) Reuse Techniques. The sludge can be reused for application on agricultural or forestry land. The only limiting factor is the presence of any toxic chemicals or heavy metals.

262. It is assumed that the STP sludge will not contain hazardous chemicals and toxic metals and can be used by farmers to fertilize their fields. In the case where industrial effluent mixes with STP influent, the respective industry should have its effluent pretreated so as to remove toxic metals and chemicals prior to discharging into the sewerage system and to avoid adding toxicity to the STP sludge. This requirement should be strictly controlled.

263. b) Product Development. The sludge may be processed to convert it into a commercial product (compost). Composting will produce valuable nutrients that can be recycled back to nature. This is cost effective, easy to manage, and marketable. The limiting factors are toxic chemicals and heavy metals.

264. It is assumed that the sludge will be transferred to Sahiwal's proposed solid waste treatment facility, where it will be converted to compost.

265. c) Disposal Techniques. Disposal options for the STP sludge include mainly sanitary landfill and incineration.

266. Sanitary landfill: This technique is used only when it is impossible to reuse the sludge. In order to use this technique for the STP sludge, detailed analysis of its characteristics must be carried out. Also, the geology and hydrology of the landfill site must be carefully examined. The proposed solid management facility at Sahiwal has a sanitary landfill site where the STP sludge can be disposed of (if required).

267. Incineration: Incineration is another disposal option for the STP sludge. The ash produced during this process needs to be properly disposed of, especially if it contains heavy metals. This technique is capital intensive and requires skilled workers. Moreover, there should be air emissions controls and monitoring of the stack emissions. There will be no incineration facility at solid waste treatment and disposal facility.

d. Liquid Waste

268. The liquid waste generally comes from the lube oil used in the various machines and from the STP vehicles. However, at this stage it is not possible to estimate what the quantity of this waste stream will be. The improper disposal of liquid waste can cause air, water, and soil pollution. The impact of liquid waste on the environment is in the category of 'Insignificant' to 'Minor'. As the quantity of this liquid waste is expected to be small, these impacts can be easily mitigated by proper collection, storage, and disposal.

e. Noise

269. a) Sources. There are two types of noise sources, i.e. plant noise and vehicular noise.

270. Plant Noise: At the STP, noise is normally generated from the pumps. The pumps will be placed in the enclosed building which will not allow to disperse noise to nearby areas. The plant operators working at pump station will be required to wear ear plugs and ear muffs for personal safety.

271. Vehicular Noise: The vehicular noise would be one of the added nuisances for the nearby community, especially during the night hours. Generally, well-maintained vehicles create noise within the PEQS level of 85 dBA, which is considered acceptable. There will be no vehicular movement at night time. Also due to less number of vehicles and low frequency of movement, vehicular noise impacts would not be significant.

f. Occupational Health and Safety (OHS)

272. The key OHS concerns in STP operations are as follows:

a. Use of OHS equipment;
b. Aerosols around the aeration tank.

273. a) Use of OHS equipment. There are a number of safety issues at the STP site. For this, there is a need for a comprehensive study on the indications of the hazards and risks posed. The general impression of industrial operations is that the workers hesitate to use OHS equipment. Therefore measures will be implemented to encourage workers to use OHS equipment and procedures on all project sites.

274. b) Aerosols around the aeration tank. Aerosols refer to tiny particles or droplets in the air, such as dust, mist, or fumes. These particles may be inhaled or absorbed through the skin, and can sometimes cause adverse health effects for workers.

275. Aerosols widely differ in terms of particle size and density, and their significance as pollutants. They generally range in diameter from 0.01 to 100 μm. Ultrafine particles smaller than 1 μm in diameter have a higher potential to be inhaled and cause inflammation to the lungs. Charged particles result in electrostatic precipitation. Poly-aromatic hydrocarbons are of great concern because of their carcinogenicity and pro-mutagenicity.

276. Suspended particulate matter below 10 μm in size can exacerbate respiratory diseases, and increase daily hospitalizations and mortality due to respiratory and cardiovascular diseases. Moreover, the indirect effects of smoke can result in a reduction in photosynthesis and a diminution of UVB radiation; the latter can result in increases in infectious airborne pathogens, with corresponding increases in infectious and mosquito-transmitted diseases.

277. The health impacts of aerosols consist of short term acute symptoms, such as asthma, and bronchitis, etc., and long-term chronic irritation and inflammation of the respiratory track, the development of lung cancer, and an overall reduction in the quality of life.

278. In regards to the STP, there will be a light dispersion of minute water droplets in the atmosphere, around the aeration/biological tank. The impact is in the category of 'Insignificant' to 'Minor'. The workers will be instructed to use face masks while working at the aeration tanks.

g. Odor from STP

279. Odor from the STP can be a nuisance for the residents of the Three Marla Housing Scheme and 95/6-R, 94/6-R villages. The impact significance of this nuisance will be in the category of 'Minor' as the distance of Three Marla Housing Scheme and villages is 500 m and 1,000 m respectively. There will be a buffer zone between the STP and the residential areas created by planting trees along the boundary of the plant so as to avoid the dispersion of odor in case the wind direction moves toward these residential areas.

280. Sludge will be dried on sludge-drying beds. There will be a potentially small odor problem from this operation, because the sludge will be stabilized through natural processes. However, the prevailing winds and the site's relatively isolated location should further reduce the already low probability of adverse impacts on the local population.

h. Mosquito/Insect Breeding and Disease Transmission

281. Mosquito larvae generally live in small, shallow water bodies, where disturbance of the surface layer is uncommon. In the biological tanks, there are chances of mosquitos and insect breeding. There is also potential for fly, mosquito or insect breeding at the sludge-drying site. However, once the sludge is dry, it is relatively inert and odorless.

282. The environmental assessment will evaluate various methods of mosquito and insect control, so as to ensure that environmentally sound measures are taken and the plant produces no adverse effect in terms of mosquito-transmitted diseases, such as malaria and dengue. There will be regular anti-mosquito and insecticide spray at the plant facility to address the mosquito and insect problem.

283. Fly and mosquito breeding in the polishing pond and sludge-drying beds can be controlled by the addition of chemicals (for example, calcium hypochlorite or chlorine). The impact significance is ‘Minor”.

i. Possible Emergencies and Plant Failure

284. Operational difficulties may be experienced at plant startup or when there are equipment malfunction. The effluent discharged under these emergency conditions would still be an improvement over the existing condition, where raw sewage is discharged directly into the Nullahs. If the need for chlorination is demonstrated, then chlorination of the effluent could be increased so as to kill any pathogenic organisms.

285. The frequency of such incidents is likely to remain low as long as the personnel are adequately trained, the equipment is maintained, and supplies of spare parts are kept available and utilized, as recommended, to keep all units operational at close to design-efficiency levels. The most likely impact scenario would be that large quantities of sludge would accumulate and would undergo anaerobic processes. Untreated wastewater would only need to bypass the STP and go directly into the canal. This would produce adverse impacts on the environment.

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

287. Maintaining equipment in good operating order is of paramount importance in preventing equipment failure. Training programs for plant operation and maintenance activities should be the part of plant operations. This means that, after the project's contractors have completed their obligations, local authorities will need to make funds available for training and also new equipment parts. The impact, here, is in the category of ‘Significant’.

j. Socioeconomic Impacts

288. Positive socio-economic impacts of the STP will be the creation of job opportunities for the local community, and improvements to environmental conditions and the health of the community. Sludge in raw form or as compost will be available at cheaper rates to the local farming community. This organic fertilizer will enhance the fertility of the farmland.

289. Farmers will not find wastewater to irrigate their fields, which is current practice in the area. This means the operation of the STP will have a significant (negative) impact on the availability of irrigation water. However, even though it poses a problem to farmers, in the long run it will be beneficial to the community health. Irrigating with polluted water transfers pollutants into the food chain and causes the types of carcinogenic and other chronic diseases that might not occur after the STP is in operation.

290. With the operation of the STP and an end to using wastewater for irrigation, farmers might try to steal water from the sewerage pipelines. This will require strict monitoring of these pipelines so as to avoid such practices.

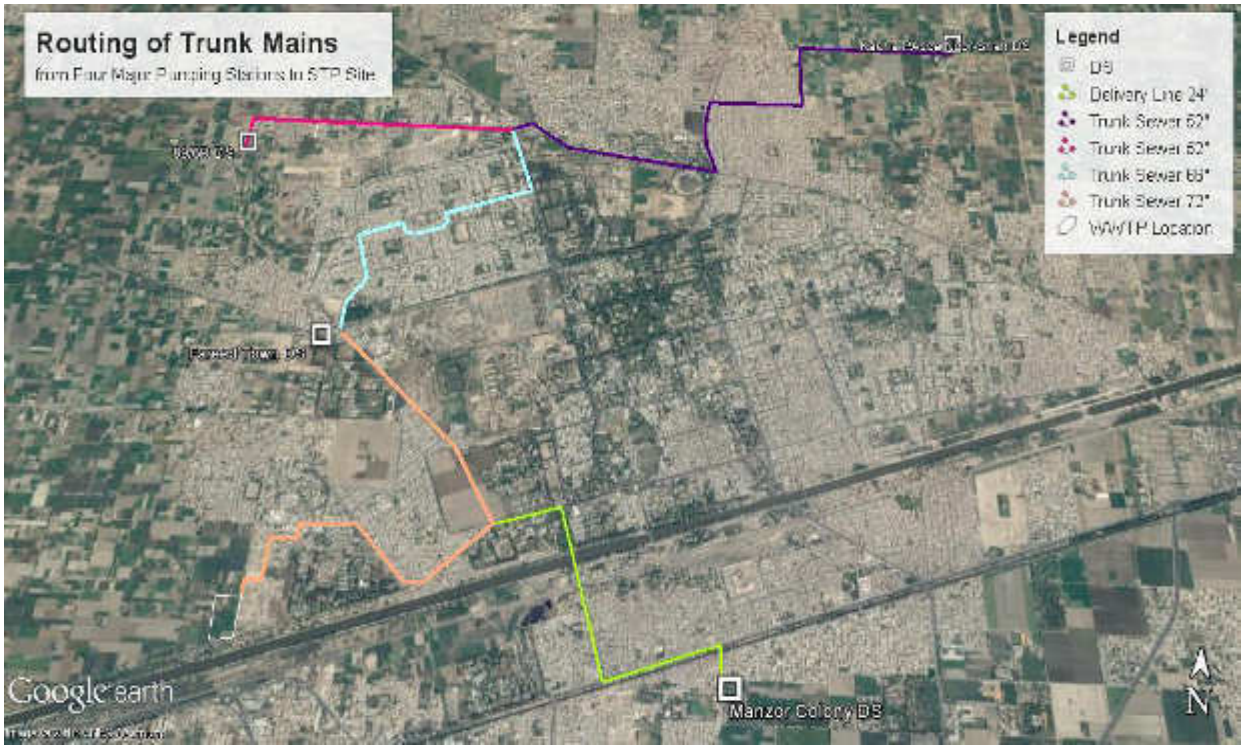
k. Impacts of Trunk Main Sewer Line

291. Trunk main sewer line will be laid down for the conveyance of city sewage to the STP. This main line will connect minor disposal stations to major disposal station and to the STP. The minor disposal stations will be abandoned and used in case of emergency. The major disposal stations will act as pumping stations for STP. This main sewer will pass through the whole city as shown in Figure-5.1.

292. The impacts associated with the sewer line mainly comprises of construction phase impacts, traffic congestion at points where roads will be dug and loss of built structures. Traffic congestion and loss of built structure will be insignificant impacts. Traffic management would be

challenging task. Compensation would be given to the affected persons for their loss of built structure. Affected structures, roads and natural features should be protected during construction and then rehabilitated to their original shape. The twice of the cut trees should be planted again at affected sites.

Figure-5.1: Routing of Trunk Mains from Four Major Pumping Stations to STP Site



l. Increase in Roadside Traffic of the Area

293. Traffic will be increased due to movement of sludge carrying vehicles and staff cars at and around the site. However, the volume of these vehicles will not be much. Traffic management will be carried out by equally distributing the traffic volume during the day shift time to avoid congestion at nearby connecting roads. The sludge will be carried away from the plant twice a week.

m. Impacts on Ecology of the Area

294. The impact on flora, fauna and geologic conditions is assessed through the loss or damaging of the residences of the plant and animal species. Regarding the loss or damaging of resident plant and animal species, there are no resident protected or endangered species, plants or animals at this site.

295. As there are no natural reserves or important ecosystems in the vicinity of the site, no severance of wildlife corridors is likely to occur.

xv. Mitigation Measures during Operational Phase

296. During the operation phase, the plant manager will have the primary responsibility of exercising good and proper management of the STP. Most of this activity should be covered in the management manuals devised for the plant's operations. These manuals will outline procedures for managing or otherwise responding to the following:

a. Operational failure resulting from obstructions in pipelines, screens, etc.;
b. Pump failures, equipment malfunctioning, and treatment process failures, etc., of any kind in the plant;
c. Operational failure resulting from fuel, oil, and volatile chemicals arriving at the plant;
d. Plant emergencies, such as general power failures, storms, etc.;
e. Safety measures, including fire protection equipment, procedures for access to confined spaces, limiting hazardous and toxic gas exposure, training personnel in the proper and safe operation of all equipment, training to avoid exposure to hazardous situations, such as encountering high voltage electrical gear, training for safe driving and for general safety procedures to avoid personal injury, such as muscle strain or damage to eyes, ears, hands, feet, head, etc.;
f. Dealing with noxious conditions, such as odors from the inlet structure and related equipment, and the sludge-management facilities;
g. Handling dangerous or corrosive chemicals, such as acid and lime;
h. Handling other special chemicals, such as polymers;
i. Cleaning sludge trucks to avoid the accumulation of offensive deposits;
j. Handling operational problems, such as spills or overflows of chemicals, sludge, pump stations, etc.;
k. Influent and effluent monitoring of the STP for operational control and for the preparation of monitoring reports for submission to the EPA;
l. Periodic monitoring of air emissions and noise from all vehicles being used for the STP and comparing the noise with acceptable levels established by the PEQS;
m. Maintaining a barrier of trees in the buffer zone to reduce the dispersion of air pollutants;
n. Preparing and implementing a traffic management plan for vehicles moving to and from the STP.
o. Enforcement of the PPE for the staff working in the laboratory and chemical stores;
p. Use of gloves, safety shoes and masks by the operators of pumps, aerators, scrappers and sludge belt press;
q. Noise control measures for the equipment, including proper maintenance and greasing of noise-producing equipment (pumps), the enclosure of noise-producing equipment, tree planting at the boundary of the project site to reduce the noise level;
r. Disposal of domestic waste at the officially designated municipal solid waste dumping site;
s. Disposal of containers, mechanical parts, and discarded material by selling them to downstream recyclers and re-users; and,
t. Safe disposal of liquid waste (e.g. entering into agreements with the major suppliers of lube oil to take them back after use).

297. In addition, it will be essential for the plant manager to be appropriately motivated and trained to manage the plant and its operators so as to achieve high quality plant performance. This will entail keeping equipment working properly through regular maintenance and repair, the regular monitoring of effluent quality, and the monitoring of influent for general water-quality parameters. The plant manager will also need to liaise with the general public and the SMC, and deal with complaints to the community's satisfaction.

VI. ENVIRONMENTAL MANAGEMENT PLAN

298. The main purpose of the Environmental Management Plan (EMP) is to provide a strategy for environmental protection. According to this plan, all the activities associated with the subprojects are controlled and monitored from the design phase, through construction, commissioning and operations. Problems that occur during the project's development are to be identified and rectified so as to prevent damage to the environment. The EMP addresses specific impacts identified in the IEE. If some issues have been overlooked, then the EMP should be amended, in consultation with the regulatory authorities, so as to ensure effective mitigation is implemented. The EMP aims to ensure that:

- It is implemented at each stage of the project;
- The project activities are managed so as to avoid or reduce the negative environmental and social impacts and enhance positive impacts;
- The surrounding communities are better off after the project is implemented, on social and environmental indicators;
- Precautions are taken against damage, and claims arising from damage are handled, in a timely manner;
- Information flow between the client, consultants, contractors and affected parties, if any, is optimized to ensure that all role players are aware of their particular responsibilities;
- Affected structures, roads and natural features are protected during construction and then rehabilitated according to the guidelines in the EMP;
- Local labor and entrepreneurs from the affected communities are used throughout the project and for project related activities wherever possible;
- Accurate records of the progress of the project (including objections) are maintained so that the concerned can be traced out in the event of claims against the client;
- The monitoring reports are produced for regulatory bodies. Their frequency and content are agreed upon prior to start of the construction phase; and
- The mechanisms are in place for reviewing the efficacy of the mitigation plan and any improvements made in the course of the projects, so that other similar projects may benefit from the experience gained.

299. The EMP contains the following information to be used for its effective implementation:

- Responsibilities or potential skills of individuals, groups, government agencies and NGOs for carrying out mitigation actions identified in the EIA assessment;
- Guidelines for communication between all parties with responsibilities for implementing the mitigation plan;
- Costs of implementing the mitigation measures;
- Institutional and training requirements for implementing the mitigation measures;
- A monitoring program to track project related events and progress in implementing the mitigation measures;
- Community liaison procedures; and
- Mechanisms for improving the mitigation plan.

A. Environmental Management Plan (EMP)

300. The environmental management plan (EMP) for those subproject activities which have environmental impacts of medium risk is provided in Table-6.1. This plan gives an overview of planned mitigation measures, frequency of monitoring, monitoring requirement and responsibilities.

B. Institutional Arrangements

i. Sahiwal Municipal Corporation (SMC)

301. Sahiwal Municipal Corporation (SMC) is the overall executing agency for the water supply, sewerage, transport routes and green spaces development projects in Sahiwal. The Mayor of Sahiwal is the executive head of the Municipal Corporation. The Deputy Mayor performs the functions of the Mayor if the Mayor is unable to perform functions on account of absence or for any other reason. The Mayor heads the municipal Corporation. He is assisted by the Chief Officer (CO). The CO coordinates and facilitates the performance of functions assigned to the Municipal Corporation under the supervision of the Mayor. The CO is the focal person in the Municipal Corporation. He acts as the coordinating and administrative officer in-charge of the offices and units of the Corporation.

302. There are five Municipal offices of the Corporation including i) Planning and Coordination; ii) Municipal Regulations; iii) Infrastructure; iv) Services; and v) Finance. A Municipal Officer (MO) heads each corporation office. These offices work under CO. The MO Infrastructure and MO Services are responsible for water supply, sewage and sewage treatment and disposal, storm water drainage, sanitation and solid waste, roads and streets, traffic planning, street lighting, firefighting, parks and slaughter houses in the Municipal Corporation. In addition, this office provides all engineering related support to other offices of the corporation (and where requested to the Union Administration).

303. Overall the SMC would be responsible for the implementation and execution of all the above mentioned projects. The water supply, sewerage and drainage, green spaces and transport routes improvement projects would be executed directly by the SMC through contractors.

304. The construction of the sewage treatment plant will be under an independent organizational setup wherein private company will work under the direction of the SMC.

ii. Sahiwal Water and Sanitation Company (SWSC)

305. In the pre-feasibility study, it has been proposed that a private company should be established under the SMC, under section 42 of the Companies Ordinance 1984. This company would have full responsibility to construct, operate, and maintain water and sanitation services, and also the operation of the facility in the declared urban areas of Sahiwal city. This is already current practice in Pakistan.

306. The current SMC can entrust the water and sanitation functions to the SWSC, under sub-clause 2 of clause 54 of the Punjab Local Ordinance 2001. The SWSC will have its own senior staff and will take over the SMC's project-related operational staff. The proposed company would be aligned with the SMC. The technical and professional management staff will be competitively recruited from the market and tasked with improving service delivery. Incentives will be better aligned with performance and designed to reward results. The SWSC's finances will be ring-fenced, rigorously audited, and not intermixed with those of the SMC. The operation of the STP will be the responsibility of the SWSC. The company can outsource the STP operation to any other company. Figures 6.1 shows the proposed organogram of the SWSC.

iii. The Urban Unit

307. The Urban Unit was established in 2006, as a Project Management Unit (PMU) of the Planning and Development department under the Government of Punjab. In 2012, it underwent significant transformation and converted into an independent private limited company, registered with the Securities and Exchange Commission of Pakistan (SECP).

The objective of The Urban Unit is to provide guidance and support to Government departments in developing urban sector reforms and to coordinate the implementation of the reform program.

308. Thematic areas of coverage include GIS, urban planning and design, solid waste management, water and sanitation, urban transport, municipal finance and urban economics, information and communication technology, management information system, capacity development and social and environment safeguards, and monitoring and evaluation (M&E). It is an important partner and interlocutor for PICIIP activities in Sahiwal and Sialkot.

iv. Environmental Safeguard Specialist

309. The Urban Unit established under Punjab Government will facilitate SMC in managing environmental concerns of the proposed projects and implementing environmental safeguard. The environmental safeguard specialist consultants will be hired for providing resources for environmental safeguard management as appropriate and required. The Urban Unit with the assistance of environmental safeguard specialist consultants will be responsible for:

a. Monitoring the implementation of environmental management measures required for each subproject.
b. Preparing environmental screening checklists and classifying subprojects that have not been yet classified.
c. Based on the checklist and as per the requirements of ADB SPS (2009), PEPA1997and relevant provincial Environmental Protection Acts, preparing IEEs and EMPs.
d. Submitting the checklists and IEE reports to ADB as part of the approval of subproject.
e. Ensuring that EMPs are included in tender documents.
f. Ensuring that all regulatory clearances are obtained before starting civil works for the subproject.
g. Ensuring that the EMPs, including all proposed mitigation measures and monitoring programs are properly implemented.
h. Undertaking monitoring of subprojects and preparing environmental monitoring reports and delivered to ADB.
i. In the case of unpredicted environmental impacts occurring during project implementation, preparing and implementing a Corrective Action Plan (CAP).
j. In the case that a Category B subproject needs to have its sitting or alignment changed or its environmental classification reconfirmed, reviewing it to determine whether a supplementary study is required. If so, carryout the study and implement any amendments to the original EMP.
k. Preparing a project specific EMP for the operations that includes a Site Specific EMP for each of the work areas.
l. Providing awareness training in environmental management for all employees working on the subproject.
m. Ensuring that meaningful public consultations (including both men and women) are undertaken with affected groups and local NGOs. The list of people attending the consultation, time and locations, subjects discussed during consultation will be recorded in a systematic manner.
n. Sharing information and disclosure of environmental safeguard documents (including any Corrective Action Plans prepared in cases of change to original project design) as required

v. ADB

310. ADB will take the following responsibilities:

- Review project IEEs as a basis for the approval of subprojects.
- Publicly disclose the final IEE before project appraisal, and afterward updated IEE and corrective action plan prepared during project implementation, if any, as well as environmental monitoring reports on the ADB website.
- Monitor the implementation of the EMP and due diligence as part of overall project review mission.
- Provide assistance to the SMC, if required, in carrying out its responsibilities and safeguard capacity building.

vi. Civil Contractor

311. For water supply, sewerage and drainage, transport routes improvement and green spaces development projects, civil contractors will be hired directly by SMC. However, the civil contractors for the STP will be hired by the respective company under a prescribed bidding process for the construction of the civil infrastructure and the installation of the mechanical and electrical equipment. The responsibilities of the civil contractor will be as under:

- Ensure compliance of CPEMP and CSP throughout the construction activities
- Ensure efficient site management for the storage of equipment, stockpiling materials etc.;
- Ensure construction plan devised and agreed with the SMC ;
- Ensure compliance of the construction plan;
- Ensure quality of the infrastructure as per mentioned in the construction contract;
- Recruit labor from local communities first;
- For the construction camp on the site, ensure appropriate sanitary arrangements, accommodation and drinking water availability;
- Liaise with the local communities regarding services and goods supply at the site;
- Liaise with the local communities regarding construction activity, time span, likely nuisances such as noise, dust and disturbance;
- Ensure provision of appropriate night lights (if required) and standby power sources; and
- Plan working hours to provide minimum disturbance to the community.
- The contractor will not cut down the trees supporting nesting places at project sites. These trees will be surveyed and marked with utmost precision.
- The Contractor will enforce strict vigilance to his work force for any killing, shooting, poaching or injuring wildlife fauna in the project vicinity.
- Nearby wetlands or marsh areas which offer shelter or feeding places for the local birds and animals, would be protected by the Contractor from any illegal usage.

vii. District Environment Officer (DEO)

312. The district's environment department is the sub department of Works and Services Department of District Government Sahiwal and is headed by the District Officer Environment. The major functions of the department include:

o. To assist Provincial Environment Protection Agency (EPA) in the discharge of its functions under the Pakistan Environment Protection Act,1997

p. Regulate motor vehicles subject to the provision of the Pakistan Environment Protection Act,1997 and the rules and regulations made there under

q. To ensure, guide and assist the proponents of new projects in submission of initial environmental examination (IEE)/Environmental Impact Assessment (EIA) to the DG Punjab EPA for approval.

r. Identify the needs for legislation in various sector of the environment

313. District Environment Officer (DEO) of Sahiwal under Environmental Protection Department (EPD), Punjab will be overall responsible for the enforcement of PEQS through his inspectors. He will be responsible for the compliance of following:

- Municipal and liquid industrial effluent parameters (32) for discharge to in land waters, sewage treatment facilities, and the sea.
- Industrial gaseous emissions (16) into the atmosphere.
- Motor and vehicle exhaust and noise (3)
- Ambient air quality (9)
- Drinking water quality (33)
- Noise for residential, commercial, industrial and silence zones

viii. STP Plant Operational Staff

314. The following operational staff will work at the STP under the SWSC:

315. The Manager Wastewater or Plant Manager O&M will be responsible for the following tasks, during operation of the STP:

a. Manage plant efficiently at all times;
b. Maintain the cleanliness of the site and facilities;
c. Recruit highly motivated and well-trained staff to run the plant;
d. Ensure staff is aware of the contents of the operational manuals (on the wastewater treatment, in particular) comprising safety procedures, emergency, shut-down, or accidental injury on the site;
e. Ensure all equipment is regularly maintained and repaired;
f. Keep stocks of spare parts in case of equipment failure;
g. Ensure daily monitoring of effluent quality and that problems are remedied as soon as possible;
h. If there are problems with receiving un-authorized wastewater, then the Plant Manage, in coordination with the TMA, will identify the source of the problem and take remedial action;
i. Ensure the timely removal of sludge from the site to the landfill;
j. Ensure the instant diagnoses and repair of leaks, spills and blockages, and alert the relevant communities of any imminent health hazards in the discharge area;
k. Liaise with community organizations regarding the nature and functions of the plant and their relationship with its operations;
l. Ensure the timely redress of complaints about the plant;
m. Maintain a record of complaints received and actions taken;
n. Ensure positive responses to requests for site visits, etc., with the view to enhancing relations with the locals and other institutions;
o. If monitoring shows that the effluent treatment is inadequate and does not meet what would be expected of the technology in place and the quality standards, then the Manager will take action to install the appropriate treatment;
p. If necessary, seek advice on how to improve the situation, especially if the equipment is not performing to the specifications;
q. Ensure sludge dewatering and removal takes place in an efficient and environment-friendly manner;
r. Devise an odor-control system if problems occur and persist; and
s. Ensure compliance with the Tree Plantation Plan, the Preventive Maintenance Schedule and the Safety Manuals

316. The Assistant Manager Operation will assist Manager Wastewater and will be responsible for the smooth operation of the STP.

317. The following responsibilities are identified for the Plant Operators O&M Team:

a. Read and digest the operational and safety manuals;
b. Ensure that safety and firefighting equipment are in place and accessible;
c. Ensure regular maintenance of the equipment;
d. Report to the Plant Manager any malfunctioning of the equipment and equipment failure; and
e. Ensure team members maintain responsible and conscientious attitudes toward the execution of their duties, at all times.

C. Local Regulations for Acquiring Environmental Approval

318. As per Government of Punjab, the SMC will have to prepare and submit environmental assessment reports of these projects to EPD Punjab to get construction phase No Objection Certificate (NOC), prior to start of construction or implementation. These reports will have to be prepared as per IEE or EIA guidelines. The public hearing and presentation of the project in front of nominated Expert Committee of EPD are also the requirements. After getting NOC, the construction can be started. The construction requires implementation of construction phase EMP, as given in the EIA or IEE report. After the completion of construction, the environmental compliance report, as per EMP of the EIA or IEE, will have to be submitted along with the application for the grant of operational phase NOC. After getting operational phase NOC, the project will then be started.

319. The water supply, sewerage, transport routes and green spaces development projects do not require any NOC from EPD as per EIA/IEE regulation. The STP would require NOC from EPD.

D. Environmental Training Needs Assessment

320. For following the environmental compliance and preparing the environmental assessment reports, SMC and SWSC do not have the capacity. SMC and SWSC will need support from environmental consultant for monitoring environmental parameters of the projects and preparing performance reports for ADB. The consultant will be responsible for the preparation of environmental assessment, monitoring and performance reports and submitting it to ADB, training of the SMC and SWSC staff on ADB's environmental safeguards during construction and operational phases, translation of EMP actions into on ground implementation etc.

321. Frequent training on environmental compliance would be required by those within the SMC Infrastructure and the services officials and SWSC staff. Most of this training will be conducted on-the-job and in workshops.

Table-6.1: Planned Environmental Monitoring

Subprojects	Mitigation Measure	Monitoring Requirement	Frequency	Responsible
Construction Phase				
- New OHRs - Bus stands - Trunk main - STP	**Soil Pollution Control** - Placement of secondary containment under fuel/lubricant containers and generator fuel oil tank to collect spillage and leakage - Placement of fuel/lubricant container on paved floor at enclosed place - Properly collect and dispose waste lube oil/oily rags after maintenance - Avoid spill and leaks of oil, lubricants on floor during maintenance activities - Immediate cleaning the spillage and leakage from the ground with saw dust/cloth and dispose of as solid waste	Strict monitoring of best practices during fuelling, oiling and maintenance activities with regard to soil contamination	Daily	Contractors Supervision by SMC
- DNI zones - Water supply pipe replacement - New OHRs - Sewerage pipe replacement - Bus stand - Trunk main - STP	**Dust Suppression** Regular water sprinkling at dust producing areas during construction activities by the contractor to suppress dust (Construction Phase Environmental Mitigation Plan-CPEMP, would be appended with the contractor bidding document)	Monitoring of water sprinkling practices at construction site	Daily (during construction period)	Contractors Supervision by SMC
- Water supply pipe replacement - Trunk main - Sewerage pipe replacement - Bus stand - STP - New OHRs	**Noise Control** - Contractor will operate well maintained vehicles and construction machines to avoid noise at the construction site - Regular maintenance of vehicles and construction machinery would be the responsibility of the contractor (Proper lubrication, oiling and greasing of the moving parts of the machines) - Regular monitoring of vehicular and machines noise	- Review of maintenance record of vehicles and machines - Noise monitoring of vehicles, machines and surrounding areas of the construction sites - Monitoring of noise control measures taken by the contractor (in case noise levels are higher than PEQS	- Review of maintenance record for every new vehicle/machine arriving at site - Daily noise monitoring & recording of	Implemented by contractors and monitored by SMC

Subprojects	Mitigation Measure	Monitoring Requirement	Frequency	Responsible
	- Taking appropriate maintenance measures in case noise level increases to 85dBA - Vehicle/machines movement is allowed only at day time - High noise producing machines would be enclosed or provided with noise barriers at site to attenuate noise levels - There will be no construction activity or movement of vehicles at night time - Noise control measures would be part of CPEMP	and 85 dBA)	vehicles/machines and surroundings three times (Morning, noon, afternoon)	
- Water supply pipe replacement - Trunk main - Sewerage pipe replacement - Bus stand	**Traffic Management** - Vehicles will be instructed to have reduced speed limit of 30 km per hour at the residential areas to avoid accident - Construction material carrying vehicles will be covered from the top to avoid dispersion of dust in the surrounding areas - In case of large number of vehicles arriving at the site, these will be planned in such a way that these should arrive at the site in different timings of the day to avoid traffic jam and nuisance for the nearby community - Proper road marking and sign board posting at residential and commercial areas - Cordon off the construction work areas and diversion of traffic to other sides as per traffic plans - Prior communication of alternative routes to the public to avoid traffic congestion at construction site	- Strict monitoring of speed limits and frequency of arrival at the site - Monitoring of road marking and signboard placing at the road side - Alternative rout plans and communication to public for the affected roads	Daily (during construction period)	SMC
Bus stands	**Construction Waste Disposal** - Disposal of construction waste at depressions - Avoid dumping at residential areas - Avoid dumping in the water bodies - Construction waste dumping practices would be part of CPEMP	Monitoring of construction waste dumping practices	Daily (during construction period)	Contractors, supervision by SMC
- Water supply pipe	**Domestic Solid Waste Disposal**	- Monitoring of solid waste	Daily	Contractors,

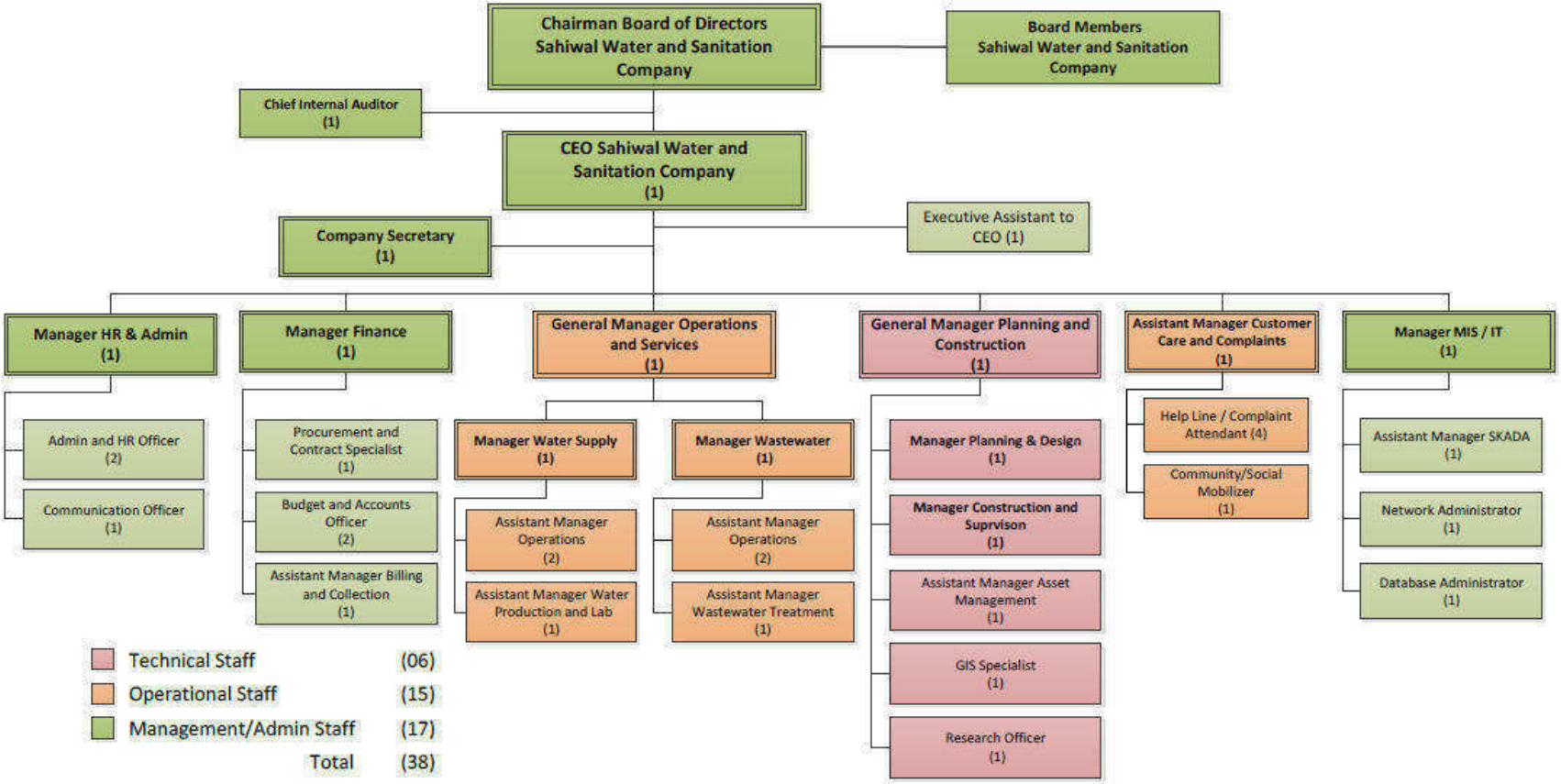
Subprojects	Mitigation Measure	Monitoring Requirement	Frequency	Responsible
replacement - Sewerage pipe replacement - Bus stand - Trunk main - STP - New OHRs	- Contractor will be instructed in the CPEMP for properly collection and dumping of domestic solid waste at the designated municipal solid waste dumping site	management at site regarding proper collection, placement and dumping at designated site		supervision by SMC
- Water supply pipe replacement - Sewerage pipe replacement - Bus stand - Trunk main - STP - New OHRs	**Sanitary Wastewater Disposal** Sanitary wastewater will be disposed of nearby drain after treatment in the septic tanks	- Construction and operation of septic tanks at the site - Proper disposal of sanitary wastewater at the drain/sewers - Monitoring of wastewater parameters (pH, BOD_5, COD, TSS, TDS)	- Start of construction activities - Daily - Weekly	Contractors Monitoring by SMC
- Water supply pipe replacement - Sewerage pipe replacement - Bus stand - Trunk main - STP - New OHRs	**Health and Safety of Workers** - Contractor will provide Construction Safety Plan (CSP) along with the bidding and contract document which will be implemented during the construction period - Contractor will be responsible for providing and strictly implementing the use of safety gadgets by the workers during construction activities. - Availability of first aide medical facility at sites	Monitoring that the CSP is properly implemented at the site by the contractor	Daily	Contractors, supervision by SMC
Operational Phase				
Chlorination facility at tube wells and OHRs	<u>Transportation:</u> Sealed containers of chlorine will be transported at site <u>Storage:</u> - Closed and locked storage of chlorine containers - Labeling, precautions/instructions at storage place in Urdu language - Secondary containment for chlorine container - Use of spill kit	Regular monitoring of safe handling and storage practices	Daily	SMC

Subprojects	Mitigation Measure	Monitoring Requirement	Frequency	Responsible
	- Proper ventilation at storage place Handling: - Only authorized person for the dispensing of chlorine through pump under secondary containment - Use of face mask, gloves and apron during chlorine handling activities			
Algal growth in OHRs	Cleaning and disinfection of OHRs	Ensure that OHRs are being cleaned as per OHR cleaning procedure	Annually	SMC
Sewage Treatment Plant (STP)	**Plantation of Trees** Plantation of trees at boundary of the plant	Progress review of tree plantation as per tree plantation plan	At start of construction and then review biannually	SWSC
	Sanitary Wastewater Sanitary wastewater will be treated in the STP	- Ensure that the sanitary wastewater is treated in STP - Monitoring of wastewater parameters (COD, TSS, TDS)	Daily	SWSC (Plant Manager)
	Generator Emissions Regular maintenance and tuning of combustion chambers of generators Regular monitoring of air pollutants and adjust air fuel ratio accordingly for generators	- Ensure that the maintenance of the generators is carried out as per preventive maintenance plan - Regular monitoring of stack emissions of generators	Quarterly (CO, SOx, NOx)	Plant Manager of SWSC
	Vehicular Emissions and Noise Use of maintained vehicles at project site to reduce noise and air pollution - Regular monitoring of vehicular noise levels - Taking appropriate maintenance measures in case noise level increases to 85dBA - Vehicle movement is allowed only at day time	- Review of maintenance record of each vehicle - Noise monitoring of vehicles	- Biannually - Monthly	SWSC (Plant Manager)
	Liquid Waste Proper collection, storage and handing over the liquid waste to the licensed lube oil recyclers	Ensure that the waste lube oil is properly collected, stored and transferred to the recyclers	Monthly or as per requirement	SWSC (Plant Manager)
	Plant Noise Control Exercising preventive maintenance of the plant	- Ensure that preventive maintenance plan is in place	Regular	SWSC (Plant Manager)

Subprojects	Mitigation Measure	Monitoring Requirement	Frequency	Responsible
	machinery - Proper lubrication, oiling and greasing of the moving parts of the machines - Noise proof enclosure around noise producing machines such as pumps, generators, compressors etc. - Exercising the use of ear plugs and ear muffs by the workers at plant - Plantation of trees at the boundary wall of the plant to attenuate noise levels	- Ensure that maintenance plan is implemented - Ensure that noise enclosure exist at noise producing areas - Ensure that workers use ear plugs/ear muffs at high noise areas - Ensure tree plantation at boundary of the plant as per Tree Plantation Plan		
	Health and Safety Strict enforcement of Operational Safety Plan of STP - Strict enforcement of use of safety equipment during working at the plant - Strict enforcement of adopting safety precautions during maintenance work - In house first aide medical facility	Ensure that Operational Safety Plan is implemented at plant site	Daily	SWSC (Plant Manager)
	Odor Control Tree plantation at boundary of the plant to attenuate odor impacts to nearby community	Ensure that Tree Plantation Plan is implemented	Biannually	SWSC (Plant Manager)
	Mosquito /Insects Breeding Weekly spraying of anti- mosquito and insecticides spray at trash and sludge areas - Use of mosquito repellent lotion by the workers	- Ensure that there is weekly spray of anti mosquito and insecticides at sludge drying beds and trash removal areas	Weekly	SWSC (Plant Manager)
	Plant Failure Preventive maintenance - Inventory of spare parts - Standby arrangement of crucial equipment such as pumps - Arrangement of standby power source i.e. generator - Training of workers on operation and maintenance of the plant - Maintenance of daily log book - Monitoring of crucial plant parameters - Taking appropriate measures as per monitoring of	- Ensure that preventive maintenance plan is implemented - Ensure that there is sufficient inventory of spare parts - Regular monitoring of effluent characteristics (BOD_5, COD, TSS, TDS etc.) - Regular monitoring of sludge quality (Cu, Cr, Ni, Hg) - Regular monitoring of stack	- Daily - Daily - Daily - Daily	SWSC (Plant Manager)

Subprojects	Mitigation Measure	Monitoring Requirement	Frequency	Responsible
	parameters	emissions of generators		
	Air Emissions from Biological Tanks Regular monitoring of NH_3 and H_2S gases near the aeration/biological tanks and take appropriate measures in case concentration of these gases is above threshold limit values	- Regular monitoring of the gases	Daily	SWSC (Plant Manager)
	Disposal of Sludge and Trash Dumping of trash and sludge at proposed solid waste treatment facility	Ensure that trash and sludge is properly transferred to the solid waste treatment facility	Daily or as per requirement	SWSC (Plant Manager)
	Aerosol from Biological Tanks Strict enforcement of face mask while working around aeration tanks	Ensure that trash and sludge is properly transferred to the sanitary landfill site of Sahiwal	Daily or as per requirement	SWSC (Plant Manager)
	Stealing of Wastewater Strict monitoring/guarding of sewerage pipelines to avoid stealing of wastewater	- Patrolling of sewerage network to ensure that untreated wastewater is not being taken by the local farmers for irrigation	Daily (day and night)	SMC

Figure-6.1: Proposed Organogram of Sahiwal Water and Sanitation Company



E. Grievance Redress System

322. The SMC will establish a Grievance Redress System (GRS) to facilitate the resolution of community complaints and grievances about the project's environmental performance. This is in line with the requirements of the ADB's SPS 2009. Under this mechanism, a Grievance Redress Cell will be established.

323. The private company (SWSC) which is established under SMC for implementing and executing the STP, and the civil contractors, will maintain a Community Complaints Management Register (CCMR), at the site, for logging complaints and grievances. These registers will be completed and maintained with the assistance of the SMC. All written and oral grievances will be recorded in the Register. The information will include the date and the particulars of the complainant; a description of the grievance; the follow-up action required; the person responsible for implementing the action; and a target date for its completion. The private company will primarily be responsible for redressing the grievances that fall within its jurisdiction, under the overall supervision of the SMC. Construction-based grievances will be redressed mainly by the SMC. The SMC will also frequently check the CCMR and take any necessary actions in cases where the private company is not following the system.

324. The affected communities and their representatives will be identified during the project preparation stage. The SMC will work toward resolving any grievances recorded in the CCMR, within seven calendar days, in conjunction with the companies' management and the contractors.

F. Environmental and Social Complaint Register

325. The STP management team (Plant Manager) will maintain an environment and social complaint register, at site office, to document all complaints received from the local communities. The register will also record the measures taken to mitigate these concerns. The final report will be communicated to the SMC. The SMC monitoring team will monitor the implementation of social and environmental mitigation measures as per the ADB Safeguard Policy Statement.

G. Environmental Management Costs

326. The cost of environmental management includes costs associated with human resources, mitigation measures during construction and operational phases, and laboratory testing charges. Table 6.2 shows the estimated cost of implementing the EMP.

Table-6.2: Cost Estimate for Environmental Management

Particulars	Detail	Unit Rate (Rs)	No. of Units	Total Amount (Rs)
Environmental Safeguard Specialist	One person for 1 year responsible for compliance of ADB and GoPb requirements and training of SMC and private company staff	150,000/month	12	1,800,000
Construction phase compliance of CPEMP	Contractors will be responsible for implementing Construction Phase Environmental Mitigation Plan (as appended with the bidding and contract documents).	-	-	-

Particulars	Detail	Unit Rate (Rs)	No. of Units	Total Amount (Rs)
	These costs will be included in their bids and will be part of their overall construction cost			
Tree plantation	Trees will be planted at STP, and at all those places where existing tree were cut during construction or rehabilitation activities as per Tree Plantation Plan	50	500	25,000
Monitoring equipment (1 sets)	i) Noise meter ii) Light meter iii) NH_3 and H_2S gas detectors iv) Glass thermometer v) Infrared thermometer vi) COD apparatus vii) pH meter viii) TDS/conductivity meter	Lump Sum		500,000
Laboratory Testing Charges Construction Phase (2 to 4 months)	i) PM monitoring ii) Stack flue gas analysis for generators and vehicles iii) Wastewater analysis iv) Water quality analysis	i) 3,000 ii) 3,000 iii) 6,000 iv) 6,000	i) 30 ii) 150 iii) 35 iv) 35	960,000
Laboratory Testing Charges Operational Phase (2 year)	i) PM monitoring ii) Stack flue gas analysis for generators and vehicles iii) Wastewater & sludge analysis iv) Water quality analysis	i) 3,000 ii) 3,000 iii) 8,000 iv) 6,000	i) 30 ii) 250 iii) 100 iv) 100	2,240,000
Personal Protective Equipment (2 year)	i) Dust masks ii) Face masks iii) Ear plugs iv) Ear muffs v) Safety helmet vi) Safety shoes vii) Safety gloves viii) First aid boxes ix) Firefighting equipment	Lump sum		400,000
Environmental NOC Expenses for STP	i) Fee for EIA report submission to EPD ii) Public hearing expenses iii) Expenses for follow up	Lump Sump		200,000
Environmental training of the SMC and private	i) General environmental awareness ii) ADB safeguard requirements	Lump Sum		500,000

Particulars	Detail	Unit Rate (Rs)	No. of Units	Total Amount (Rs)
company staff	iii) GoPb environmental legislation and compliance requirements iv) STP environmental issues v) STP EMP vi) Monitoring requirement vii) Health and safety viii) Firefighting			
Total				**4,825,000**

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

327. Public consultations have been carried out during the prefeasibility study stage and during this feasibility study, with different stakeholders. These stakeholders included the local communities directly or indirectly affected either positively or negatively by the project components, NGOs, government departments, and private sector bodies. At the feasibility study stage the consultations have been carried out during preparation of the Gender Analysis and Gender Action Plan, the Poverty Analysis and Social Development Plan, and the Land Acquisition and Resettlement Action Plan. The summary of these consultations is presented in this chapter.

328. The objective of the Public Consultation process was to involve stakeholders from the earliest stages. The viewpoints of the stakeholders have been taken into account and their concerns and suggestions for possible improvements have been included where appropriate. Much of the consultation process to date has resulted in positive feedback from the stakeholders. They appreciated the project components which would improve their lives, but with some concerns relating to land acquisition reimbursement.

329. There is also a requirement for ongoing consultation for preparation of the Land Acquisition and Resettlement Plan (LARP), which is being documented separately. It is expected that this process will continue through all stages of the subproject in order to accommodate stakeholder aspirations and to orient the stakeholders positively towards the project implementation, and where possible to harness cooperation over access issues in order to facilitate timely completion.

330. The environmental assessment process under the Pakistan Environmental Protection Act only requires the disclosure to the public after the statutory IEE / EIA has been accepted by the relevant EPA. In this IEE, the consultation process was performed to satisfy the ADB requirements.

A. Results of Public Consultations

331. This section provides results of various public consultations carried out during prefeasibility and feasibility study stages.

i. Prefeasibility Study Stage Public Consultations

332. Consultation meetings were conducted with identified primary, secondary and key stakeholders. Discussion points of the meetings focused on gathering information on the organization's set up, to conceive their strengths and weaknesses; their priority related issues and concerns; willingness to support the project and its activities including possible assistance.

333. Listening to stakeholder concerns and feedback was a valuable source of information that improved project related aspects and outcomes, and helped to identify and control external risks. In this regard meetings were conducted with TMA authorities such as the Administrator, TMO, TO Finance, TO Infrastructure &Services and TO planning, to brief them regarding the project objectives, and to obtain feedback regarding the available resources with TMA Sahiwal. In addition, meetings

were conducted with NGOs and civil society activists who are involved with different aspects of development in Sahiwal. The main NGOs in the area, such as Finca, Kashaf Foundation, U-Micro financing, Waseela, Tameer Bank and Akhoowat were consulted to understand the social and economic conditions of the area.

334. The meetings with stakeholders assessed the existing infrastructure practices, problem identification, root causes associated with them, needs, demands and priorities and explored the different options for future coordination.

335. The main topics discussed were:

i. Availability of poor urban infrastructure services with the old and outdated water supply system which does not perform efficiently;
ii. Non-availability of the landfill sites for proper dumping of the solid waste;
iii. Blocked and choked sewage lines at various places;
iv. Lack of a Social and Resettlement Expert to manage the LAR issues during the project execution;
v. Community ignorance regarding the city cleanliness;
vi. Community willingness to participate in the project activities in terms of monetary and physical participation;
vii. The TMA will replace the various sections of water supply line and restore the abandoned bores under the PCIIP;
viii. The TMA will upgrade the damaged sections of the sewage pipelines under the PCIIP;
ix. District Government (through the Revenue Department) will identify the landfill site;
x. NGOs will help the project proponent in identification of problematic areas in terms of poverty and gender issues;
xi. The Resettlement Expert will build the capacity of the concerned department to address the safeguard issues in concurrence with the ADB's Safeguard Policy Statement (SPS) 2009;
xii. Local people will be provided with employment on a priority basis under the project;
xiii. There will be provision in the contract that movement of the local population should not be hindered, especially the working class/students and women.

336. Through the field survey and FGDs it was revealed that drinking water is the highest level priority and the sewerage system is the second priority of the Sahiwal residents.

337. Initial social assessment meetings were arranged with the residents/beneficiaries. They were interviewed to obtain the community's response to the proposed investment. People were asked about the potential benefits / problems related to the execution of the Project. They were also consulted to understand their views regarding the alternatives to determine any adverse impact of the project. Participants indicated that this project would be beneficial for the community in the future. Implementation of the water supply and sewerage component will result in a positive impact on their socio-economic status and quality of life.

338. During consultation, people shared their views regarding land acquisition for the sewage treatment plant:
i. People are reluctant to sell their land, as they intend to keep it for commercial purposes.

ii. They showed apprehension that the market land rate will not be provided to them, as the government always provides a lower amount.
iii. The prevailing market rate is Rs.10,000,000/acre and the Government may not compensate them accordingly.
iv. The project is likely to have negative impacts on the surrounding areas as a result of bad odors, and eventually their life will become more miserable. The project should be launched away from the population centers.
v. The government should buy the land situated towards the north side that belongs to a single person.
vi. Since the land is not transferred to the names of legal owners, they may go to court for a stay order.

ii. Feasibility Study Stage Public Consultations

339. Following are the summary points of the public consultations carried out during the feasibility stage:

i. Women participants of the Focal Group Discussions (FGDs) in both cities reported that health related expenditures form a significant portion of their total monthly expenditures. There is anecdotal evidence that a large majority of the population relies on private sector health facilities.
ii. Women and men in all FGDs, in both cities, have noted that there is a high prevalence of hepatitis which they attribute to contaminated water and inadequate solid waste disposal.
iii. According to primary data from FGDs, there is no development activity, donor assisted projects or initiatives. The civil society representatives provided a different perspective but it can be stated that with the exception of some philanthropic activity for installation of water filters, none of the sample areas are being targeted under any urban services improvement programs.
iv. Women residents talked at length on the poor or non-existent services available to them in terms of the quality and quantity of water, sanitation, health or education.
v. Poor communities do not have gas and no proper arrangements for water supply, sewage or solid waste management.
vi. At an institutional level, it is observed that there are no specific gender mainstreaming strategies or mechanisms at the level of the TMAs in both Sahiwal and Sialkot and it would not be an exaggeration to state that these public services institutions are gender-blind. None of the TMAs mentioned having any policies and resources to this effect and indeed the facilities and working environment is very unfriendly towards women despite the fact that both employ women, at least in the workers' category
vii. Overall, the issues in water access and quality are common across both cities. These include poor water quality, erratic supply and mixing of water pipelines with sewage.
viii. According to FGDs data, the government water supply follows fixed timings and is mostly available three times a day for an hour each time (roughly same finding for both cities). The water quality has been reported to be poor to very poor and unsafe for drinking, in all cases. Some residents noted that water quality is so bad that it is even unfit for bathing. For drinking purposes, almost all households resort to either boiling water or collecting it from the various public and private water filtration plants installed in different areas. While a small number of people reported that they are making do with collecting water from filters, most of the women and men stated that filter plants are either far away or are dysfunctional.

ix. Due to unavailability of municipal water supply, the majority, however, depend on motor operated pumps and pay heavy electricity bills (ranging between Rs 3,000-4,000 per month)

x. Observations were made in FGDs in Sahiwal e.g. in UC 44, men stated that less than 20 percent families have municipal water connections and that the overall reliance of households is on their own pumping based water supply or collect water from the area filtration plants. They claim that the water quality is inferior, the timings for supply are unpredictable and few (3 times a day for one hour each) and that mixing of water and sewer lines is frequent. They claim that they have gotten water testing done in the past and was found to be inferior in most cases. “The water quality is so poor that we do not want to pay the bills” they said claiming that more than 80 percent of those with official connections do not pay their bills.

xi. The main points of conclusion from the consultations around the sewage system is as follows: the public system is a badly planned, haphazard, outdated, inefficient, faulty collection of old rusty pipes and open and semi-covered and covered drains. All primary data confirms a perpetual problem of clogged and overflowing drains, flooding of streets and lanes with filth and sewage with *adhoc* arrangements being made in emergency situations that only provide temporary relief. The severity of the situation varies but is particularly alarming in middle or low income areas. Women respondents in all FGDs mentioned great difficulty faced by them due to this problem and the health, hygiene and mobility constraints they face because of this situation.

xii. Rain water is gathered and remains standing for days and many areas can reportedly remain inundated for days on end. The functioning of the TMA is highly unsatisfactory and people have mentioned that there are severe staff shortages or those who come do not do a satisfactory job. According to city residents, the cleaning and operation of the sewage system is a combination of luck, chance or circumstance where an active UC chairman or councillor will take action to mobilise resources. Moreover, it was learned (FGD UC 44, Sahiwal) that sewage is also sold to farmers for irrigation of vegetables and pumps operate more regularly during peak demand season.

xiii. Observations were made in the UC 44 FGD, Sahiwal that sanitary workers don’t perform their jobs (and particularly the Muslim staff do not want to do cleaning/sweeping), the dustbins are not enough and a majority rely on private cleaners/sweepers who are paid between Rs 50-100 per month. They also mentioned the dilemma of cattle owners within residential areas who violate blatantly the Corporation’s rules and animal waste is creating health hazards as well as choking up the sewage system.

xiv. The widespread involvement of marginalised gypsy families in Sahiwal in solid waste collection and disposal (and separation) was pointed out by an NGO (Lok Sujag) who also stated that these poor families have been operating informally for decades and their livelihoods stand at risk by induction of a new waste management company that has its own contractor arrangements and some safeguards should be considered as to how these vulnerable families can be brought under any new system.

xv. The FGD respondents mentioned that solid waste collection staff is limited; containers are not placed evenly across the city, neighborhood and lane level disposal is not thought out, the dumpers are often faulty and timing schedules are not adhered to. Moreover, it was noted that the available SWMC staff (sanitary workers) refused to work on the pretext that they are on strike. TMA has alleged that the separation of solid waste sanitary staff has created a worse situation whereby they sweep garbage directly into open lines and let the TMA staff attend to it.

xvi. The cities face a huge problem of traffic congestion and road safety. Overcrowding and unregulated traffic flow and congestion are serious concerns. Commercial places

are encroached upon by myriad vendor stalls and carts. There is no official public transit system. Walking, motorbikes, auto rickshaws and *qingchis* (motorcycle rickshaws) remain the dominant forms of transportation for men and women alike.

xvii. The only mode of transportation for a large majority of the population is the *qingchis* and auto rickshaws and these are also reportedly unaffordable. Most of the women noted that they travel on *qingchis* at a flat rate for Rs 20 within the city but more for travel to far off places and this places a financial burden, especially for those who have to go out every day for education or employment purposes.

xviii. Women students of various crafts (from rural and urban areas) met with in the district Sanatzaar (Industrial Home) Sahiwal claimed that one of their biggest issues was lack of transportation facilities in getting to the centre and asked for safe and reliable transport for women.

xix. From consultation, it is evident that the city residents (men and women) in Sahiwal and Sialkot feel that they are not adequate, safe, reliable, consistent or regular services vis-à-vis water supply, sewage, solid waste management or transportation. It is also evident that women, due to their multiple productive and reproductive roles, are inconvenienced and burdened due to limitations in service provision. Men and children are also involved in terms of both time and labour (water carrying/collecting, garbage collection). The proposed project, therefore, stands to benefit everyone and does not have any adverse impacts.

xx. The field findings from the FGDs indicate community prioritisation of needs as follows:

a. Better sewage and sanitation
b. Water supply
c. Solid waste management
d. Health facilities/improvements
e. Community spaces/centres
f. Transportation

xx. Another equally important and oft mentioned concern by almost all women met with is their aspiration for *a women friendly public space that is open to all and where they can come together for various purposes.* “A women centre run for women and by women” is how many different women put it – a space where they can congregate for various purposes in a safe and unhindered manner.

xxi. The civil society organizations (e.g. in Sahiwal) emphasized clean water, sewage system, health and education.

xxii. The willingness to pay for the amenities aspect was explored under all sectors and in all data collection instruments for primary data collection. By and large, all respondents in both cities reported that they are not *able* to pay any additional charges for water supply or solid waste because they are already barely able to make ends meet. “The Rs 626 is already too high and we sometimes have to pay this amount in instalments” is how the women in UC Kareem Pura, Sialkot put it.

xxiii. Households are already paying fees for privately acquired services, electricity bills for water or rickshaw fares which could be higher than municipal service charges for the same services which would suggest willingness to pay.

xxiv. Participants of all FGDs indicated that hepatitis prevalence is highest in Sahiwal city because of contaminated water. In their opinion, about one quarter of the city population is suffering from hepatitis because of contaminated water, highly inadequate waste water disposal and inappropriate solid waste removal.

xxv. Another common utility is electricity-operated water pumps for water supply. Information provided in the FGD indicated that about 70% of the houses have their own water pumps and they are not dependent on municipal water supply.

xxvi. The FGDs with elected representatives of three union councils and women representatives indicated that quality of water is poor in most areas and tolerable in a few areas of the city. Sewerage and water supply pipelines are very old in some city areas and leakage from both is common. Sewage is mixing with water supply pipelines in many areas and water is not usable in many localities. People get drinking and cooking water from water filter plants installed in different localities. About 12 localities of the town receive the worst quality of water. The problem is more severe in areas where houses are very small and they have not installed water pumps.

xxvii. FGD conducted indicated that the sewerage system is almost dysfunctional in all areas of the UC No. 50, and in some areas of UC 44. The elected councilor mentioned that streets are frequently flooded with sewage and access to houses is difficult. Complaints are made frequently but not addressed without follow up and payment of petty cash to sewer men. In their view, the main cause of flooding is irregular operation of disposal pumps. It was reported that sewage is sold to farmers who mix it with canal water for irrigation of vegetables grown near the city area. During peak demand of sewage for irrigation by farmers, pumps operate regularly and streets are clean. During slack periods of sewage demand for irrigation, pumps are not operated and sewage overflow occurs in different city areas.

xxviii. Union council No. 50 comprising *katchi abadis* of Ghalla Mandi has a severe problem of sewage overflows in almost all streets. This has severely affected access to their houses.

xxix. In city areas, a small proportion of households keep cattle and animal waste disposal is not done properly. In some localities, some people collect dung from other cattle owning households and dispose of it as farm yard manure. FGD participants considered this to be a health hazard and indicated that complaints in this regard have not produced any result.

xxx. The TMA informed that only 20% of the consumers pay bills for water supply and 80% are defaulters.

xxxi. The FGD informed that water and sewerage rates are not paid by people on two pretexts: (i) very low quality of services, and (2) annual billing instead of quarterly bills. Many households cannot afford to pay annual bills because of the escalating cost of living and low incomes.

xxxii. FGDs conducted with public representatives indicated that the main reason for default is poor quality of services. Some of the members argued that payment of water rates will increase after improvement of services. The main question is the tariff for water and sanitation services. They were asked about willingness to pay if the service charger were to be PKR 500 per month. A minority of the participants said that people will pay if they receive clean water and an efficient sewerage system. But the majority of the participants said that people cannot pay this amount because of low incomes. Women participants said that this amount is in addition to monthly bills paid by households for electricity and gas. Women said they have first-hand experience of economic conditions of the households where a vast majority face difficulties in paying utility charges and school fees for their children.

xxxiii. The FGD participants informed that in large houses municipal water is used for irrigation of lawns, car wash, floor wash and sprinkling. Because of its contamination it cannot be used for other purposes. If water is metered, then the majority of the houses with their own water pumps may not apply for water supply connection. There will be little demand for water connection in households with their own water pumps.

xxxiv. About 7% of the households own cars and about 40% own motorbikes. Traffic congestion is observed in the centre of the city near government offices and markets. There are two traffic signals in the city but none of these are operational.

xxxv. In Sahiwal, unemployment among male educated youth and men was reported as a major problem by FGD participants. They cited general unemployment for daily wage earners and for skilled workers. Unemployment of women was not cited as problem by male and female FGD participants. They all agreed that there are few opportunities for women's employment in the city.

xxxvi. All people affected by proposed land acquisition for the Sewage Treatment Plant were informed by Numberdar that a portion of the land will be acquired by the government for construction of the wastewater facility. All APs are willing to provide land provided that the replacement value of land is paid. APs had expressed apprehension about compensation for land. In their view the land acquired by government is usually at a lower than the market price, because the average value of land is calculated based on recent transactions. It is common practice to report very low prices of land transactions to avoid payment of land mutation taxes. APs have expressed concern that land prices should be fixed according to the prevalent market rate.

340. Consultations Held at Sahiwal Bus Stands: Consultation were held both at the Multan Road and Railway Road bus stations, the consultations were attended by the shop owners, representatives of the shop owner union, representative of the societies owning shops at Railway Road bus station, resettlement team of the PPTA consultant, deputy team leader of the PPTA consultant, tax superintendent of the city government and rent collectors of the city government present at the bus stations.

341. The main discussions were about the potential impacts during the construction work on the existing structures and businesses at the bus stations. The main concern raised by the shop keepers was that the shops should not be damaged as it was the main source of livelihood of the people running the businesses. They suggested that improvements should be made to the existing layout of the bus stands. The improvements suggested by the locals were improvement of sanitation and drainage, pavement of the bus station grounds, development and upgrading of the passenger waiting area, provision of clean drinking water supply, provision of adequate lighting, overall facelift of the bus terminal and ameliorating the entry and exit of the buses so that the traffic flow can be improved.

342. The deputy team leader Mr. Azher assured the people that he would be working with the design engineers and the design would be changed so that no damage could be done to the existing structures and the improvements should be made to the existing layout and facilities. He also informed the people that once the revised design was finalized, it would again be shared with the people so that everyone could be informed and in case if there were any concerns and objections these could be addressed accordingly.

343. He however also informed the people that in case if there was any damage to a structure, the affected person would be provided an alternate structure prior to dismantling or demolishing the existing one so that the chances of loss of livelihood could be minimized.

344. Group Discussion Sessions at STP Sites: Group discussion sessions were held with the community. Separate sessions were held in each settlement. Residents of the settlements were informed in advance about the purpose of the meeting so that all the interested people could attend the session regardless of their gender, religion and age. Influential persons of the area were also invited in the meeting.

345. The community of the area was briefed about the proposed project (STP) in the area and overview of the nature of the construction and operational activities. Community was provided an opportunity to ask question regarding the proposed project.

346. To ensure that project affected people had equal opportunity to receive project information and raise their concerns following approaches were used:

- Sufficient time was given to the participants so that they could voice their concerns.
- Participants were allowed to raise their concerns on one to one basis
- Illiterate (People who were not able to read and write) participants were asked to listen to the project description and give their comments to the consulting team.

347. Table-6.1 shows number of persons attended the group discussion while Annexure-3 shows the list of persons, CNIC (Computerized National Identity Card) number and contact number.

Table-6.1: Number of Participants in Group Discussions

Settlement	Date	Union Council	Venue	Number of Participants
95/6R	Feb 10, 2017	11	Govt. School, village	30
94/6R	Feb 11, 2017	42	Village	41
135/9L	Feb 12, 2017	24	Private School, Village	39
Three Marla Housing Scheme	Feb 13, 2017	11	Settlement	27

348. Summary of Public Consultation at STP Site: During public consultation at Chak 95/6R, Chak 94/6R, Chak 135/A9L and Three Marla Housing Scheme, the overall response was positive. Most of the people of the project area were not aware of the STP project. The overall project including proponent, components of the project, phases of the project, land acquisition, environmental and social impacts were introduced to the local people and asked to raise their concerns related to the proposed project. A summary of feedback received is given below:

Issue Discussed	Feedback
Land Acquisition	• Affected people apprehensions are related to the land to be acquired for the construction of the components of the project. They were of the view that they were poor people, authorities should pay them timely compensation on the basis of market rate; • One affected person of 95/6R was not willing to sell his agricultural land to the Government. He was of the view that Government should acquire an alternate land as cultivation is only

	source of bread earning for his family. • Judicious compensation should be paid to the affected people as per market rate; • Compensation procedure should be less time consuming.
Job Creation	• All the participants emphasized the need to ensure the selection of locals in non technical jobs during the construction phase while during operational phase, employment to the locals should be provided on permanent basis according to their skills
Movement of Heavy Vehicles and Odor	• Authorities should consider a safe route rather than the route passing through the settlements for the movement of heavy vehicles and sludge carrying trucks during operational and construction phases. • Safety signs should be posted on the route selected for movement of vehicles • As the project site is near to 95/6R, construction activities should not be carried out at night times.
Air Quality	• Odor from STP may cause problem to nearby community as some people are more sensitive to the odors than others therefore management should implement practical measures to control the odor issue. • Management should purchase the surrounding land to serve as a buffer zone
Community Relations	• Authorities should maintain a cooperative attitude towards community and pay attention to all community concerns that may arise during the project implementation
Positive Achievement	• There is no proper sewerage system in the area. Sewage disposal system of the area should be connected to STP. • According to the residents of Three Marla Housing Scheme, the only benefit of the project is the proper drainage and sewerage system of their area • According to locals, sewerage system

	of the area has destroyed completely because of the low quality of sewerage pipe lines. Moreover, there was no proper wastewater disposal station of the area. One disposal station was available but it was not made operational from day first because only civil work was completed but no other machinery like electrical pump-motor sets were installed to functional this disposal station. Locals were hopeful that this non-operational disposal station will be made operational with the construction of ST
Wastewater	• Wastewater should comply the government requirements
Area Development	• Apart from STP related activities, natural gas, paved streets, vocational training centre and medical facilities are the necessities for the development of the area.

V. CONCLUSIONS AND RECOMMENDATIONS

349. This study was carried out at the feasibility study stage of the PICIIP. Primary and secondary data were used to assess environmental impacts. The report has provided a picture of all potential environmental impacts associated with the project, and recommended suitable mitigation measures.

350. Most of the water supply, sewerage and transport route improvement projects have minor environmental impacts during the construction phase, and these are manageable through implementation of the CPEMP. The environmental impacts of the STP during the construction phase will also likely be of a minor nature, and should be manageable through the CPEMP, with overall supervision from the SMC. Most of the operational phase impacts of STP will be insignificant-to-minor, except for possible canal water contamination due to generation of untreated wastewater because of plant failure. These impacts should be manageable within available resources. However, the staff of the SMC and private company will require training on EMP implementation during the construction and operational phases.

351. The water supply, sewerage and transport routes improvement projects under provincial environmental protection act regarding IEE/EIA do not require any NOC from the government. The STP falls under Schedule II of EIA/IEE regulation requiring EIA study to be submitted to EPD prior to construction for acquiring NOC. The information provided in this report can form the basis of any further submission to EPA as required.

352. The construction phase environmental mitigation plan (CPEMP) and construction safety plans are also required to be prepared before awarding construction contract to the contractors. These plans will be part of the bidding documents.

353. These projects will not pose any negative social impact. However, if land acquisition is required, the compensation to the APs and concerned parties will be given. The provisions may be made in the LARP. A Gender Analysis and Gender Action Plan, Poverty Analysis and Social Development Plan and Land Acquisition and Resettlement Plan have been completed in tandem with this IEE for the whole subproject. These studies have:

a. *Examined and assessed the overall social and poverty profile of the project area on the basis of the primary and secondary data sources and prepared socio- economic profile of the project areas.*

b. *Prepared a social and poverty analysis, taking into account socio-economic and poverty status of the project area of influence, including the nature, extent and determinants of poverty in the project area including assessment. In addition, estimation of the likely socioeconomic and poverty reduction impacts of the project were included.*

c. *Held consultations with relevant officials from the government and other relevant officials, including consultation with affected communities to assess responses to the project and ascertain the nature and scope of local participation in project planning and implementation.*

d. *Identified, analyzed and, where appropriate, quantified the potential resettlement impacts (minimal) of the proposed project on the area and the population.*

354. Baseline monitoring activities have been carried out during project feasibility stage to establish the baseline of parameters for checking during the construction and operational stages. The results should be integrated with the contract documentation to establish performance action thresholds, pollution limits and contingency plans for the contractor's performance.

355. During the operational phase, the monitoring of environmental parameters should ensure that statutory requirements have been achieved. Monitoring activities will focus on periodic recording environmental performance and proposing remedial actions to address any unexpected impacts.

A. Summary and Conclusions

356. The water supply, sewerage, transport routes improvement, green spaces development and sewage treatment plant projects under PICIIP are feasible and sustainable projects from engineering, environmental, and socioeconomic points of view. Implementation of the EMP is required and the environmental impacts associated with the subprojects need to be properly mitigated. Existing institutional arrangements are available for the implementation of EMP. Additional human and financial resources will be required by SMC to comply with environmental safeguard requirements. The proposed mitigation and management plans are practicable but require additional resources.

357. This IEE, including the EMP, should be used as a basis for an environmental compliance program and as guidelines for the preparation of construction related EMP document which should be included as an Appendix to the contract document. The EMP shall be reviewed at different stages of the project and be updated as per requirement. In addition, any subsequent conditions issued by EPA Punjab as part of the environmental clearance should also be included in the environmental compliance program. Therefore, continued monitoring of the implementation of mitigation measures, the implementation of the environmental conditions for work and environmental clearance, and monitoring of the environmental impact related to the operation of the subproject should be properly carried out and reported at least twice a year as part of the project performance report.

ANNEXURE-1
REA CHECKLISTS

Rapid Environmental Assessment (REA) Checklist

SEWAGE TREATMENT

Instructions:

- ❑ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional Sustainable Development Department.
- ❑ This checklist is to be completed with the assistance of an Environmental Specialist in a Regional Department.
- ❑ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on i) involuntary resettlement, ii) indigenous peoples planning iii) poverty reduction, iv) participation, and v) gender and development.
- ❑ Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: PAKISTAN/Punjab Intermediate Cities Improvement Investment Project (PICIIP)

Sector Division: Water and other urban infrastructure and services

SCREENING QUESTIONS	Yes	No	REMARKS
A. Project Siting Is the project area			
➢ Densely populated?	☐	■	
➢ Heavy with development activities?	☐	■	
▪ Adjacent to or within any environmentally sensitive areas?			
➢ Cultural heritage site	☐	■	
➢ Protected area	☐	■	
➢ Wetlands	☐	■	
➢ Mangrove	☐	■	
➢ Estuarine	☐	■	
➢ Buffer zone of protected area	☐	■	
➢ Special area for protecting biodiversity	☐	■	

SCREENING QUESTIONS	Yes	No	REMARKS
➢ Bay	☐	■	
B. Potential Environmental Impacts Will the Project cause			
▪ Impairment of historical/cultural monuments/areas and loss/damage to these sites?	☐	■	
▪ Interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.??	■	☐	Transient impacts possible during replacement of sewer lines. Mitigation measures proposed as part of the EMP
▪ Dislocation or involuntary resettlement of people?	■	☐	LARP under preparation for the STP site
▪ Impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?	■	☐	STP plant design to incorporate protection measures in the event of system failure. Mitigation measures proposed as part of the EMP
▪ Overflows and flooding of neighboring properties with raw sewage?	■	☐	STP plant design to incorporate protection measures in the event of system failure. Mitigation measures proposed as part of the EMP
▪ Environmental pollution due to inadequate sludge disposal or industrial waste discharge illegally disposed in sewer?	■	☐	STP plant design to incorporate protection measures in the event of system failure. Mitigation measures proposed as part of the EMP to cater for industrial waste water discharge to sewer. Sludge disposal to STD facility for use in composting operations.
▪ Noise and vibration due to blasting and other civil works?	■	☐	Transient impacts during construction. Mitigation measures proposed as part of the EMP.
▪ Discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?	■	☐	Compliance monitoring and inspection to be stipulated as part of the EMP.
▪ Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?	■	☐	Transient impacts during construction. Mitigation measures proposed as part of the EMP.

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Social conflicts between construction workers from other areas and community workers?	☐	■	
▪ Road blocking and temporary flooding due to land excavation during rainy season?	■	☐	Transient impacts during construction. Mitigation measures proposed as part of the EMP. Scheduling of works to avoid the rainy season
▪ Noise and dust from construction activities?	■	☐	Transient impacts during construction. Mitigation measures proposed as part of the EMP.
▪ Traffic disturbances due to construction material transport and wastes?	■	☐	Transient impacts during construction. Traffic management measures proposed as part of the EMP.
▪ Temporary silt runoff due to construction?	■	☐	Transient impacts during construction. Mitigation measures proposed as part of the EMP.
▪ Hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?	☐	■	
▪ Deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?	■	☐	STP plant design to incorporate protection measures in the event of system failure. Mitigation measures proposed as part of the EMP. Sludge disposal to STD facility for use in composting operations.
▪ Contamination of surface and ground waters due to sludge disposal on land?	■	☐	Sludge disposal to STD facility for use in composting operations.
▪ Health and safety hazards to workers from toxic gases and hazardous materials which may be contained in sewage flow and exposure to pathogens in sewage and sludge?	■	☐	Health and safety measures for workers have been proposed during operational phase of the plant and incorporated into the EMP

Rapid Environmental Assessment (REA) Checklist

URBAN DEVELOPMENT

Instructions:

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- ❑ This checklist is to be completed with the assistance of an Environmental Specialist in a Regional Department.
- ❑ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on i) involuntary resettlement, ii) indigenous peoples planning iii) poverty reduction, iv) participation, and v) gender and development.
- ❑ Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: PAKISTAN/Punjab Intermediate Cities Improvement Investment Project (PICIIP)

Sector Division: Water and other urban infrastructure and services

SCREENING QUESTIONS	Yes	No	REMARKS
C. Project Siting Is the project area			
➢ Densely populated?	☐	■	
➢ Heavy with development activities?	☐	■	
▪ Adjacent to or within any environmentally sensitive areas?			
➢ Cultural heritage site	☐	■	
➢ Protected area	☐	■	
➢ Wetlands	☐	■	
➢ Mangrove	☐	■	
➢ Estuarine	☐	■	
➢ Buffer zone of protected area	☐	■	
➢ Special area for protecting biodiversity	☐	■	
➢ Bay	☐	■	
D. Potential Environmental Impacts			

SCREENING QUESTIONS	Yes	No	REMARKS
Will the Project cause			
▪ Impacts on the sustainability of associated sanitation and solid waste disposal systems and their interactions with other urban services?	☐	■	
▪ Deterioration of surrounding environmental conditions due to rapid urban population growth, commercial and industrial activity, and increased waste generation to the point that both manmade and natural systems are overloaded and the capacities to manage these systems are overwhelmed?	☐	■	
▪ Degradation of land and ecosystems (e.g. loss of wetlands and wild lands, coastal zones, watersheds and forests?	☐	■	
▪ Dislocation or involuntary resettlement of people?	■	☐	Social safeguard report under preparation for parties affected by plans to redevelop the bus terminal
▪ Degradation of cultural property, and loss of cultural heritage and tourism revenues?	☐	■	
▪ Occupation of low lying lands, floodplains and steep hillsides by squatters and low income groups, and their exposure to increased health hazards and risks due to polluted industries?	☐	■	
▪ Water resource problems (e.g. depletion/degradation of available water supply, deterioration of surface and ground water quality, and pollution of receiving waters?	☐	■	
▪ Air pollution due to urban emissions?	☐	■	
▪ Social conflicts between construction workers from other areas and local workers?	☐	■	
▪ Road blocking and temporary flooding due to land excavation during rainy season?	■	☐	Traffic management measures required as part of the EMP. Scheduling of construction work to avoid rainy season

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Noise and dust from construction activities?	■	□	Transient impacts from construction activities. Mitigation measures proposed as part of the EMP
▪ Traffic disturbances due to construction material transport and wastes?	■	□	Traffic management measures required as part of the EMP. Transient impacts
▪ Temporary silt runoff due to construction?	■	□	Construction activities to be confined to dry season/dry weather. Scheduling to be stipulated in the EMP
▪ Hazards to public health due to ambient, household and occupation pollution, thermal inversion, and smog formation?	□	■	
▪ Water depletion and/or degradation?	□	■	
▪ Overpaying of groundwater, leading to land subsidence, lowered groundwater table, and salinity?	□	■	
▪ Contamination of surface and ground waters due to improper waste disposal	□	■	
▪ Pollution of receiving waters resulting in amenity losses, fisheries and marine resources depletion, and health problems?	□	■	

Rapid Environmental Assessment (REA) Checklist

WATER SUPPLY

Instructions:

- ❑ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional Sustainable Development Department.
- ❑ This checklist is to be completed with the assistance of an Environmental Specialist in a Regional Department.
- ❑ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on i) involuntary resettlement, ii) indigenous peoples planning iii) poverty reduction, iv) participation, and v) gender and development.
- ❑ Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: PAKISTAN/Punjab Intermediate Cities Improvement Investment Project (PICIIP)

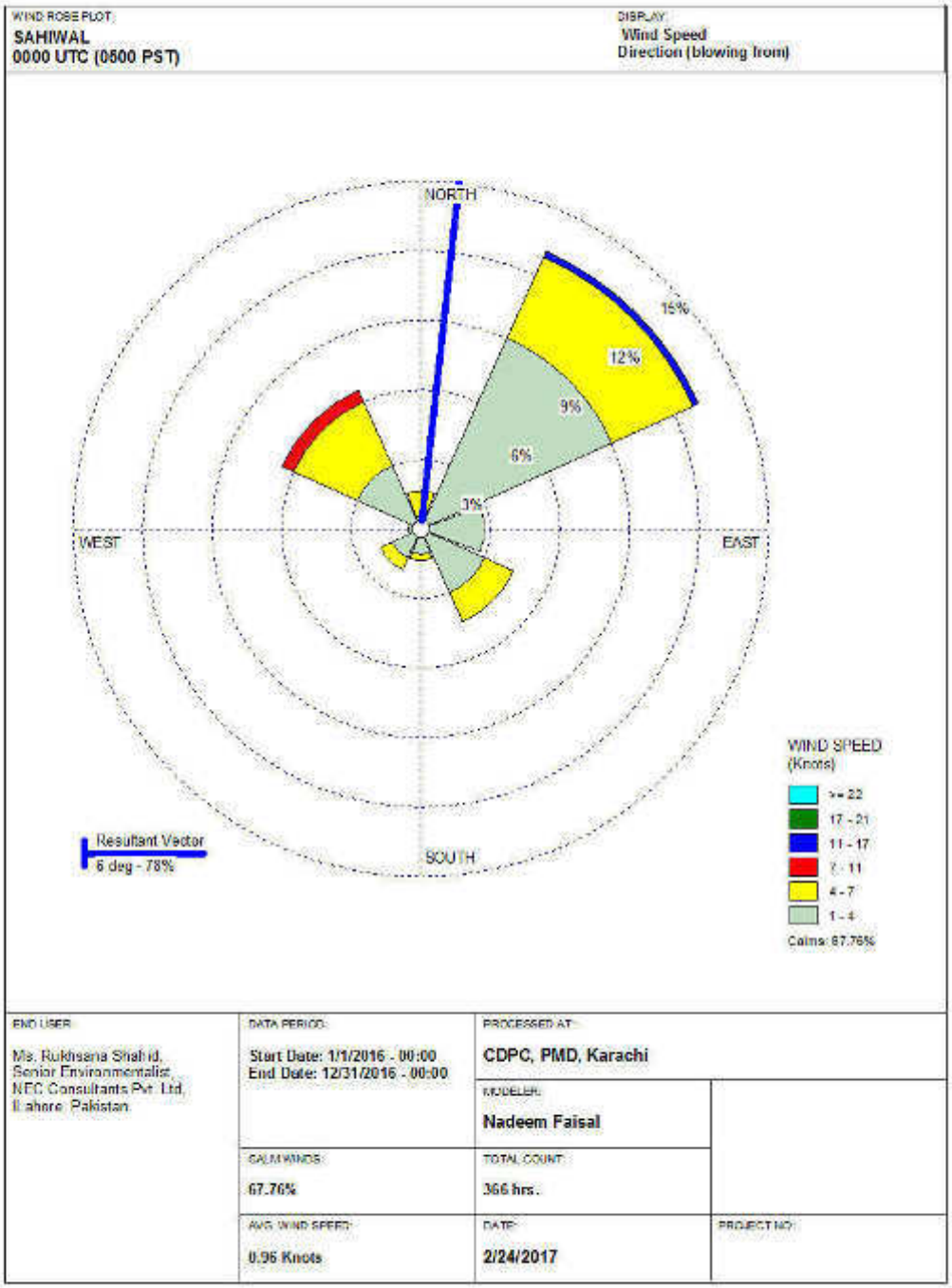
Sector Division: Water and other urban infrastructure and services

SCREENING QUESTIONS	Yes	No	REMARKS
E. Project Siting Is the project area			
➢ Densely populated?	☐	■	
➢ Heavy with development activities?	☐	■	
▪ Adjacent to or within any environmentally sensitive areas?			
➢ Cultural heritage site	☐	■	
➢ Protected area	☐	■	
➢ Wetlands	☐	■	
➢ Mangrove	☐	■	
➢ Estuarine	☐	■	
➢ Buffer zone of protected area	☐	■	
➢ Special area for protecting biodiversity	☐	■	
➢ Bay	☐	■	
F. Potential Environmental Impacts			

SCREENING QUESTIONS	Yes	No	REMARKS
Will the Project cause			
▪ Pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?	☐	■	
▪ Impairment of historical/cultural monuments/areas and loss/damage to these sites?	☐	■	
▪ Hazard of land subsidence caused by excessive groundwater pumping?	☐	■	
▪ Social conflicts arising from displacement of communities?	☐	■	
▪ Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?	☐	■	
▪ Unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?	☐	■	
▪ Delivery of unsafe water to distribution system?	■	☐	Disinfection system proposed at production and storage facilities
▪ Inadequate protection of intake works or wells, leading to pollution of water supply?	☐	■	
▪ Over pumping of groundwater, leading to salinity and ground subsidence?	☐	■	
▪ Excessive algal growth in storage reservoir?	■	☐	Preventative maintenance required for all production and storage facilities
▪ Increase in production of sewage beyond capabilities of community facilities?	■	☐	Improvements to sewerage system proposed in parallel with this project
▪ Inadequate disposal of sludge from water treatment plants?	☐	■	
▪ Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?	☐	■	
▪ Impairments associated with transmission lines and access roads?	☐	■	
▪ Health hazards arising from inadequate design of facilities for	■	☐	Handling and storage procedures built into the EMP

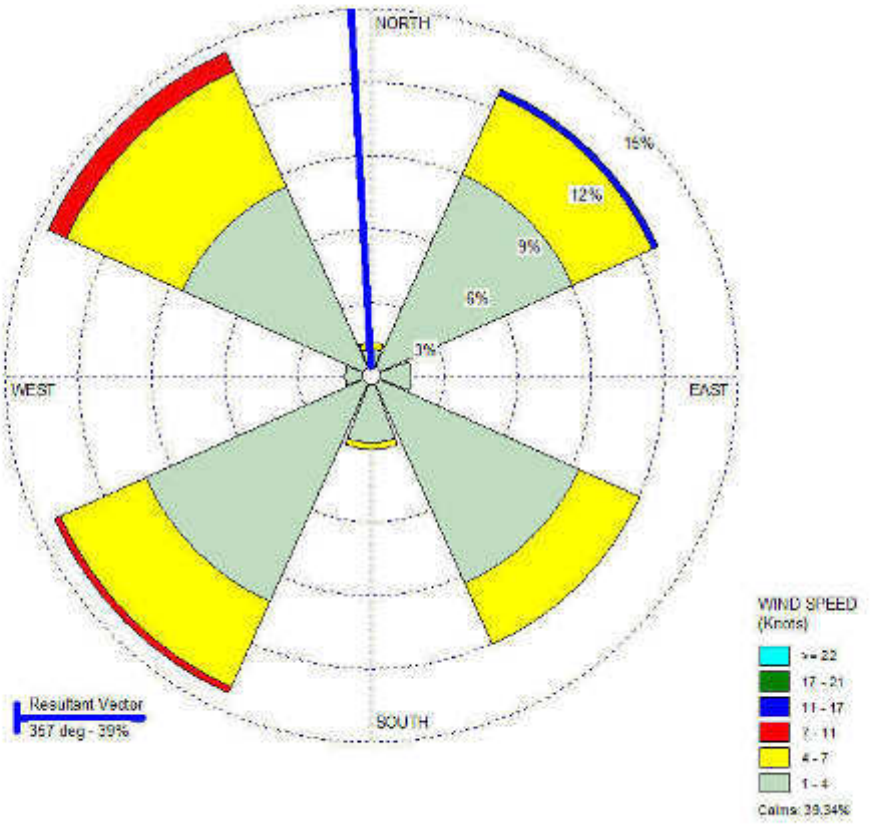
SCREENING QUESTIONS	Yes	No	REMARKS
receiving, storing, and handling of chlorine and other hazardous chemicals?			
▪ Health and safety hazards to workers from the management of chlorine used for disinfection and other containments?	■	□	Handling and storage procedures built into the EMP
▪ Dislocation or involuntary resettlement of people	□	■	
▪ Social conflicts between construction workers from other areas and community workers?	□	■	
▪ Noise and dust from construction activities?	■	□	Noise and dust control measures to be specified in the EMP. Impacts are transient.
▪ Increased road traffic due to interference of construction activities?	■	□	Traffic management plan to be specified in the EMP. Impacts are minor and transient.
▪ Continuing soil erosion/silt runoff from construction operations?	□	■	
▪ Delivery of unsafe water due to poor O&M treatment processes (especially mud accumulation in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?	■	□	Preventative maintenance required for all production and storage facilities. Monitoring requirements to be specified in the Monitoring Plan
▪ Delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?	■	□	Preventative maintenance required for all production and storage facilities. Monitoring requirements to be specified in the Monitoring Plan
▪ Accidental leakage of chlorine gas?	□	■	
▪ Excessive abstraction of water affecting downstream water users?	□	■	
▪ Competing uses of water?	□	■	
▪ Increased sewage flow to increased water supply	□	■	
▪ Increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant	■	□	Improvements to sewerage system proposed in parallel with this project

ANNEXURE-2
WIND ROSE



WIND ROSE PLOT:
SAHIWAL
1200 UTC (1700 PST)

DISPLAY:
Wind Speed
Direction (blowing from)



END USER	DATA PERIOD	PROCESSED AT	
Ms. Rukhsana Shahid, Senior Environmentalist, NEC Consultants Pvt. Ltd. Lahore, Pakistan	Start Date: 1/1/2016 - 12:00 End Date: 12/31/2016 - 12:00	CDPC, PMD, Karachi	
		MODELER: **Nadeem Faisal**	
	CALM WINDS: **39.34%**	TOTAL COUNT: **366 hrs.**	
	AVG. WIND SPEED: **1.69 Knots**	DATE: **2/24/2017**	PROJECT NO:

ANNEXURE-3
DETAIL OF PUBLIC CONSULTATION PARTICIPANTS

Name	Title/Designation and Organisation	Date, Place
Sahiwal		
Mian Mohammad Asghar	Tehsil Municipal Officer, Sahiwal	31st Oct
Malik Nisar Ahmed Hayat	Tehsil Officer, Infrastructure & Services, TMA	31st Oct
Sheikh Waheed Qaiser	SDO	31st Oct
Dr Shirazi	Sanitation Enforcement Inspector, TMA Sahiwal	31st Oct
Tariq Mehmood	Katchi Abadi Incharge, TMA	1st Nov
Syed Alamdar Husain	District Officer Social Welfare/EDO Community Development	1st Nov
Mohammad Abbas	Deputy District Officer, Social Welfare	1st Nov
Ms Sidra	Superintendent, Dar-ul-Aman	1st Nov
Mian Nadeem Zia	Assistant Director/Manager, Sanatzaar	1st Nov
Shafique Butt	Executive Director, Punjab Lok Sujag	2nd Nov
Dr Mujtaba Jamal	President, Social Development Organisation	2nd Nov
Anjum Raza Mattoo	Insaan Dost Asociation	2nd Nov
Syed Mohd Haider	District Officer Labour, Sahiwal	3rd Nov
Chaudhry Tariq	Numberdar, Shahabad, 95 -6/R	3rd Nov

Sahiwal
FGD 1: Katchi Abadi, Fateh Sher Colony, Union Council 45 **Participants:** 1. Surraya bib 2. begum Parveen 3. Kausar bibi 4. Zakiya bibi 5. Aasiya bibi, 6. Shamim bibi
FGD 2: UC 44 **Participants:** 1. Mohd Zafar Ashraf 2. Rana Mohd. Latif 3. Mohd Amir Nomi 4. Rana Mohd Ali 5. Mohd Anwar 6. Mohd Aslam 7. Imtiaz Ahmed
FGD 3: Khokha Baazar, Madina Colony, Union Council 49 **Participants:** 1. Firdous Zafar 2. Najma Bashiran 3. Bashiran bibi 4. Attiya Noreen 5. Parveen Shahbaz 6. Bilquis Akhtar 7. Jamila Nafees
GD 4: Shah Abad, 95 – 6/R **Participants:** 1. Kishwar 2. Rashidaan 3. Kulsum Akhtar 4. Bilquis Akhtar 5. M Amjad 6. Nazir Husain *(Note: Technically this was not an FGD but a group discussion held over different locations) and also in a rural UC marked for land acquisition)*

SOCIO-ECONOMICS SURVEY - STP SHAIWAL PROJECT

CHAK NO: 135 A/ 9L

UNION COUNCIL NO: 24

CHAIRMAN NAME: AZEEM AZAM KHAN

SR#	NAME	ID CARD NO.	CONTACT NO.
1	AMMAN ULLAH	36502-3414047-9	0321 - 6910726
2	SAJJID ALI	36502-8459776-7	0321 - 6907913
3	MUHAMMAD NAYYAZ	36502-1288490-1	0305 -2184835
4	MUHAMMAD AWAIS	36502-1288492-5	0321 - 6981205
5	MUHAMMAD ASLAM	36502-7786659-7	NIL
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7	MUHAMMAD ALMAS KASHIF	36502-5587084-9	0300- 45745275
8	MUHAMMAD NAVEED	36502-1030187-9	0302 -2153128
9	MUHAMMAD ARSALAN	36502-7489381-7	0313-7489381-7
10	ABDUL GHAFFOR	36502-0264186-3	NIL
11	MUHAMMAD NAEEM ANWER	36502-6229318-9	0300 - 6930628
12	ASIF NAYYAZ	36502-6978491-3	0321 - 4949420
13	ARMGHAN SHOIAB	36502-0940891-7	0320 -3073990
14	MUHAMMAD BILAL YONUS	36502-5369892-9	0321 -4392804
15	MUHAMMAD ANWER	36502-1288509-7	0313 - 6315135
16	JAVID HASSAN	36502-1062921-7	0306 - 9397739
17	MUHAMMAD SARWER	36502-1288482-7	0341- 6363073
18	MUHAMMAD TUAFAL ANJUM	36502-1384511-7	0322 - 7096533
19	MUHAMMAD MUBASHER HABIB	36502-4433654-3	NIL
20	ARSHAD HUSSAIN	36502-1288115-1	0303 - 7978579
21	ABDUL KARIM	36502-1288114-5	0312 - 6053135
22	FAYYAZ HUSSAIN	36502-1288116-7	0300 - 4170595
23	CH. AKHTARSALEEM IRFAN	36502-13986114-1	0311 - 6907913
24	MUHAMMAD AFZAL YONUS	36502-1283495-1	0321 – 6931038
25	MUHAMMAD MOHSIN	36502-5534450-1	0314 - 4560073
26	JHAGEER ALI	36502-8286509-5	0300 - 6936235
27	MUHAMMAD FAYYAZ	36502-4100155-1	0300 - 6907263
28	ABID ALI	36502-7456919-3	0321 - 6936835
29	MEHRAN AZEEM	36502-9537251-5	0321 - 6923225
30	NOUMAN ALI	36502-5949505-9	0300 -6917466
31	ABDUL GHAFFAR	36502-2293693-5	NIL
32	MANZOOR ALI	36502-7166307-1	0321 -6907913
33	NAVEED HASSAN	36502-9733751-3	0306 - 9397739
34	WAHEED HASSAN	36502-6618313-9	0320 - 7750071
35	MUHAMMAD ARSAD	36502-1622655-3	0301 - 7133638
36	BUHADAR ALI	36502-6981326-3	NIL
37	JUSTON JHAN PARWANA	36502-1348607-3	NIL
38	MUHAMMAD ASIF	36502-7100740-9	0300 - 6919722
39	MUHAMMAD ADNAN ALI	36502-9645884-7	0321 - 6931797

CHAK NO:3 MARLA HOUSING SCHEME
UNION COUNCIL NO: 11
CHAIRMAN NAME:MALIK FAROOQ

SR#	NAME	ID CARD NO.	CONTACT NO.
1	MUHAMMAD AKRAM	36502-1224346-5	0302 - 6921171
2	MUHAMMAD SHAFIQUE	36502-1341513-5	0315 - 6238321
3	LIAQUAT ALI	36502-5843169-9	0341 - 7209177
4	MUHAMMAD USMAN	36502-1172919-9	0303 - 9002969
5	MUHAMMAD HABIB	36502-6379851-1	0344 - 6106128
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9	MIRZA MUHAMMAD AZAM	36502-7210225-7	0313 - 6901474
10	GHULAM HUSSAIN	36502-0986827-9	0345 - 7458094
11	MUHAMMAD SALEEM	36502-1335144-1	0301 - 6912387
12	TALIB HUSSIAN	-------	0321 - 6907376
13	MUHAMMAD ASLAM	36502-2369857-3	0304 - 0762205
14	ILYAS UR REHMAN	36502-5434081-3	0300 - 3710500
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17	ZAHID RASHID	36502-1091634-3	0301 - 6530136
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21	IFTIKHAR HUSSAIN	36501-9300564-3	0300 - 4849187
22	RANA SHABIR HUSSAIN	36502-1403892-7	0308 - 6934140
23	KHALID MEHMOOD	36502-1307112-5	0321 - 6935198
24	HAFIZ MUJAHID	----------	0334 - 7133693
25	KHALID ZIA	36502-3904455-7	0300 - 6906850
26	MUHAMMAD ZEESHAN	36502-7050032-5	0322 - 7503570
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UNION COUNCIL NO: 42

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4	M. ASHFAQ	36502-2406088-1	0306 - 7919493
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9	RASHID AHMED	36502-3710694-1	0302 - 7107212
10	M. KASHIF RAFIQ	36502-4753186-1	0305 - 77727553
11	MANZOOR	36502-4529103-3	NIL
12	SAJID ALI	36502-8782765-3	0302- 7552612
13	JAFAR HUSSAIN	36502-1278113-5	0306 - 7532750
14	M. AMIN	36502-6385162-7	0300- 6900930

15	M. AKBAR	36502-5443714-5	0347-3284215
16	M. NAZIR	36502-3335484-9	NIL
17	M. ANWER NAVID	36502-5607053-5	0300- 9691252
18	M. WAQAS	36502-7531177-5	0308- 8556172
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21	MUKHTAR AHMED	36502-4290720-9	NIL
22	ABDULL JABBAR	36502-0997396-5	NIL
23	AMJID RAFIQ	36502-6231667-5	0300 - 4040087
24	TAJ DIN	36502-7532583-1	0305-7101395
25	M. RIZWAN	36502-4447579-3	0348 - 4216003
26	M. SAJID	36502-1352288-7	0300 - 6936455
27	M. ASHIQ	36502-4946373-7	NIL
28	M. ISMAEEL	36502-2585455-1	0305 - 7530036
29	M. AKRAM	36502-7994345-1	0304 - 6484693
30	M. RAMAZAN	36502-1277855-9	0303 - 7805294
31	M. RIZWAN	36502-4447579-3	0348 - 4216003
32	SHAHBAZ ALI	36502-5313272-5	0305 - 6744755
33	PEER BUKSH ANJUM	36502-1409738-7	0322 -7057194
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35	M. ASHRAF	36502-1328225-7	NIL
36	M. SALEEM TAHIR	36502-5682518-3	0308-5094355
37	M. FASAIL	36502-56604811	0303 -7970893
38	ALI SHUKRAN	36502-2995282-1	0344 - 4445177
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CHAK NO:95/6R
UNION COUNCIL NO:11
CHAIRMAN NAME: MALIK FAROOQ

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3	M.FARHAN	36502-9665154-9	0303-9595082
4	ABDULREHMAN	36502-1229026-7	0300-6928395
5	BASHIR AHMED	36502-8939137-1	0302-6530940
6	M.REHMAN	36502-3614398-3	0305-8438395
7	ARSHAAD	36502-4680159-9	NIL
8	M. RIZWAN	36502-0308707-5	0322-8775740
9	M. AFZIL	36502-2841576-1	0345-7442208
10	M. IRFAN	36502-1091502-5	0305-3952237
11	SABBAR HUSSIAN	36502-6778276-5	0346-7460490
12	M. SHAKEEL	33105-6642242-9	0342-0220600
13	ASLAM MASIH	36502-2707868-3	NIL
14	AKRAM MASIH	36502-9339725-7	NIL
15	NADEEM MASIH	36502-4051413-3	NIL
16	M. HANIF	36502-1086956-9	NIL
17	MUSHTAQ AHMED	36502-1228568-3	NIL

18	M. AFZAL	36502-6529510-7	NIL
19	MAQSOOD MASIH	36502-0950212-3	0301-6136994
20	MAQBOOL	------	0307-2734762
21	TALIB HUSSAIN	------	0301-6917281
22	M. SADIQUE	------	0345-7444894
23	AKRAM UL HAQ	------	0304-1468986
24	HAKAM ALI	------	0305-8911475
25	M. SHARIF	------	0302-6534314
26	M. AKRAM	------	0321-6938733
27	MALIK KHAN	36502-64161126-1	NIL

ANNEXURE-4
LABORATORY TESTING REPORTS

Initial Environmental Examination

April 2017

PAK: Punjab Intermediate Cities Improvement Investment Project
Sialkot City

Prepared by the SaafConsult B.V., Netherlands, Joint Venture with Dev-Consult, Pakistan and NEC Consultants Private Limited, Pakistan, and M J Edge for the Asian Development Bank.

INITIAL ENVIRONMENTAL EXAMINATION

Document Stage: Draft
Project Number: TA8683-PK
April 03, 2017

PAK: Punjab Intermediate Cities Improvement Investment Program (PICIIP) - Sialkot City

i) Water Supply Improvement
ii) Sewerage and Drainage Improvement
iii) Transport Routes Improvement
iv) Green Spaces Development

Prepared by the SaafConsult B.V., Netherlands, joint venture with Dev-Consult, Pakistan and NEC Consultants Private Limited, Pakistan, and M J Edge for the Asian Development Bank. This is a draft version of the document.

Contents

TABLES

FIGURES

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REFERENCES

ABBREVIATIONS

µg/m^3	Microgram per Cubic Meter
AC	Asbestos Cement
ADB	Asian Development Bank
AP	Affected Person
BOD	Biochemical Oxygen Demand
CAP	Corrective Action Plan
CCMR	Community Complaint Management Register
CDIA	Cities Development Initiative for Asia
CI	Cast Iron
CO	Carbon monoxide gas
CO_2	Carbon dioxide gas
COD	Chemical Oxygen Demand
CPEMP	Construction Phase Environmental Mitigation Plan
DEO	District Environment Officer
DG	Director General
DNI	Distribution Network Improvement
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPD	Environmental Protection Department
FGD	Focal Group Discussion
GI	Galvanized Iron
GoP	Government of Pakistan
GoPb	Government of Punjab
GRS	Grievance Redress System
GRC	Grievance Redress Cell
Ha	Hectare
IEE	Initial Environmental Examination
IFC	International Finance Corporation (World Bank Group)
KM	Kilometer
LARP	Land Acquisition and Resettlement Plan
LGO	Local Government Ordinance
m^3/d	Cubic meter per day
M&E	Monitoring and Evaluation
MCU	Motor Control Unit
mg/l	Milligram per liter
MGD	Million Gallon per Day
mm	Millimeter
NEQS	National Environmental Quality Standards
NGO	Non-Government Organization
NOC	No Objection Certificate
°C	Celsius Centigrade
OHR	Over Head Reservoir
OHS	Occupational Health and Safety
Pak	Pakistan
PC	Public Consultation
PEPA	Pakistan Environmental Protection Act
PEQS	Punjab Environmental Quality Standard
PICIIP	Punjab Intermediate Cities Improvement Investment Program
PK	Pakistan
PMU	Project Management Unit

PPE	Personal Protective Equipment
PVC	Poly Vinyl Chloride
REA	Rapid Environmental Assessment
RH	Relative Humidity
RTA	Rapid Transit Authority
SCADA	Supervisory Control And Data Acquisition
SMC	Sialkot Municipal Corporation
SPS	Safeguard Policy Statement
TDS	Total Dissolved Solids
TMA	Tehsil Municipal Authority
TOC	Total Organic Compound
TSS	Total Suspended Solids
UC	Union Council

Local Terminology

Chak:	Village
Koel:	Cuckoo
Nullah:	Natural water body, drain

Units

1 Marla	= 225 square feet	= 0.005165 acres
1 Square foot	= 0.0929 square metres	
1 Acre	= 43,560 square feet	= 0.404685642 hectares
1 Square metre	= 10.76391 square feet	= 0.0002471 acres
1 Hectare	= 2.4710538 acres	= 10,000 square metres
1 Inch	= 25.4 mm	= 2.54 cm
1 Mile	= 5,280 feet	= 1.609344 kilometres
1 Kilometre	= 0.62137 miles	= 3,280.84 feet
1 Gallon (Imperial)	= 4.54609 litres	= 0.0045461 cubic metres
1 Cubic metre	= 1,000 litres	= 219.96925 gallon (imperial)
1 Cubic metre/second	= 3,600 cubic metres/hour	= 35.31467 cusec
1 Cusec	= 101.941 cubic metres/hour	

Currency Conversion

1 US$ = 104 PKR

I. INTRODUCTION

A. Punjab Intermediate Cities Improvement Investment Program

1. The Asian Development Bank (ADB) and the Cities Development Initiative for Asia (CDIA) are partnering with the Government of Punjab Province (GoPP), to undertake the Punjab Intermediate Cities Improvement Investment Program (PICIIP). The PICIIP aims to improve the quality of urban services available in five selected cities in Punjab Province, the most populous province in Pakistan, with city populations between 250,000 and 1,000,000. Urban infrastructure development is an important component of the PICIIP. The duration of the program will be six years. The PICIIP's overall budget is US$500 million, to be disbursed in phases. The first phase will fund investments in the intermediate cities of Sialkot and Sahiwal. Major projects planned for Sialkot city during Phase 1 of PICIIP are water supply improvement, sewerage and drainage improvement, and urban development improvements, including transport routes and green spaces.

2. This IEE study examines the environmental implications of all of the subprojects.

B. Subproject Types Identified for Implementation

3. The prefeasibility study of Sialkot city, carried out under PICIIP in April 2016, has identified three projects under transport, water supply and sewerage improvement, as given in Table-1.1.

i. Water Supply Improvement Project: Rehabilitation of water supply tube wells, overhead reservoirs and water distribution pipelines will be carried out at different parts of the city. These projects will improve water quality and water supply situation in the city. At some places, new water supply infrastructure will also be installed. The Supervisory Control and Data Acquisition (SCADA) system implementation and bulk metering of water supply will also be the part of water supply improvement project.
ii. Sewerage and Drainage Improvement Project: Rehabilitation of sewerage and drainage network and disposal stations will be carried out at different parts of the city. At some places the sewers will be replaced.
iii. Transport Routes Improvement Project: Improvements and upgrades to 3 KM Kashmir Road and one general bus stand will be carried out under this part of the project.
iv. Green Spaces Development: Rehabilitation of existing parks and development of green belts at different parts of the city will be the green spaces development projects.

C. Environmental Assessment

4. The ADB requires the consideration of environmental issues in all aspects of the Bank's operations. The requirements for environmental assessment are described in the ADB's Safeguard Policy Statement (SPS), 2009. This Initial Environmental Examination (IEE) study was carried out based on a prefeasibility study and conceptual engineering designs. The IEE was prepared during the project feasibility stage and may be updated during the implementation stage to reflect any required changes related to the latest sub-project designs.

Table-1.1: Subprojects for Sialkot under PICIIP

Sector	Projects
Transport Routes	3 KM Kashmir Road improvement/upgrades
	General bus stand, improvement/up-gradation
Water Supply	Rehabilitation of overhead reservoirs
	Efficiency improvement of tube wells
	Replacement of water supply pipelines
	Provision of disinfection units at tube wells and overhead reservoirs
	Provision of bulk metering, pressure gauges and Supervisory Control and Data Acquisition (SCADA) system at selected water production facilities
	Development of DNI zones
	Rehabilitation of Fateh Garh Scheme water distribution system
Sewerage and Drainage	Replacement of sewers (27.9 KM)
	Provision of accessories for sewerage improvement and health and safety equipment for municipal corporation staff
	Rehabilitation of disposal stations (8)
Green Spaces Development	Rehabilitation of Gulsha-e-Iqbal and Qila Park
	Green belt along the drain

5. An environmental assessment using ADB's Rapid Environmental Assessment (REA) checklists for urban development, sewerage and water supply was conducted and results of the assessment show that the projects are unlikely to cause significant adverse impacts (refer to Annexure-1). The water supply improvement, sewerage and drainage improvement, and urban development improvement projects are classified as Category B. This initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects and provides mitigation and monitoring measures to ensure no significant impacts as a result of the subprojects.

6. The environmental assessment requirements of the Punjab Environmental Protection Act, 1997 (Amended 2012) are different from those of the ADB. The Government of Punjab's environmental regulations categorize development projects into two schedules, according to their anticipated potential environmental impact. The proponents of the projects with the potential for more adverse environmental impacts (Schedule II) are required to submit an Environmental Impact Assessment (EIA). While, for the proponents of projects with the potential for less environmental impact (Schedule I), must submit an IEE with the respective environmental protection agency (EPA). There is no requirement from the GoPb for the above-mentioned projects of water supply, sanitation and urban development for submitting EIA or IEE report.

7. The field studies were undertaken by a team with experience of environmental assessment for development projects in Pakistan. This team conducted the preliminary scoping, survey and assessment activities, public consultations and coordinated the field sampling and analysis.

8. The study process began with scoping and field reconnaissance during which a RRTAid Environmental Assessment was carried out to establish the potential impacts and categorization of project activities. The environmental impacts and concerns requiring further study in the environmental assessment were then identified. The methodology of the IEE study was then elaborated in order to address all interests. Subsequently, both primary and secondary baseline environmental data was collected from the proposed works and the intensity and likely location of impacts were identified with relation to the sensitive receivers; based on the work expected to be carried out. The significance of impacts from the construction and operation of the projects was then assessed and, for those impacts requiring mitigation, measures were proposed to reduce impacts to within acceptable limits.

9. Many Public Consultations (PCs) were carried out during prefeasibility and feasibility stages in line with ADB guidelines. Under ADB requirements the environmental assessment process must also include meaningful public consultation during the completion of the draft IEE. The PC process included verbal disclosure of the subproject as a vehicle for discussion. Interviews were conducted with local families and communities. The results of these PCs have been incorporated in this report.

D. Executing Agency

10. The Sialkot Municipal Corporation (SMC) under Local Government will be the executing agency of the proposed projects. The executive branch of SMC is divided into five departments and a Municipal Officer (MO) heads each of the departments (Finance, Planning and Coordination, Regulation, Infrastructure and Services) to carry out its functions. The MO Infrastructure and MO Services are responsible for water, sewerage, drainage, sanitation, roads, streets and street lighting, firefighting and park services.

C. Structure of Report

11. This IEE reviews information on existing environmental attributes of the study area. Geological, hydrological and ecological features, air quality, noise, water quality, soils, social and economic aspects and cultural resources are included. The report predicts the probable impacts on the environment due to the proposed subproject. This IEE also proposes various environmental management measures. Details of all background environmental quality, environmental impact/pollutant generating activities, pollution sources, predicted environmental quality and related aspects have been provided in this report. References are presented at the end of the report. Following this introduction the report generally follows ADB guidelines and includes:

- Policy, Legal and Administrative Framework
- Description of the Subprojects
- Description of the Environment
- Assessment of Potential Environmental Impacts and Mitigation Measures
- Institutional Arrangements and Environmental Management and Monitoring Plans
- Information Disclosure, Public Consultation and Participation
- Findings and Recommendations
- Conclusions

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

12. Several statutes contain direct legislation on environmental protection, namely the Pakistan Environmental Protection Act (1997), the Punjab Environmental Protection (Amendment) Act (2012, the Forest Act (1927), and the Punjab Wildlife Act (1974). In addition, the Land Acquisition Act (1894) also provides powers in respect of land acquisition for public purposes. There are also several other items of legislation and regulations that have an indirect bearing on the sub-project or general environmental measures.

A. Statutory Framework

13. The Constitution of Pakistan distributes legislative powers between the federal and provincial governments through two 'lists' that are attached to the Constitution as Schedules. The Federal List covers the jurisdictions over which the federal government has exclusive legislative power, while the Concurrent List contains jurisdictions over which both the federal and provincial governments can enact laws. "Environmental pollution and ecology" is included in the concurrent list; hence, both the federal and the provincial governments can enact laws in this jurisdiction. However, to date, after the 18th Constitutional Amendment, the Federal Ministry of Environment was dissolved and the provincial governments are now authorized to formulate environmental laws and regulations. The key environmental laws affecting the subprojects are discussed below.

i. Pakistan Environmental Protection Act, 1997

14. The Pakistan Environmental Protection Act, 1997, is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The act is applicable to a wide range of issues and extends to air, water, soil, marine, and noise pollution, and to the handling of hazardous wastes. The key features of the law, in as far as it has a direct bearing on the proposed subprojects, relate to the requirement for an IEE and an EIA for development subprojects. Section 12 (1) requires that: "No proponent of a sub-project shall commence construction or operation unless he has filed with the Federal Agency an Initial Environmental Examination [IEE] or, where the subproject is likely to cause an adverse environmental effect, an Environmental Impact Assessment [EIA], and has obtained from the Federal Agency approval in respect thereof." The Pakistan Environmental Protection Agency has delegated the power of review and approval of environmental assessments to the provincial environmental protection agencies, in this case the Punjab EPA.

ii. Punjab Environmental Protection (Amendment) Act, 2012

15. After the 18th Constitutional Amendment in the Constitution of Pakistan, the Federal Ministry of Environment was dissolved and the provinces were accorded jurisdiction over the environment. The EPA Punjab has formulated its own Act, the major content of which is the same as the PEPA, 1997. Minor amendments/changes have been made, as follows:

a. The name of the Act has been changed to "Punjab Environmental Protection (Amendment) Act, 2012".
b. For the words "Federal Government", wherever they occur, the word "Government" shall be substituted; For the words "Federal Agency", wherever they occur, the words "Provincial Agency" shall be substituted; and
c. For the word "National", wherever it occurs, the word "Punjab" shall be substituted.
d. All the other clauses, sub-clauses, sections and sub-sections are almost identical.

Since these subprojects fall within Punjab province, may be approval from Punjab province will be required, if these fall under the category.

iii. Punjab Environmental Protection Agency Review of IEE and EIA Regulations

16. The Punjab Environmental Protection Act provides for two types of environmental assessments: IEEs and EIAs. EIAs are carried out for subprojects that have the potential for 'significant' environmental impacts, whereas IEEs are conducted for relatively smaller sub-projects with relatively less potential for significant impacts. The Punjab Environmental Protection Agency Review of the IEE and EIA Regulations categorizes the subprojects that require an IEE and an EIA. Schedules I and II, attached to the Regulations, list these types of subprojects.

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

a. To determine whether a sub-project is categorized as requiring an IEE or EIA, use the two schedules attached to the Regulations.

b. An EIA or IEE is conducted as per the requirements outlined in the Pak-EPA guidelines.

c. If the project is located in the provinces, then the EIA or IEE is submitted to the concerned provincial EPA; if it is located in Islamabad and federally administrated areas, then it is submitted to the Pak-EPA. The Fee (depending on the cost of the sub-project and type of report) is submitted along with the EIA or IEE document.

d. The IEE/EIA is also accompanied by an application in the format prescribed in Schedule IV of the Regulations.

e. The EPA conducts a preliminary review of the report and replies within 10 days of the submission. It either a) confirms completeness, or b) asks for additional information, if needed, or c) returns the report and asks for additional studies, if necessary.

f. If the issue is confirmation of completeness, then the EPA is required to make every effort to complete the IEE and EIA review process within 45 and 90days, respectively.

g. The EPA accords their approval, subject to certain conditions:

   - ✓ Before commencing construction of the sub-project, the proponent is required to submit an undertaking accepting the conditions.
   - ✓ Before commencing operation of the sub-project, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of the IEE.

h. An Environmental Management Plan (EMP) is to be submitted with a request for obtaining confirmation of compliance.

i. The EPAs are required to issue confirmation of compliance within 15 days of receipt of the request and complete documentation.

j. The IEE/EIA approval is valid for three years from the date of operational phase NOC.

k. After completion of construction, a monitoring report is to be submitted to the EPA, followed by annual monitoring reports, during operations.

18. As per Punjab Environmental Protection Act for the EIA or IEE, the STP and solid waste disposal facility would fall under Schedule II (Review of IEE & EIA Regulations). Schedule II projects require an EIA, due to their anticipated adverse environmental impacts. Under

provincial requirements, the water supply, sewerage and drainage, and transport projects do not require either an EIA or an IEE.

iv. National Environmental Quality Standards (NEQS)

19. The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and were amended in 1995 and 2000. Standards for the following types of effluent and emissions are specified in the NEQS and may be relevant to the specified projects:

a. Municipal and liquid industrial effluent parameters (32) for discharge to in land waters, sewage treatment facilities, and the sea.
b. Industrial gaseous emissions (16) into the atmosphere.
c. Motor and vehicle exhaust and noise (3)
d. Ambient air quality (9)
e. Drinking water quality (33)
f. Noise for residential, commercial, industrial, and silence zones

v. Other Relevant Laws

20. A number of other federal and provincial laws are important in the context of environmental management. The main laws that potentially affect the sub-projects in this MFF are listed below.

a. **The Punjab Wildlife Protection Ordinance, 1972,** empowers the government to declare certain areas to be reserved for the protection of wildlife and to control activities within in these areas. It also provides protection to endangered wildlife species. As no activities are planned in these areas, no provision of this law is applicable to the proposed sub-projects.

b. **The Forestry Act, 1927,** empowers the government to declare certain areas as reserved forests. As no reserved forests exist in the vicinity of the proposed sub-project, this law will not affect to the proposed sub-projects.

c. **The Antiquities Act of 1975** ensures the protection of Pakistan's cultural resources. The act defines 'antiquities' as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, and national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain articles of archaeological significance. This project site is not in the proximity of a protected antiquity.

d. **Safety Regulations** directly or indirectly govern occupational health and safety (OHS) issues during the currently studied production activities. These regulations mainly include three laws and regulations: (i) PEPA Laws, 2000; (ii) Labor Laws; and (iii) Electricity Rules,1937.

B. ADB Requirements

21. ADB safeguard policies require that:

i) impacts are identified and assessed early in the project cycle;

ii) plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and

iii) affected people are informed and consulted during project preparation and implementation.

22. The policies apply to all ADB-financed projects, including private sector operations, and to all project components.

23. The implementation processes as follows:

i) screening and scoping of the main issues start as soon as potential projects for ADB financing are identified and continue throughout the project cycle;

ii) impacts are assessed, safeguard plans summarizing mitigation measures, monitoring program, and institutional arrangements are prepared, and arrangements are made to integrate safeguards into project design and implementation;

iii) affected people are consulted during project preparation and implementation and information is disclosed in a form, manner, and language accessible to them; and

iv) safeguard plans are disclosed to the general public and the information is updated at various stages in the project cycle.

24. ADB's safeguard policies require that both ADB's and developing member countries' (DMCs') safeguard requirements are complied with.

25. Applicable standards for air emissions for general application, ambient air condition at property boundary for general purpose, limits for process wastewater, domestic sewage and contaminated storm water discharges to surface water and ambient noise levels are given below, and are based on the standards described in the World Bank Group (IFC) Environmental, Health and Safety Guidelines (EHS Guidelines). The Punjab Environmental Quality Standard (PEQS) values are also given against each value for the comparison with local requirement.

Air Emissions Limits for General Application
(milligrams per normal cubic meter)

Pollutant or Parameter	Limit	PEQS
PM	50 for units with >⊓50 MWe input	300 -500
	100 for units with < 50 MWe input	
Nitrogen Oxides as NO2		Oxides of Nitrogen
Coal fired	750	1,200
Oil fired	460	600
Gas fired	320	400
Sulfur dioxide	Not to exceed 2,000	Sulfur Oxides 1,700

MWe Megawatts Electricity

Ambient Air Conditions at Property Boundary, for General Application
(micrograms per cubic meter)

Pollutant	Concentration	PEQS
Particulate Matter		
Annual Arithmetic Mean	50	360
Maximum 24 hour Average	70	500
Nitrogen Oxides (Maximum 24 hr)	150	80
Sulfur dioxide		
Annual Arithmetic Mean	50	80
Maximum 24 hr Average	125	120

Limits for Process Wastewater, Domestic Sewage, and Contaminated Storm Water Discharged to Surface Waters, for General Application

(milligrams per liter, except for pH, bacteria, and temperature)

Pollutant or Parameter	Limit	PEQS
pH	6–9	6 -9
BOD	50	80
COD	250	150
Oil and grease	10	10
TSS	50	200
Metals Heavy metals, total	10	-
Arsenic	0.1	1.0
Cadmium	0.1	0.1
Chromium Hexavalent	0.1	-
Total	0.5	1.0
Copper	0.5	1.0
Iron	3.5	8.0
Lead	0.1	0.5
Mercury	0.01	0.01
Nickel	0.5	1.0
Selenium	0.1	0.5
Silver	0.5	1.0
Zinc	2.0	5.0
Cyanide Free	0.1	-
Total	1.0	1.0
Ammonia	10	40
Fluoride	20	10
Chlorine, total residual	0.2	1.0
Phenols	0.5	0.1
Phosphorus	2.0	-
Sulfide	1.0	1.0
Coliform bacteria	< 400 MPN/100 ml	-
Temperature increase	< 3°Ca	< 3°C

Note: MPN, most probable number

a. The effluent should result in a temperature increase of no more than 3° C at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge.

Ambient Noise

Receptor	Maximum Allowable log equivalent (hourly measurements) in dBA		PEQS	
	Day (07:00 – 22:00)	Night (22:00 – 07:00)	Day	Night
Residential, Institutional, Educational	55	45	55	45
Industrial, Commercial	70	70	65- 75	55 - 65

III. DESCRIPTION OF SUBPROJECTS

21. Under the first phase investments of the PICIIP it is proposed to implement urban development sub-projects in the following:

- Water supply;
- Sanitation; and
- Urban development, with respect to transportation infrastructure and the development of green spaces.

22. This Section provides an overview of the existing situation in Sialkot, and outlines the subproject proposals designed to address some of the current deficiencies in the provision of urban services. Where applicable, solutions and approaches which are alternative to the proposed subprojects are considered and discussed.

A. Water Supply Improvement Projects

i. Current Status

23. In total, 95 tube wells are operational, catering to the needs of the urban population of Sialkot. This does not include the cantonment area for which an additional 15 tube wells are in operation. The design discharge of all tube wells is 1.5 cusec (153 m^3/hr), however actual discharge varies depending upon the age and condition of the tube well. All tube wells operate on average 12 hours a day. Based on average discharge and operation time, the total daily production for Sialkot City (excluding the cantonment) is approximately equivalent to 38.4 million gallons, while per capita production is equivalent to 79.8 gallons per capita per day. These are raw estimates since accurate production data is not available due to the absence of metering and monitoring mechanisms. The higher volume of water production, absence of monitoring mechanisms, absence of valve control mechanisms on the pipe network, and absence of customer meters illustrates the exploitation of the resource and high production costs.

24. Based on the current and projected populations for the Sialkot and the projected per capita water demand of 33 gallons per day, both current (2015) water demand and future (2035) water demand is estimated to be less than available supply. Industrial water demand is assumed to be only 15% of the total water consumption as it is assumed that larger industrial establishments have a private water supply. Commercial and institutional demands have been assumed to be 15% and 10% of the total water consumption respectively.

25. The estimated daily production of water in Sialkot is 38.4 MGD, which supports current estimated demand. The high amount of losses (possibly up to 50%) would partially explain why it is not possible to provide a 24/7 service at present. The nominal rating of all the tube wells is 149.5 cusec (15,249 m^3/hr) or 80 MGD, although this is expected to now be less than 100 cusec (10,200 m^3/hr) given the lower water table and the condition of the pumps. Nevertheless, the capacity of the existing tube wells seems to be sufficient for the foreseeable future provided the pumps are rehabilitated and the lowering of the water table is addressed.

26. The piped water system in Sialkot is supplied by tube wells constructed at various locations in the city, and these pump water directly into the system. Valves have been

installed on the network but the staff of the SMC has not been using them, given the interconnectivity of the network and the sufficient production capacity of the system. Moreover, the valves have mostly been buried under the ground due to construction activities, and there is a lack of knowledge about their location. If one or two tube wells are dysfunctional, other tube wells in the vicinity feed the system thus catering for emergency needs.

27. Approximately 75% of the area within the city limits receives water from the SMC system. The pressure in the network is good, with limited complaints from the consumers. The quality of service and pressure is obvious, because almost all households have an overhead reservoir which is directly filled by the SMC supply up to second floor and without the need for a pumping facility. However, water quality is reported to be poor, especially by consumers in the low-income areas of the city. The main complaints relate to odor, and there is a perception that there is ingress of sewage into the water pipelines.
28. The design life of the tube wells is 15 years. Twenty nine tube wells are more than fifteen years old, while 11 tube wells are more than twenty years old. In its short-term plan, SMC recommends the construction of 11 new tube wells. The SMC has been re-boring wells during the past few years owing to the reduced discharge and efficiency of the tube wells. However, the turbines for these tube wells have not been installed due to a lack of funding. Overall 12 tube wells have been re-bored and require turbine replacement.

29. There is no integrated control system such as a Supervisory Control and Data Acquisition (SCADA) for the tube well installations or pressure gauges at the sites, which would enable some pumps to be switched off when not required.

30. There are eleven elevated or overhead reservoirs (OHR) distributed throughout the piped network with a total storage capacity of 1,568 m^3 (345,000 gallons), although these are currently not in service. Reportedly they were taken out of service due to security concerns, as it was considered that the water supply could be deliberately contaminated at the reservoirs. The storage represents 0.54 hours of storage excluding system losses. Generally, about 3-4 hours storage is considered necessary to balance supply and demand without giving consideration to fire-fighting water availability and the impact of load shedding which is frequent in Sialkot. The SMC Infrastructure and Services Division is not interested at this stage in bringing the reservoirs back into service as they are concerned that the time taken to fill the reservoirs would either increase the total pumping time or reduce the time that water is distributed to the consumers. Since water is already pumped into the system at high pressure, consumers are generally able to fill their above ground private storage tanks. However, bringing the reservoirs into service could provide for a more efficient supply and they could, if required, be filled concurrently with pumping directly into the network such that they fill during low demand and empty during peak demand.

31. The conditional survey for the OHR conducted during the study concluded that out of eleven (11) reservoirs, nine (9) could be rehabilitated. Almost all the reservoirs require plastering, fillers, finishing of structures, replacement of doors installed and replacement of delivery and rising mains. The connection of OHR with the distribution system and tube wells needs to be reinstated by construction of new connecting pipelines. If a 24/7 supply is to be provided using District Metering Areas (DMAs), it will be necessary to bring the reservoirs back into service. Furthermore, bringing the reservoirs back into service will provide security against power supply load shedding, which is currently prevalent.

32. Currently it is understood that good pressures are achieved at household connections throughout the system. However, many of the pipelines are reported to be old and in poor condition, so leakage and unaccounted for water is expected to be high. Overall 52% of

the network is identified as rusted and damaged requiring replacement. The total length of the network requiring replacement is 186 KM. Major network expansion in the city was undertaken during 1914, 1937, 1963 and onwards. No major project targeting network improvement in terms of replacement of rusted or damaged pipes has been initiated by the city government since the installation of the network. Moreover, the SMC does not have any mechanism for leak detection or identification and replacement of damaged pipes.

33. Currently the tube wells do not have pressure gauges or flow meters. This makes it difficult to operate them efficiently and there is no way to measure the performance of the tube wells or establish how much water is being lost in the network. While chlorination facilities are in place at the tube well pumping stations, it is not clear whether the water is being regularly chlorinated with the correct dosage.

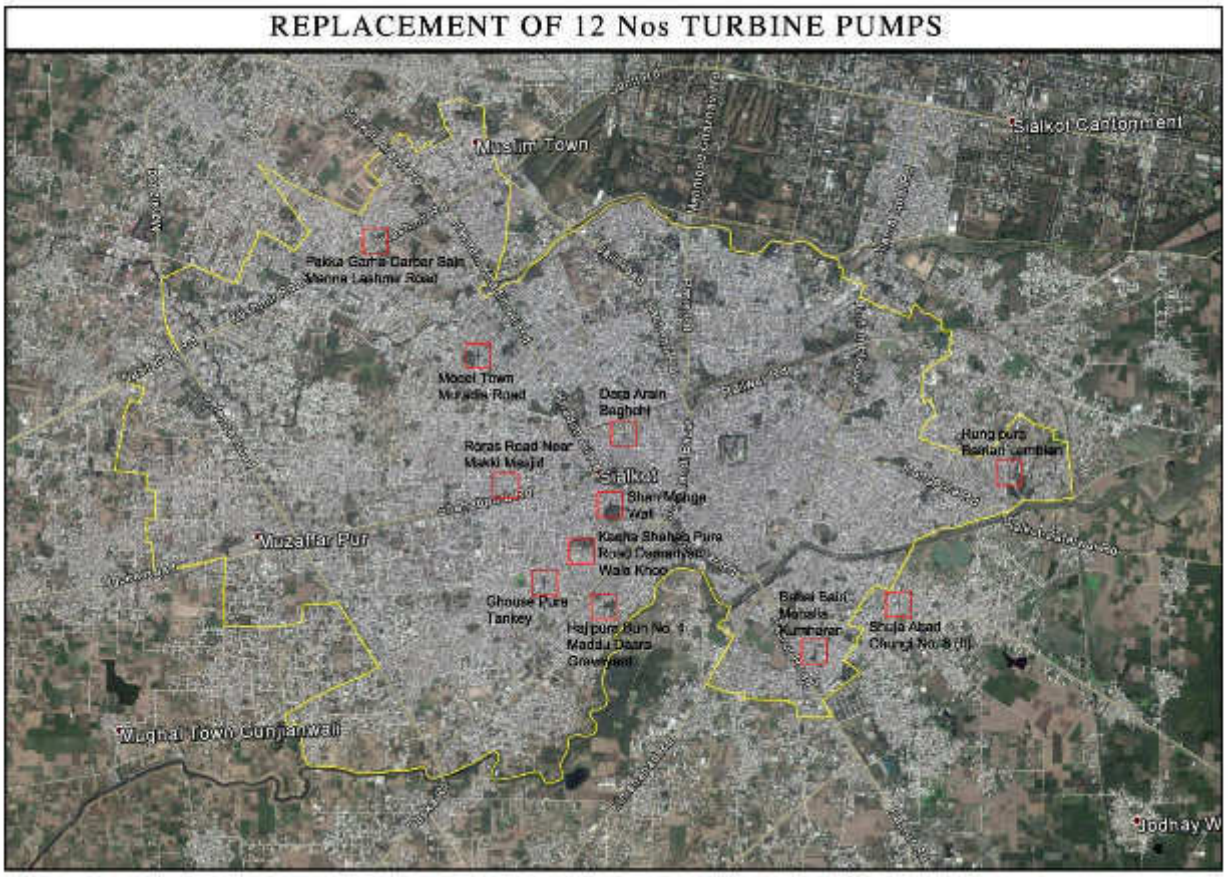
ii. **Proposed Projects**

a. Rehabilitation of Tube Wells

34. The objective of this subproject is to restore 95 tube wells to their original design rating such that a total capacity of 149.5 cusec (15,249 m^3/hr) can be achieved. SMC has been re boring wells to deal with the problem of reduced discharge. In most of the cases re-boring has been done, however the turbines of existing tube wells have been re-installed in new re-bored wells. The rehabilitation works required at the 95 tube wells within the existing service area are as follows:

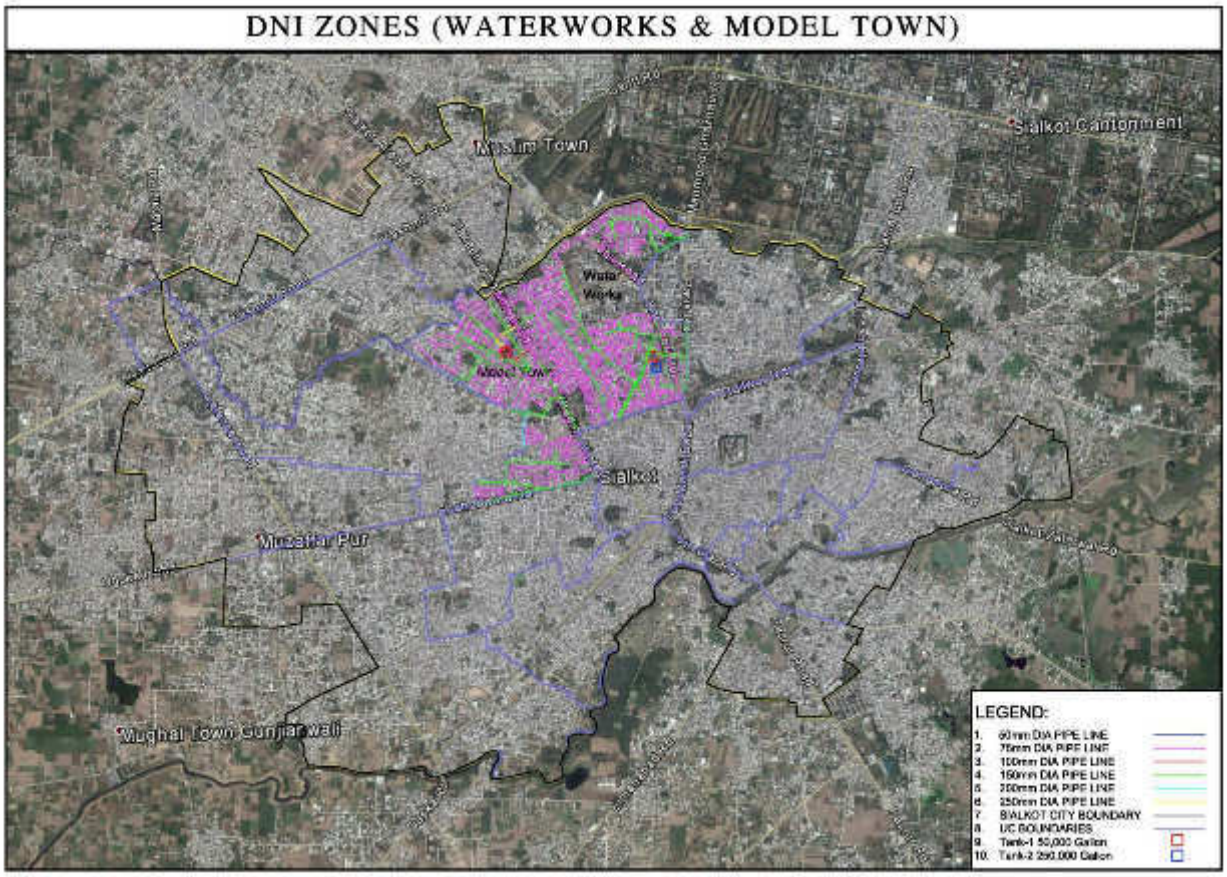
- Replacement of turbine pumps and motors at twelve (12) re-bored tube wells.
- Provision of new switchgear and electrical installations (26)
- Chlorination units at all 95 tube wells.
- Improving the efficiency of 60% of the tube wells (57) through the provision of bulk meters, pressure gauges, non-return valves, air valves, installation of capacitors, upgrading of delivery pipes as required.
- Development of DNI Zones: It is experimented that two union councils i.e. Model Town and Water Works are declared as DNI (Distribution Network Improvement) zones where water meters will be installed at all the houses and charged bill accordingly. These DNI zones will be supplied water for 24/7.

The intervention location of replacement of pumps and motors is shown below:

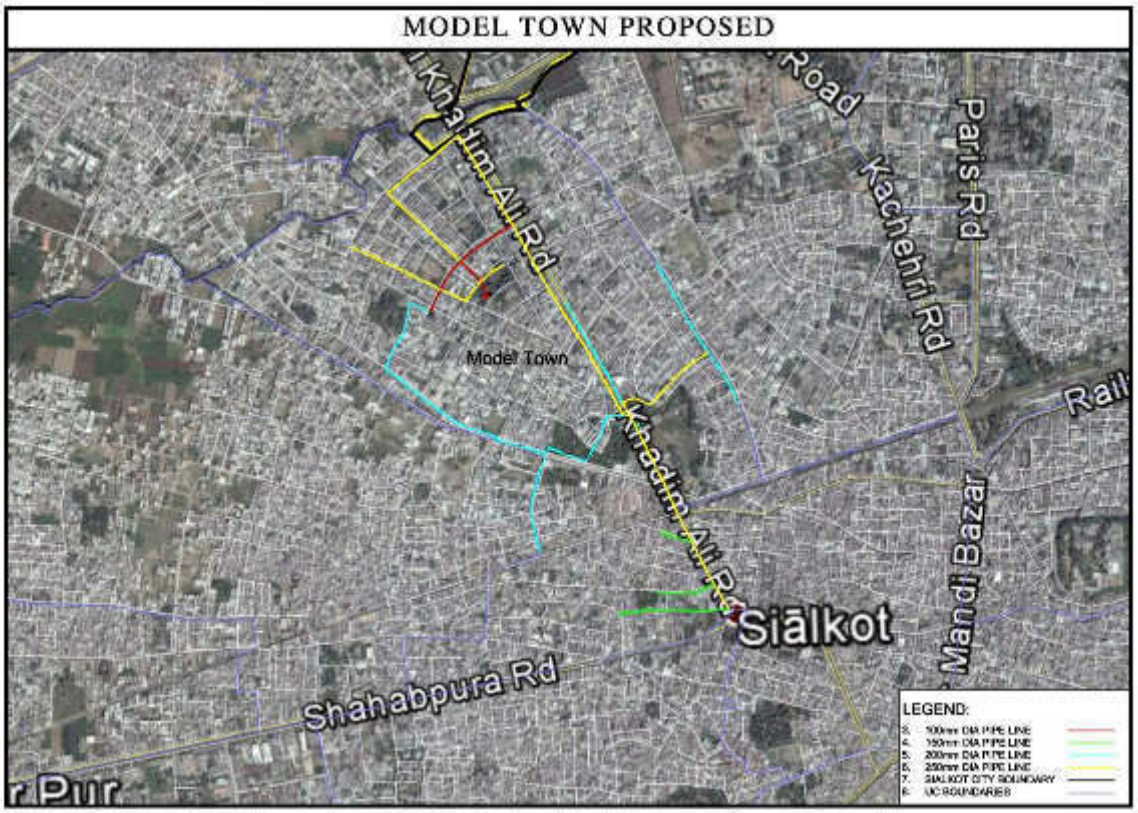


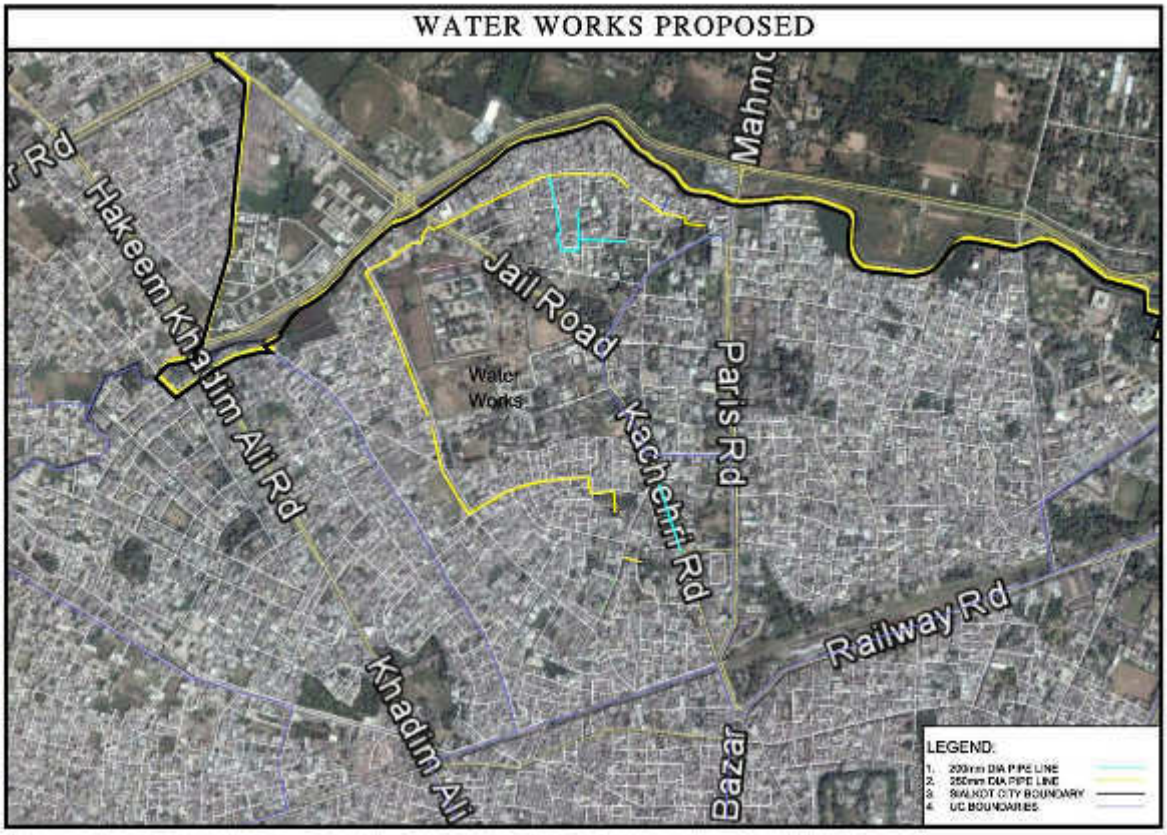
The intervention location of two DNI zones and proposed intervention of pipe replacement in these two DNI zones is shown below:

DNI ZONES (WATERWORKS & MODEL TOWN)



MODEL TOWN PROPOSED



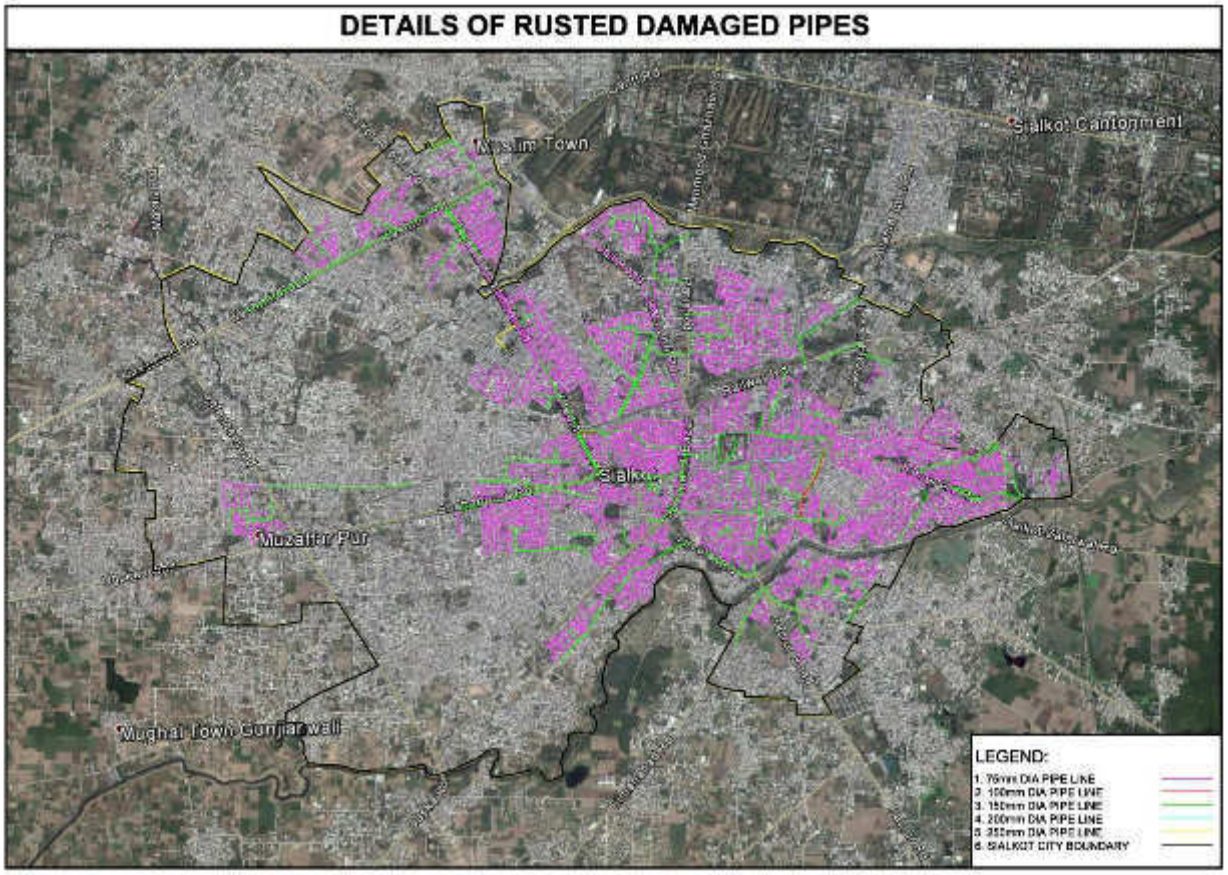


b. Rehabilitation of Distribution Network

Replacement of Rusted/Damaged Pipes

35. Approximately 75% of the city has coverage for water supply through a piped network. The major portion of the city is supplied by the piped network constructed by SMC while some public buildings and large installations have their own arrangements (tube wells and OHRs). In addition, privately constructed housing schemes including the WAPDA colony, MAG town, and the Government Polytechnic staff colony have poor condition/rusted networks, which are proposed to be replaced as a short-term investment plan. A total of 49 KM of the network (Cast Iron, Mild Steel and PVC pipes) is in poor condition and needs to be replaced, comprising pipelines ranging in diameter from 50-254 mm.

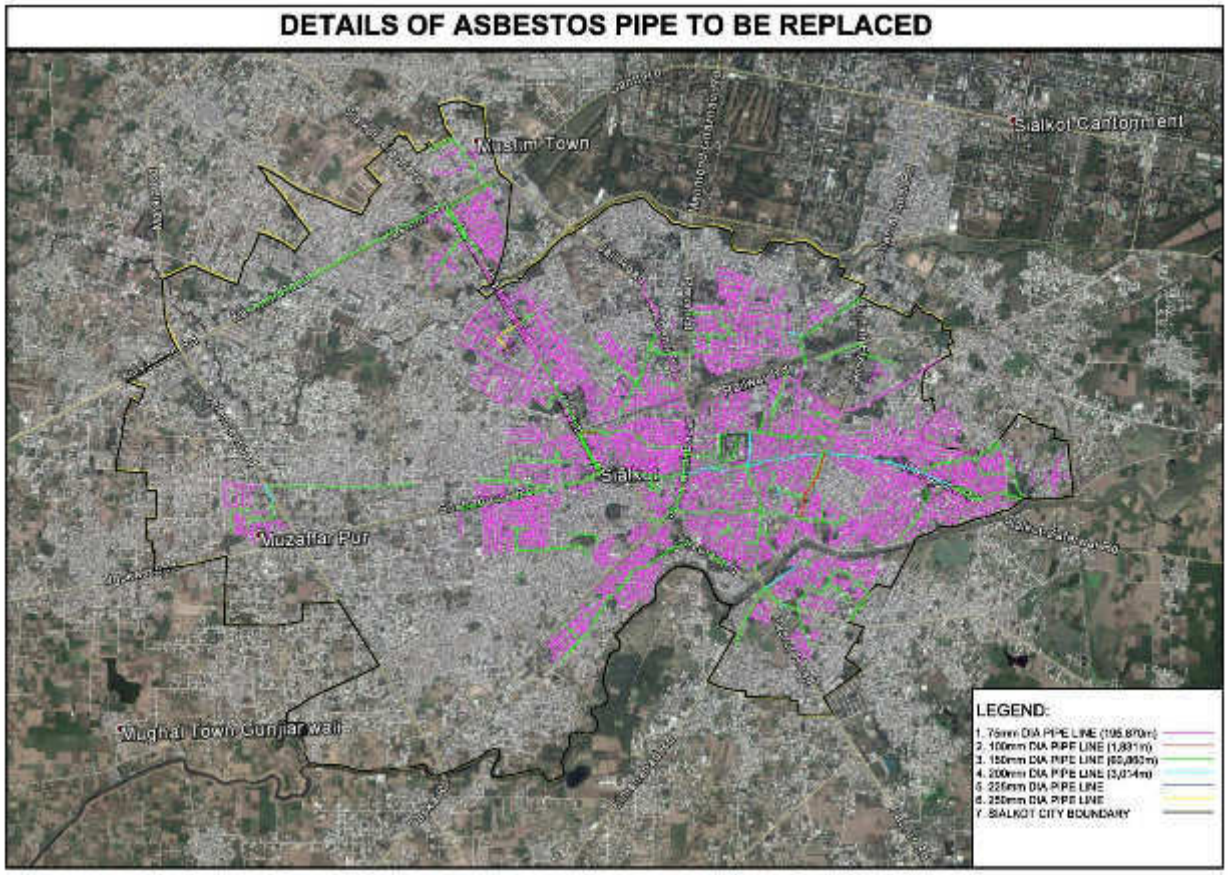
The location of rusted/damaged pipes is shown below:



Replacement of Asbestos Pipe

36. Keeping in mind the detrimental effects of asbestos on health, it is proposed to replace the asbestos cement pipes as part of the medium term investment plan. About 262 KM of asbestos cement pipe of either damaged or due to detrimental health impacts is required to be replaced. The existing AC pipes will remain buried in the ground by discontinuing their water connection because their disposal is health hazards. There is sufficient space available for laying side by side pipes.

The location of the asbestos pipes to be replaced is shown below:



Rehabilitation of Fateh Garh Distribution System

37. In Union Council Fateh Garh, a water supply scheme was constructed for Bogra serving approximately 400 households. The scheme consists of tube wells and a water distribution network. Due to technical flaws the scheme has never operated and has not been functional since the construction was completed. SMC staff report inadequacy of the distribution network (inappropriate design) limiting the supply water to the target population. The tube wells installed are functional and can be used if the pipe network is replaced. The scheme is proposed to be rehabilitated through replacing the pipe network.

c. Rehabilitation of Existing Overhead Reservoirs

38. This item will comprise the rehabilitation and bringing back into service of nine (9) of the existing eleven (11) overhead reservoirs. The other two are in better condition and do not require any rehabilitation (Shahab Road and Tiba Tank). The rehabilitation works will include:

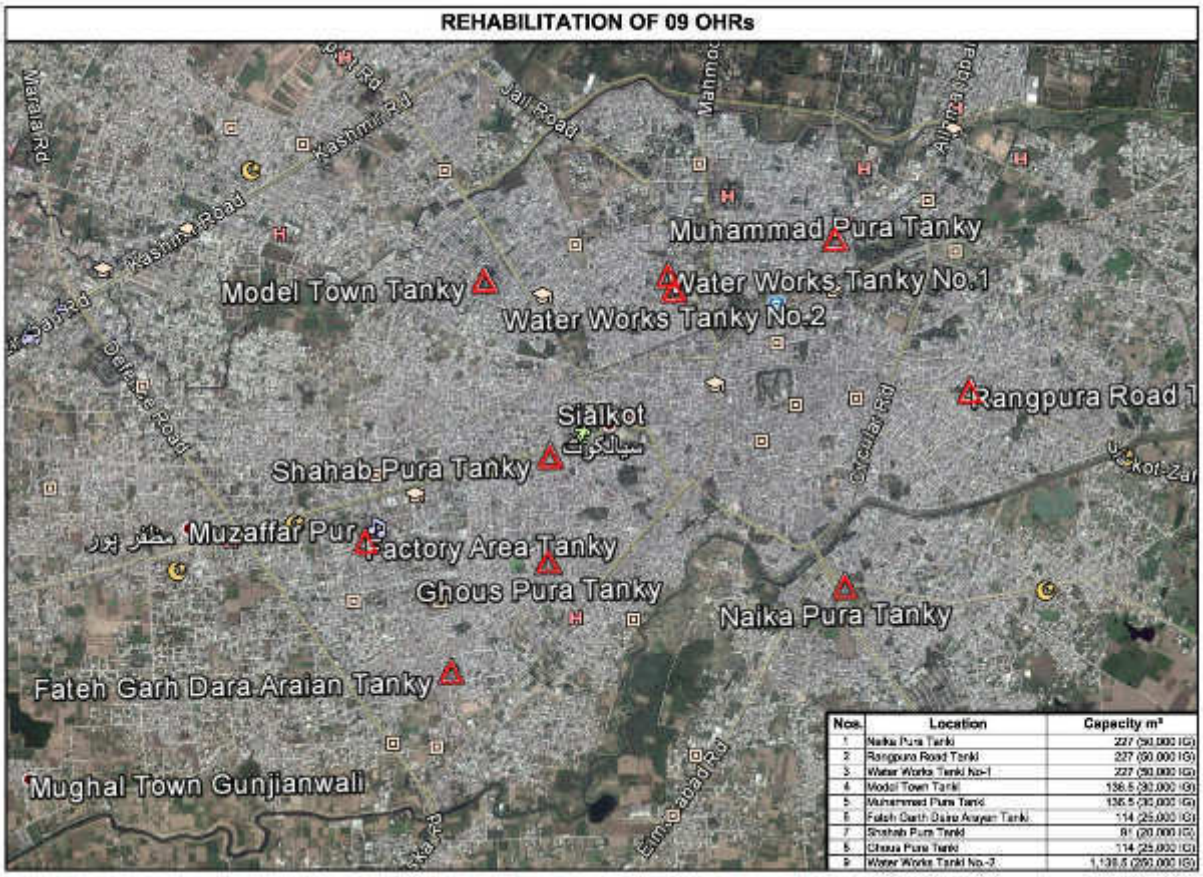
- Replacement of doors and windows.
- Plastering, fillers and minor structural repairs
- Connection on inlet and outlet pipe work and valves

Table-3.1 shows name and capacity of nine OHRs to be rehabilitated.

Table-3.1: Detail of Rehabilitation of Nine OHRs

#	Location	Capacity m^3
1	Naika Pura Tanki	227 (50,000 IG)
2	Rangpura Road Tanki	227 (50,000 IG)
3	Water Works Tanki No-1	227 (50,000 IG)
4	Model Town Tanki	136.5 (30,000 IG)
5	Muhammad Pura Tanki	136.5 (30,000 IG)
6	Fateh Garth Daira Arayan Tanki	114 (25,000 IG)
7	Shahab Pura Tanki	91 (20,000 IG)
8	Ghous Pura Tanki	114 (25,000 IG)
9	Water Works Tanki No.-2	1,136.5 (250,000 IG)

The intervention location of OHRs is shown below:



d. Installation of SCADA System

39. A Supervisory Control and Data Acquisition (SCADA) system will be installed to facilitate more efficient water supply system operation at DNI zones. It will allow automatic operation of tube well pumping stations based on the reservoir levels and system

pressure. It will enable real time measurement of flows and pressures throughout the system, and will enable accurate assessment of water losses. SCADA is essentially a real-time industrial process control system used to centrally monitor and/or control remote or local industrial equipment such as valves, pumps, sensors, etc. SCADA is a combination of telemetry and data acquisition, which will perform the functions of (i) data acquisition; (ii) networked data communication; and (iii) data presentation.

iii. Alternatives

40. Following alternatives for groundwater supply for Sialkot city is proposed under prefeasibility study:

41. Given the available groundwater resource, it is likely that supply of water from tube wells will remain the principal water source for the foreseeable future. However, alternative sources may need to be considered in the longer term given the reported lowering of the water table in the vicinity of Sialkot city, the potential impact of climate change on recharge and the continued high cost of pumping. These alternative water source options include rainwater harvesting, artificial recharge and surface water development.

42. *Rainwater Harvesting and Artificial Recharge:* Rainwater harvesting can play a significant role in ground water recharge, as groundwater levels in Sialkot are dropping and this raises the question as to (a) whether natural groundwater recharge is decreasing and (b) whether some means is available to increase groundwater recharge rates.

43. One option for increasing the rate of recharge will be to create storm water holding areas, which will serve the dual purpose of attenuating peak storm flows and allowing recharge but it will be complex due to the limited space available in all areas of the city. It does not appear to be viable for the areas where there is lack of open space. However, it should be considered as an integral part of the design of any parks provided as part of the overall planning approach. In addition, recharge tube wells can serve the purpose of recharging deep aquifers or injection wells can be provided for recharge through percolation. Recharge through abandoned dug wells can be another option and recharge trenches can be built where permeable strata is available at shallow depths. However, converting from a ground water source to a surface water source is the most suitable way to address the alarming scale of ground water depletion.

44. *Surface Water Development:* The imbalance between ground water recharge and ground water abstraction is likely to develop into a crisis and water insecurity issue. The Upper Chenab canal is passing by Sambrial Tehsil of Sialkot District while river Chenab crosses by Wazirabad District which is located 45 KM away from Sialkot. In the long term the available surface water resources (Chenab River and Upper Chenab Canal) need to be explored for domestic water supply project in Sialkot as well as adjacent cities. Water filtration plants may be designed and constructed for treatment of this water.

45. There are two options for water supply i.e. pressurized supply through continuous running of water turbines and filling of OHR and supply through it with intermittent running of tube wells. OHR option is considered energy efficient as compared with continuous pressurized water supply.

46. Liquid chlorine is used as disinfectant universally. It is considered useful at water supply facilities without considering any other alternative

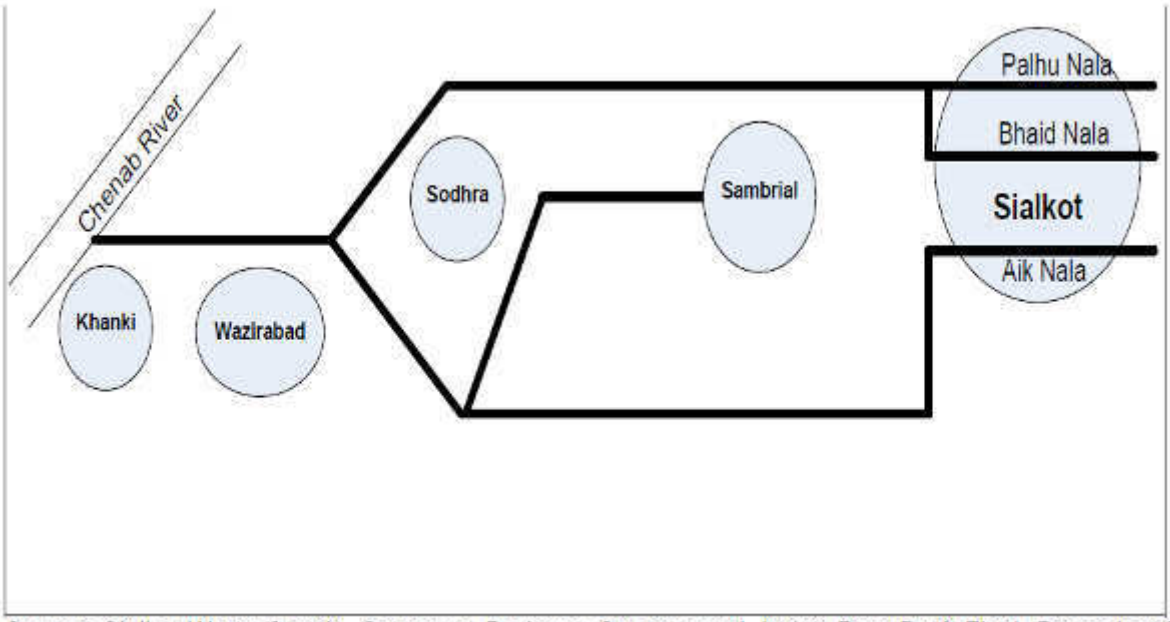
B. Sewerage and Drainage Improvement Projects

i. Current Status

47. Sialkot is traversed by two water channels or nullahs, the Bhaid and Aik Nullahs. The Bhaid Nullah drains the northern part of the municipal area and part of the Cantonment while the Aik Nullah drains the southern part of the municipal area. The Bhaid Nullah has a relatively small catchment area but receives wastewater from many industries and is highly polluted. It also has limited carrying capacity, which is exacerbated by many encroachments along its banks. The Aik Nullah originates in Jannu Hills, is 66 KM in length, has a much larger catchment but generally presents less of a threat to the town than does the Bhaid Nullah.

48. Both wastewater and storm water drainage are collected by a combination of sewers and open drains which eventually discharge into either the Aik or Bhaid Nullah or a tributary of the Bhaid Nullah, the Ganda Nullah, adjacent to the city core area.Water from all nullahs flows through the town and eventually drains into the Chenab River. Figure-3.1 presents the overview of the sewerage and drainage disposal system.

Figure-3.1: Sewerage and Drainage Disposal System



Source: Sialkot Water Supply, Sewerage Drainage Strategy and Action Pan, Draft Final, December 2010 GHK Consulting Ltd.

49. Sialkot has a relatively well developed sewerage system. There are essentially six separate catchment areas that comprise the sewerage system. Sewage from these catchment areas is collected by the sewerage network and conveyed to disposal stations from where raw sewage is discharged to the Aik Nullah, the Bhaid Nullah or the Ganda Nullah. Due to the dispersed nature of industries in Sialkot, the sewage received at the disposal stations contains a mix of domestic and industrial wastewater. During storms, a considerable quantity of storm water also finds its way into the sewerage system either

through interconnections or through the practice of lifting manholes during flood events to alleviate flooding.

50. The total length of the sewerage network in Sialkot city is 178 KM, while overall coverage is approximately 49% with the remaining part of the city served through covered or open drains. Approximately 14km of the network is choked and non-operational, and 15 KM is in poor condition, and needs replacement.

51. Contamination of the water supply system with sewage was cited by the SMC as a serious issue. This is reportedly caused by the proximity of water supply and sewerage pipes possibly laid in a common trench, in addition to the poor condition of the pipes. Replacement of the older, corroded pipes in the network and providing appropriate separation of the pipes should reduce this problem. Ultimately it is necessary to provide a 24-hour supply and keep the water mains pressurized to prevent contaminated water entering the water mains.

ii. Proposed Projects

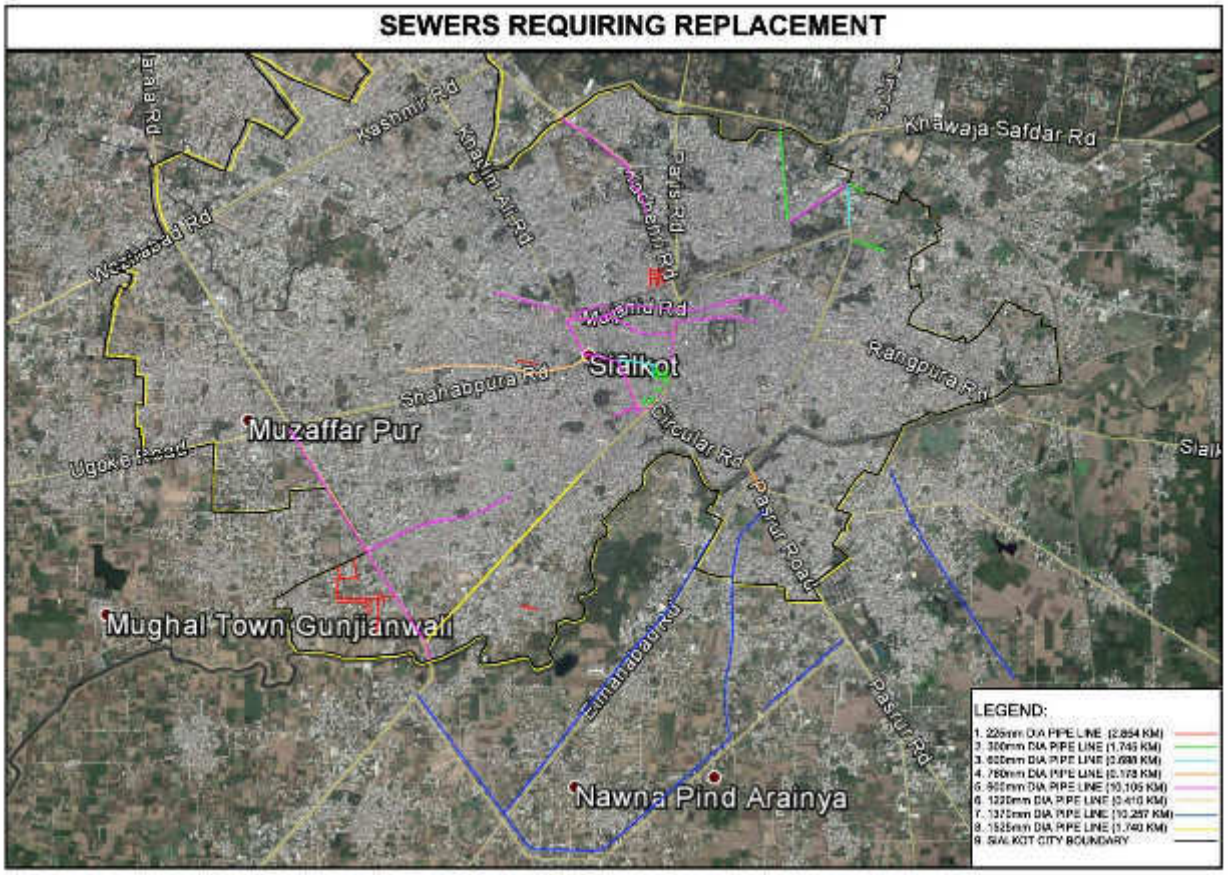
a. Sewerage Pipes Needing Replacement

52. There are 27.9 KM of sewers that require replacement. The breakdown in terms of sewer diameters is shown in Table-3.2.

Table-3.2: Detail of Sewers Requiring Replacement

#	Sewer Diameter (mm)	Sewer Length to be Replaced (KM)
1	1,524	1.74
2	1,370	10.257
3	1,219	0.410
4	914	10.105
5	762	0.178
6	609	0.700
7	304	1.745
8	225	2.854
Total		**27.989**

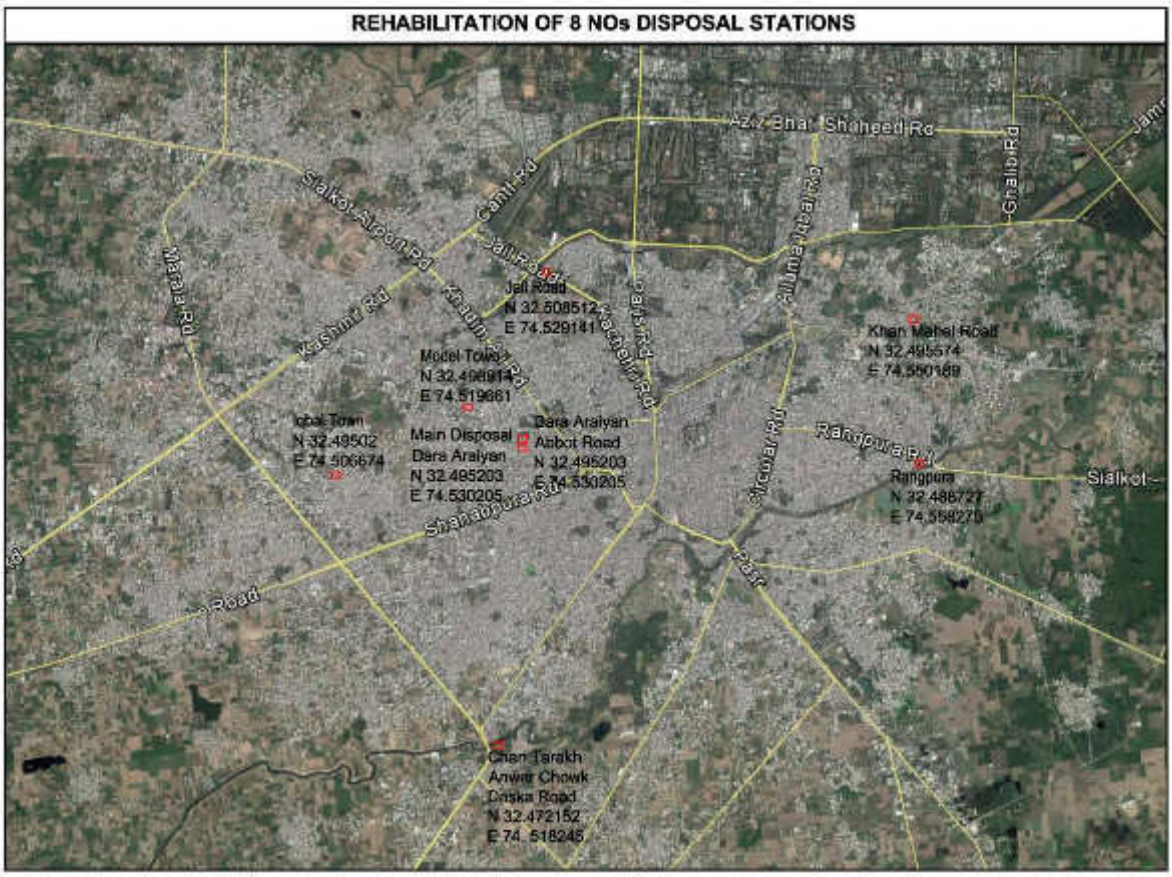
The intervention location of sewers replacement is shown below:



b. Rehabilitation of Disposal Stations

53. The condition of eight disposal stations is not good with respect to electrical, mechanical and civil condition. These eight pumping stations will be upgraded to increase capacity, so as to avoid overloading upstream sewers. The rehabilitation includes replacement of pump and motor, improvement of electrical panels, repair and maintenance of pumps and motors and civil work.

The intervention location of rehabilitation of disposal stations is given below:



C. Transport Routes Improvement Projects

i. Current Status

54. Traffic congestion is growing within the urban area of Sialkot city. Nearly all primary roads and some secondary roads, which carry significant traffic volumes, are dual carriageways with substantial road width, narrow central medians and footpaths. As is common in urban centers in Pakistan, the footpaths are generally encroached and are rarely available for pedestrian use. The omnipresent disorganized and opportunistic curbside parking and absence of adequate traffic management / control measures results in significant traffic congestion for much of the day. This is particularly the case in the old parts of the city where major commercial activity is concentrated.

55. The urban transport sector in Sialkot is measurably worse than that of Sahiwal. This is due to the higher population, a higher level of an economic activity, higher vehicle volumes, poor junction layouts, minimal traffic management facilities and encroachments which create side friction and often brings the traffic to a standstill. Moreover, the population is growing at an annual rate of 2.2% and there is an increasing rate of growth in motorized vehicles from 3.4% between 2005-2010 rising to a 10% annual growth for the 2012-2015 period.

56. Problems exist with poor road layouts, inefficient junction configurations, poor placement and maintenance of traffic signals, inadequate facilities for pedestrians, non-motorized transport and public transport, uncontrolled road side parking and absence of clear

demonstration and display of traffic regulatory control measures. This results in poor utility of road space, road congestion, inefficient mobility and threats to economic growth.

57. Public transport is not adequately developed. Only intercity bus routes passing through two major corridors pass through suburban areas. The majority of travelers use motor bikes for commuting adding to congestion. Two bus terminals situated on Jail Road are operating in Sialkot. One is owned by Daewoo that handles luxury intercity bus services. Main Terminal belonging to Sialkot Cantonment is spread over an area of 6.5 hectares. Around 1,200 plus bus departures a day are reported from this terminal. Terminal operation is, however, poorly managed. SMC is interested in developing a new site in the south of city. An elaborate road network exists that can be upgraded to operate city bus service. Currently the transport sector is administered through multiple organizations, whereas, the government is geared to assign the responsibility to Regional Transport Authority [RTA] at the district level.

ii. Proposed Projects

a. Road improvement/Upgrade

58. It is proposed that Kashmir Road in 3 KM length will be improved/upgraded with following interventions:

i. Road pavement
ii. Intersections improvement
iii. Traffic signals
iv. Storm water drainage
v. Walkways
vi. Regulatory signage
vii. Markings and cat eyes
viii. Curbstones
ix. Bicycle track
x. Parking
xi. Bus stops
xii. Street furniture
xiii. Face uplifting of buildings

Figure-3.2 shows one section of proposed layout of Kashmir Road.

b. Improvement of Bus Terminal

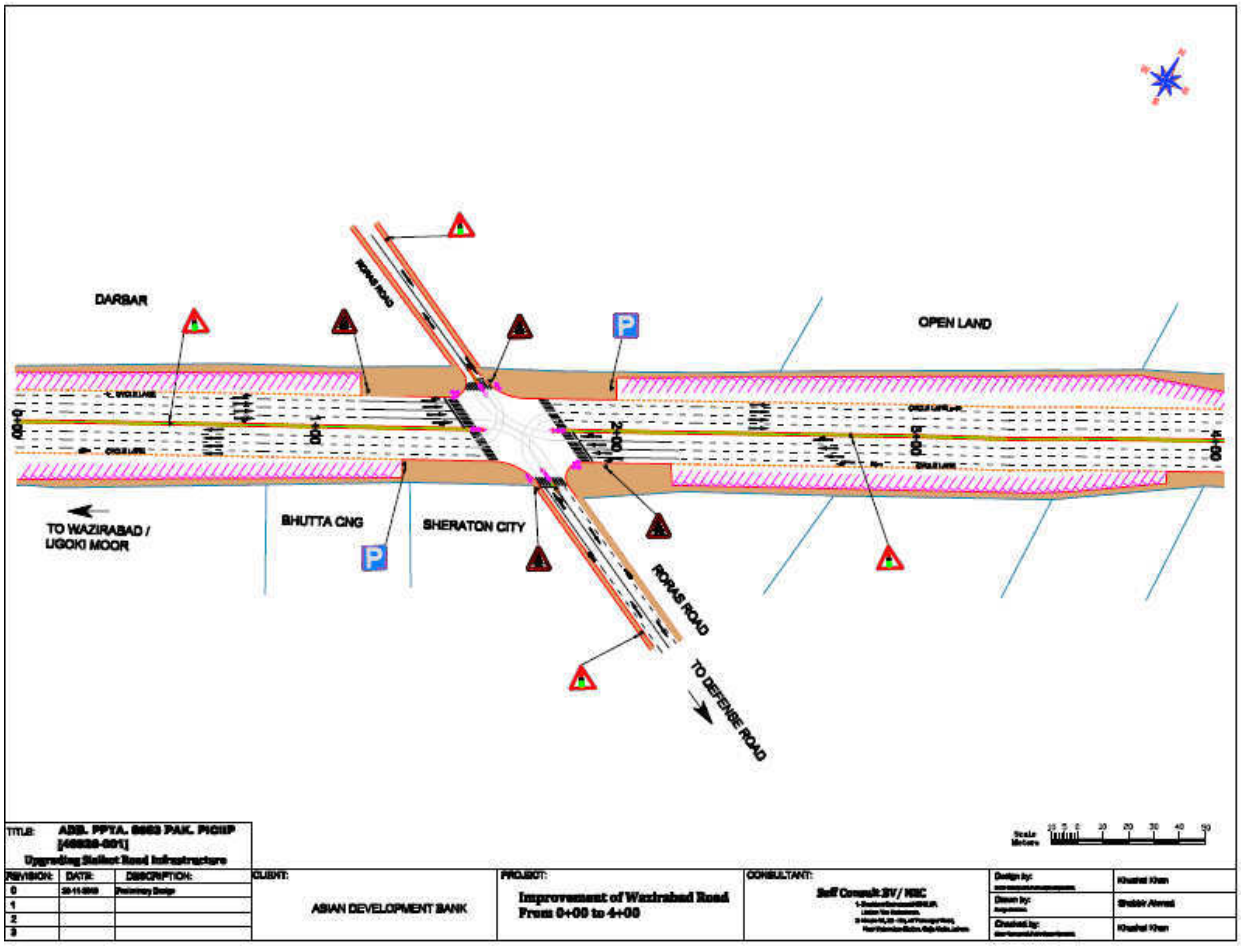
59. The cantonment area bus stand is proposed for revamping. Development of passengers lounges, cafes, parking, utilities, debussing, bussing, staking and maintenance are the part of revamping of the bus stand. The guiding principles for the designing of bus stand are that the existing structures and shops will not be demolished. The livelihood of the people will not be disturbed.

iii. Alternatives

60. The Local Government considers Kashmir Road, being the main city road, to be considered for up-gradation.

61. There only one main bus stand in the city, therefore up-gradation is proposed for this bus stand only

Figure-3.2: Proposed Layout of One Section of Kashmir Road



D. Green Spaces Development Projects

i. Current Status

62. There is lack of green spaces in Sialkot city. The existing parks are not well maintained.

ii. Proposed Projects

63. The following green space development projects are proposed:

- Development of Green Space along Drain Side: There is one big drain at Cantonment area which provides an excellent opportunity to develop a multi-functional green wedge that can provide ample green and recreational facilities for the inhabitants.
- Rehabilitation of Gulshan-e-Iqbal Park and Qila Park: Gulshan Park and Qila Park already exists in Sialkot city which needs development such as jogging tracks, recreational activities for children and sitting arrangemnets.

iii. Alternatives

64. Green belting is proposed along the drain at cantonment area which will improve landscape of the area.

65. The existing two parks, located at different parts of the city, are not in good condition and need rehabilitation.

IV. ENVIRONMENTAL & SOCIAL BASELINE CONDITIONS

66. This chapter describes the baseline environmental and social conditions of the subproject sites. The sites' environmental conditions will describe the various resources affected by the economic development that takes place, i.e. physical resources (atmospheric conditions e.g. ambient air quality and climate, topography and soils, surface water and groundwater quality), ecological resources (fisheries, wildlife, forests, rare and endangered species, protected areas etc.), and social resources.

A. Physical Resources

67. Sialkot is located in Province Punjab and has distance of 125km from Lahore in the northeast of Pakistan, along the Indian border. It is an industrial city and famous for its leather, sports and surgical products. The city is not just an industrial fort, but has a colorful culture that is strongly interspersed with its vibrant past.

i. Geography

68. Sialkot is situated between 32 30‘ north latitude and 74 30‘ east longitude at 256 meters above sea level. It is bounded on the north by Indian held Jammu and Kashmir, on the northwest by District Gujrat,on the southwest by the District Gujranwala, on the northeast by District Sheikhupura and Narowal.District Narowal was separated from Sialkot in the year 1991.Its total area is 3,107 square kilometer. In the southeast “Nullah Daik ” separates District Narrowal fromDistrict Sialkot and enters Lahore. In west, there is a vast plain area which is very fertile. The earth atthe surroundings of “Nullah Daik ” and river “Chenab” is also very fertile.

69. There are two canals in the district namely; Upper Chenab and Marala Ravi Link. These canals were derived from River Chenab and Marala Head Works in 1937 and 1955. In 1949, B.R.B canal was derived from Upper Chenab at Bambanwala.

ii. Climate

70. Sialkot is hot and humid during the summer and cold during the winter. The summer season starts from April and continues till October, while the duration of winter season is from November to March. June is the hottest month. The maximum and minimum temperature during the month of June is about 40 and 25 degree Celsius respectively. January is the coolest month. The maximum and minimum temperature during the month of January is about 19 and 5 degree Celsius respectively. The months of November and March are pleasant.

71. Sialkot experiences significant seasonal variations in temperature with the average monthly temperature varying from 11.6^{o}C in January to 32.2^{o}C in June with an average temperature over the coldest three months of the year of about 12.7^{o}C, rather lower than Lahore.

iii. Rainfall

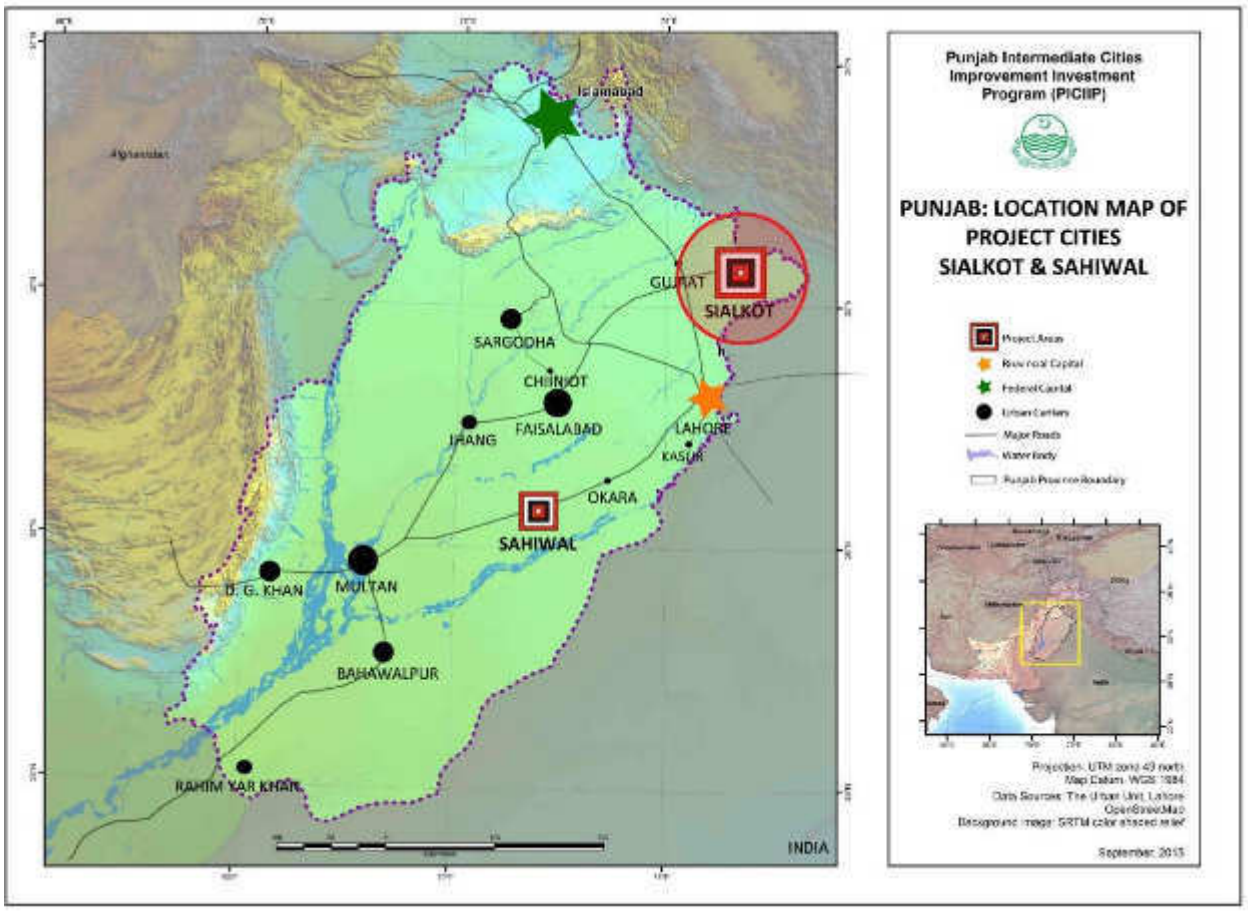
72. The mean annual rainfall is 957 mm, over half of which falls in the summer monsoon months of July and August which often results in flooding. Sialkot has one of the most modern weather forecasting and flood warning centers in the country, which is fully equipped to record and transfer data to and from the relevant concerns. This facility is equipped with radar and is internationally linked. The detail of temperatures and precipitation recorded at Sialkot are given in Table-4.1:

Table-4.1: Monthly Climate Information of Sialkot

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temp. Mean Value C°	11.6	13.8	18.6	25.0	30.0	32.2	29.8	29.0	27.9	23.7	17.8	12.8
Mean Peak Temp. C°	18.5	21.0	25.7	32.8	38.0	39.9	34.9	33.6	33.6	31.7	26.1	20.1
Mean Lowest Temp. C°	5.0	7.1	11.8	17.3	22.0	25.1	25.1	24.8	22.3	16.0	9.6	5.6
Mean Monthly Precip. Mm	41.1	43.8	53.7	30.1	28.0	65.6	288.4	259.1	94.1	14.5	9.1	30.4

Source: Sialkot Weather Forecasting Center

Figure-4.1: Location Map



iv. Humidity

73. Maximum values of relative humidity are observed during the months of January and December. The values range between 76% and 36% during morning and evening times respectively. Minimum values are obtained during the month of May between the morning and evening times (i.e., 45% and 22%).

v. Hydrology

74. Sialkot is situated in the Upper Rachna Doab, which is bounded by the Ravi and Chenab rivers. It sits over abundant shallow and deep groundwater aquifers which are used by both the city water supply system and inhabitants with wells for their water supplies. The Chenab River flows to the northwest of Sialkot, and the Marala Ravi Link Canals flow to the west. Sialkot is traversed by three seasonal streams, comprising Aik Nala, to the south of the city, Bhaid Nala, between the Cantonment and the rest of the city, and Pahlu Nala, north of the Cantonment. The general slop of the land within the Doab is to the southwest and the area is an active flood plain, although floods are to a large extent controlled by irrigation and power generation works carried out on the Indian side of the border.

vi. Geology

75. The area is underlain by Pleistocene deposits to a depth of several thousand meters. The first 200meter of these deposits consist of approximately 70% silty sand interspersed with limited clay layers. The strata are generally heterogeneous with little vertical or lateral continuity. The historic center of Sialkot is located between two seasonal watercourses, the Bhaid Nullah and the Aik Nullah. It occupies land that is elevated up to about 10 meters above the surrounding areas. Apart from the central area, the city is generally flat. Overall, there is an east to west fall, from around 253 meters in the east to about 245 meters in the west, an average fall of about 1 in 1000.

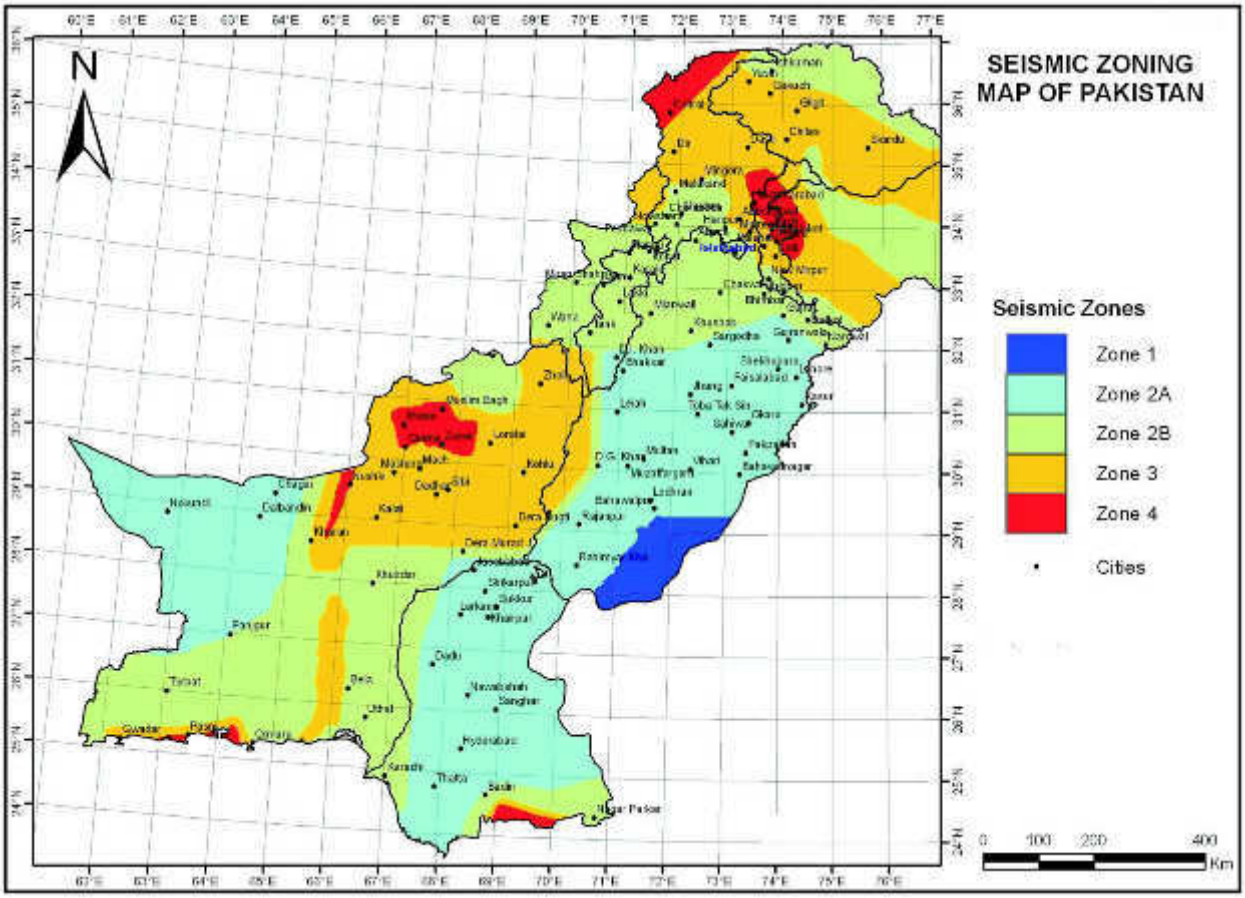
vii. Floods

76. Every year Sialkot District has to face the onslaught of flood causing devastation and disruption of normal life. The situation is sometimes aggravated due to excessive rains, flash floods in 'Nullahs' and high floods in rivers. Three rivers i.e. Chenab, Jammu Tawi and Munaawar Tawi threaten Bajwat in the north. The area in the south of Marala Head works including some villages of Sambrial is affected by the downstream discharge of River Chenab. Pasrur Tehsil is mainly hit by flood in Deg Nullah.

viii. Seismicity

77. Pakistan lies in a seismically active zone. Seismic observations indicate that hundreds of shocks occur in the region every year. According to the seismic zoning map of Pakistan, included in Pakistan Building Code Seismic Provisions (2007), the project area falls under seismic zone 2A, with a peak horizontal ground acceleration of from 0.08 to 0.16. The seismic zoning map of Pakistan is given as Figure-4.2.

Figure-4.2: Seismic Zoning Map of Pakistan



ix. Groundwater

78. Groundwater is the sole source of potable water exploited in Sialkot. The water table is in the range of 13–34meter below ground level and upper levels produce limited quantities on mineralized water. At depth of 137-152meter greater quantities of good quality groundwater are available and this is where the city's supplies are derived. The water table in recent years has been falling at a rate of one 0.30 meter per year. This is because of due to pumping down and decreased rainfall and recharge. It is not clear whether the aquifer is being overexploited, but this is unlikely at present level of abstraction in view of the wide dispersal of the tube wells. The quality of groundwater of Sialkot city is shown in Table-4.2. Turbidity is on the higher side. The samples are contaminated with coliforms.

Table-4.2: Groundwater Quality Analysis

Parameter	Value
pH	7.7 – 7.87
Turbidity, NTU	1.4 – 10.8
Total Dissolved Solids (TDs), mg/l	300 – 320
Fluoride, mg/l	0.03 – 0.1
Nitrate, mg/l	0.6 – 1.2
Arsenic, mg/l	*BDL
Total Coliform, MPN/100 ml	12 - >23
Fecal Coliform, MPN/100 ml	1.1 - >23

Source: PICIIP Feasibility Study Report, December 2016, * **BDL** Below Detection Limit

x. Wastewater Quality

79. The quality of the wastewater flowing in the Sialkot sewerage system is shown in Table-4.3:

Table-4.3: Wastewater Quality Analysis

Parameter	Value
Biochemical Oxygen Demand (BOD_5)- mg/l	61 - 226
Chemical Oxygen Demand (COD)-mg/l	114 – 764
Total Suspended Solids (TSS)-mg/l	50 – 760
Total Dissolved Solids (TDS)-mg/l	420 – 800
Oil & Grease-mg/l	4 – 7

Source: PICIIP Feasibility Study Report, December 2016

B. Ecological Resources

i. Ecology

80. The Sialkot District has been a part of the ecological zone called thorn forest but with the introduction of extensive irrigation network of canals for development of agriculture, industrial development and urbanization has changed its biological features. Most of the part of the district is now agriculture zone with human related or human dependent fauna and flora and for the most part of the district is now an agricultural zone.

81. About 2.17 % of the total area of the district is under human forest plantation of trees of economic importance like Shisham, Keeker, Mulberry that are used in construction and making sports goods and furniture. Other introduced species are Mesquite an invasive species and Safeda Sheesham Bohar and Bakain are also seen in and around the urban areas. The district Sialkot is the host of a variety of flora. The indigenous tress are Lasoora, Bairy, Siris, Keeker, Phali, Khajoor, Toot and Paper Mulberry. These are commonly found along the edges of agricultural fields.

Game Reserve

82. About 54 KM^2 of the Bajwat region in the Sialkot District is the Bajwat Game Reserve. About 16 KM^2 of the area around Marala Head works is also protected within the game reserve and is of considerable importance for wintering waterfowl.

83. Fortunately, from a planning perspective all development activities foreseen under PCIIP will be far away from these environmentally sensitive areas and will therefore not be adversely affected by any of the proposed interventions.

84. Most parts of the Punjab are under very intensive irrigated cultivation. In addition, livestock rearing is also practiced extensively, and milk animals are common. The use of chemical fertilizers and pesticides is very common. Several species of wildlife have adapted to the changed habitat. These include: jackal, jungle cat, Bengal fox, small Indian mongoose, shrew, hog deer, ravine deer, black buck, blue bull, hares and rodent pests including porcupine, fruit bats and wild boar. The avifauna which survived the modified habitat include doves, black partridge, cuckoos, koel, woodpeckers, parakeets, bulbuls, babblers, black drongo, bee eaters, finches, owls, hawks and house sparrow. The reptilian species of this modified habitat include krait, cobra, saw scaled viper, rat snake and monitor lizard.

ii. Protected areas / National Sanctuaries

85. In Pakistan there are several areas of land devoted to the preservation of biodiversity through the dedication of national parks and wildlife sanctuaries. There is no protected area or national sanctuary near the area of works and subproject area.

C. Economic Development

86. Sialkot is located close to the Indian border some 125 KM north of Lahore. It is a major industrial center, specializing in leather products, surgical instruments, diesel engines, pharmaceuticals, steel rolling mills, textiles and sports goods. There are at least 264 tanneries, 244 leather garment producing units, 900 leather sports goods producing units, 57 rice husking mills and 14 flour mills in the city.

87. The history of industrialization of Sialkot is very old. The Damascene craftsmen of Sialkot (koftgars or koftars) were famous during the Mughal era for their fine swords and daggers. Papermaking in Sialkot dates back to the time of the Mughal Emperor Akbar which was famous all over the world. Brick making was another historic skill of the people of the Sialkot and those bricks were known as the "Sialkoti Bricks" throughout South Asia. Most of the states in the South Asian region relied on the Sialkoti bricks for the erection of forts, castles, monuments, public buildings, infrastructure construction, etc.

88. Nowadays, Sialkot is famous all over the world because of its sports equipment and Surgical Instruments manufacturing industry. The most successful sports manufacturing firms now have international collaborations with the well-known sports brands like Adidas (Germany), Puma (Germany), Nexo Sports (Canada), Nike (USA), Dita (UK), Mikasa Sports (Japan) and Slazenger (UK). In the recent past, however, lack of modernization and allegations of child labor usage have resulted in a loss of market share to the new entrants in the business like Thailand, Korea and China. The Sialkot Chamber of Commerce and Industry has now almost controlled the incidents of child labor usage within the industry with the collaboration of the United Nations (ILO). Most of the companies have adopted the ISO standards.

89. The facilities of a dry port and recently built airport have contributed significantly towards its economic growth and Sialkot is now the third largest economic hub in Punjab after Lahore and Faisalabad. It is commercially linked with the Lahore Stock Exchange through its Sialkot branch, known as the Sialkot Trading Floor (STF). The State Bank of Pakistan and the Export Promotion Bureau of Pakistan has branch offices in Sialkot. After Karachi, Sialkot is Pakistan's second largest source of foreign exchange earnings through its exports and remittances from the overseas manpower. For the past several decades, the manufacturers and exporters of the city have been awarded the annual National Exports Award by the Federation of Pakistan Chambers of Commerce and Industry. Sialkot has an Industrial Estate and an Export Processing Zone. Another Export Processing Zone is planned along the Sialkot Lahore Motorway. The per capita income of Sialkot is ranked among the highest in Pakistan.

i. Land Use

90. Land uses in Sialkot City are mixed, and in many cases incompatible. Sialkot would benefit from stronger land use controls, to prevent potentially harmful activities from being located near residential areas and vice versa. Sialkot has very few green areas or parks, with the most prominent being Gulshan-e-Iqbal park, off Narowal Road, a park in the Cantonment and the stadium. There is a need for more open spaces, more space for industrial activities and a better-defined road network, in both core city and contiguous areas.

91. Eleven arterial roads radiate out from the Sialkot City center and link it with surrounding agricultural areas, other cities and Sialkot International Airport which lies about 20 km to

the west of the City Centre. The airport road also connects to the Dry Port and proposed new Tanneries' Industrial Estate. This may become Sialkot's major growth direction.

92. Industries and housing estates have developed in a ribbon pattern along all of the north, west and south radial roads. Agricultural communities close to the roads and to industries are fast becoming urbanized.

ii. Industrial Land Use

93. Industries have developed in a ribbon pattern along all of the north, west and south radial roads, as have housing estates. Agricultural communities close to the roads and to industries are fast becoming urbanized. Whereas industrial land uses within the central city are scattered throughout the area in Wazirabad Road and in the small Industries estates along Haji Pura, Daska, Emanabad, Narowal, Defense, Kullowal roads and north of the Railway Station. Commercial land uses, once concentrated in the area around the fort, are now found in outlying areas such as Defense Rd., Paris Rd., Saddar in the Cantonment and along major roads.

94. There are about 3,000 large, medium and selected small industries in Sialkot District, some located in the central city areas and many along the arterial roads leading out of the city. Together, they employ about 22,300 persons. Industries located along Gujranwala Road include Redo factory, Micro Corporation, Europlus, Saga Sports, Taj Mahal Factory, Phonix Cutlery, Remix Factory, Tata Sports, Motor Bike Apparel, numerous leather goods factories, Awan Sports, Taylon Industries, Pakol Industry and many more. Sambrial Road has significant tanneries along it, particularly between the two canals, east of the Dry Port. On Pasrur Road, there are mixed land uses along the segment closer to Sialkot urban area, but there are many rice mills along the outer segments of this road. There are however no significant developments along Eminabad Road and Zafarwal Road outside urban limits.

95. There is an industrial complex in Sambrial, in vicinity of the airport. This includes an export processing zone, a dry port and a number of industries around it and all along Wazirabad Road, which passes through Sambrial. These industrial developments, as stated earlier, are near the airport. An industrial estate for tanneries is also proposed near the airport. For this purpose, an area of 155 hectares (384 acres) has been acquired.

iii. Commercial

96. The city has a number of commercial areas including the area immediately north of the fort. In addition to the older, more traditional areas high-end commercial, financial and related activities have been developed, making the city, once single-centered on the commercial areas around the fort, now multi-cantered.

iv. Institutional

97. Institutional land uses are also prominent, in areas such as Katchary Road, Beetshania Hospital, Allama Iqbal Memorial Hospital, the WAPDA offices and similar areas.

v. Settlement Patterns

98. Settlement in Sialkot started with the 5,000-year-old fort on the central hill and has proceeded to expand in a more or less organic, low-rise manner since. The only formally planned part of Sialkot is the Cantonment Area. The traditional rural settlement pattern of tightly developed compact villages, chaks, have had a significant influence on Sialkot's urban form and settlement patterns as they have become absorbed into the main urban area.

99. The dominant and most problematic current settlement pattern is an unplanned and uncontrolled sprawl. This takes three main forms:

- individual industrial developments, primarily along major traffic arteries;
- small-scale commercial or individual houses developed in an ad hoc manner, and
- the larger scale “housing societies” where significant sized pieces of land are converted from agriculture to multi-unit private residential development. These again occur without planning approval

Table-4.4 presents the areas and proportions of various land uses in Sialkot:

Table-4.4: Land Use Distribution in Sialkot

#	Land Use	Area		% of Total Area
		Acre	Sq. Km.	
1	Residential	1,836.81	7.44	46.0
2	Commercial	363.44	1.47	9.1
3	Agricultural	169.32	0.69	4.2
4	Public Buildings	151.96	0.62	3.8
5	Religious	38.10	0.15	1.0
6	Education	87.48	0.35	2.2
7	Health	52.05	0.21	1.3
8	Industry	322.36	1.31	8.1
9	Graveyard	91.02	0.37	2.3
10	Parks/Open Spaces	256.13	1.04	6.4
11	Vacant Area	284.52	1.15	7.1
12	Unidentified Parcels	338.00	1.37	8.5
Total Area		**3,991.19**	**16.17**	**100**

vi. Agriculture

100. The majority of the population in Sialkot District depends on agriculture and the major crops of district Sialkot are wheat, rice and sugarcane. Their average annual production over the period 1998-2001 was 453,242,6 and 11 thousand metric tons, respectively. A variety of vegetables are also grown in the district. There are two seasons called Rabi and Khareef . Wheat, rice and sugarcane are the main crops of the district. Study of cropping patterns indicates an increasing stress on food crops mainly wheat, rice and cotton the cash crop. The rice from District Sialkot covers the major portion of the Pakistan.

vii. Livestock

101. The population of cattle, buffaloes, sheep and goats was 195, 471, 42 and 137 thousand heads respectively. For poultry, there were 954 broiler, 134 layer and 9 breeding poultry farms, having a rearing capacity of 11,150, 747 and 63 thousand birds respectively. The annual availability of hides and skins is estimated at 536 thousand pieces. There exists a scope for dairy farms, animal/poultry feed and cattle/sheep/goat fattening farms.

viii. Irrigation

102. The source of Upper Chanab Canal and Marala Ravi Link Canal is Marala Head works. It is located in the north-west of the Sialkot District. Upper Chanab Canal irrigates Kharif crops of Daska Tehsil, Marala Ravi Link Canal irrigates part of Sialkot, Pasrur and Daska Tehsils. Rice is in abundance in canal fed areas and is of expellant irrigation from well is carried on throughout the district wherever water can be found except in the Bajwat,

Doshi and riverine circles where wells are hardly necessary. In the Aik and Charhari circles, constant supply of water is found everywhere. Irrigation from the Degh consists mainly of over spill, but in the lower reaches, lift by Jallars is sometimes employed.

ix. Power

103. A close look has not been taken at power supply and demand other than to note that an industrial city needs adequate, reliable and uninterrupted 24/7-power supply. Sialkot does not currently have this. Interruptions are frequent forcing industries; other businesses and many residents who can afford it to rely on back-up diesel generators. These are costly, environmentally degrading and generally a poor second option. Power generation and primary distribution is generally beyond a single urban center's capacity to manage and relies on provincial and national government support. A city with reliable power enjoys an immediate competitive advantage. Solar options are increasing in popularity and should be promoted for institutional and residential use, but the technology has not reached the stage whereby it can be the sole source for heavier industry.

x. Industrial Activity

Sports Goods

104. Sialkot is well known for its sports goods such as football, hockey sticks, cricket bats, all kind of sports gloves and sportswear; and enjoys an excellent reputation in the international market. The basic raw material is leather and mulberry wood that is available in Pakistan.

105. The Pakistan sports good industry is facing many competitors including China, Taiwan, India and South Korea. There is a need to modernize and mechanize the Industry for the improvement in quality and consequently in export.

Surgical Instruments

106. Sialkot enjoys specialized skills in surgical instrument manufacturing. Products are exported to high income markets of USA, Germany and France. Stainless steel and steel forgings both imported as well as local are major industrial inputs. The other materials required are processed chemicals. The manufacturers have concerns about the quality of the local steel, as it reportedly doesn't conform to health grade steel. Steel is mainly imported from Japan, France, Germany and Taiwan. Due to volatile prices of imported raw material the Sialkot based firms find it difficult to do long term forecasting. There is a shortage of good quality Titanium because its import is banned. Titanium is thus taken from ship breaking which causes air bubbles in the material.

Leather Products

107. The Leather industry makes up the second largest export-earning sector after textiles in Pakistan. Currently, the Sialkot sector of Leather is contributing around USD 457 million in 2013 but has the potential to multiply volume of exports with the improvement of quality and diversification in different range of products. Leather is the basic raw material. Pakistan is fortunate that the raw material required by the industry is available in the country in abundance. Local availability of raw materials and low wage cost gives the country a competitive edge in the world market.

108. The issues being faced by the leather industry are insufficient level of modernization and technology up gradation, low labor productivity, lack of confidence among small manufacturing establishments, environmental problems, new regulations of environmental and social compliance and lack of market information. There is stiff

competition from regional players such as China, India, Turkey, Thailand, Indonesia, etc. However, there are opportunities in terms of room for capacities utilization, product diversification and new markets. Sialkot can diversify further in Leather Goods for industrial use sector.

xi. Water Supply Service

109. Sialkot's water supply is good by Pakistan standards. There are about 43,469 connections in the town (39,658 domestic), which serve about 87% of the population within the old Municipal Corporation limits but only about 35% of the total urban population, excluding the Cantonment. However, according to the Administrator TMA Sialkot, the water supply coverage recently has increased close to 50%. There are approximately 5,500 connections in the Cantonment, covering an estimated 38,500 people or about 47.5% of the civilian population of the Cantonment.

110. The existing distribution system consists of one large interconnected system and four small discreet systems on the western side of the city. The estimated total length of main is about 198 KM. The water supply distribution network is very old with rusted pipes, which result in mixing of sewage in water supply lines, and significant amount of drinking water is wasted due to leakages.

xii. Sewerage System Service

111. Sialkot is served partly by sewers and partly by open and covered drains. The sewers are in poor condition and blocked in many places. The main system served the center of the city and the area to the west, discharging up to a 1,372 mm diameter trunk sewer along Roras Road, which conveyed wastewater to a main pumping station at Mianapura. This was intended to lift wastewater into the Bhaid Nullah.

112. The majority of the existing drains do not function due to filling in by adjacent shop owners and/or use of drains for dumping solid waste.

xiii. Solid Waste Management

113. Sialkot's solid waste management (SWM) system is in a state of disarray. The city currently generates about 350 tons of municipal solid waste daily, or about 125,000 tons per year. Of the 125,000 tons per year of municipal solid waste generated, only 25 percent enters the municipal waste system, leaving 75 percent of the population without waste collection. Practically all-municipal waste is burned, dumped or buried illicitly on vacant land throughout the city, causing significant environmental damage and posing a health hazard.

114. Population growth and increase in its economic activity means that Sialkot's daily waste generation is destined to accelerate to about 195,000 tons per year by 2020, and then to about 300,000 tons per year by 2030. Furthermore, poor solid waste management impedes road efficiency, blocks drainage leading to flooding, and generally contributes to a degraded urban environment. SWM is one urban service successfully privatized in many urban centers with a managed hierarchy of collection steps. This approach can be used to effectively mobilize communities, raise awareness of recycling potentials and add employment.

115. Numerous examples of individual recycling efforts are noted throughout the city involving plastic bottles, cardboard and metal. Private entrepreneurs, both informal and semi-formal are undertaking this, so there is obviously a market and money to be made. Industry and individuals are separating and selling recyclable materials. The Administrator notes there is no official recycling facility in Sialkot to take direct advantage of this collection, however, note was taken of at least 8 smaller facilities processing

plastic bottles and generating employment.49 The municipality can further these initiatives by further promoting at-source separation making it easier for the informal collectors. Other community-based public awareness initiatives could also help reduce the SWM demands on landfill and the environmental degradation that comes with it.

xiv. Transport

Road Networks

116. Sialkot is about two hours from Lahore and four hours from Islamabad. Sialkot is linked with the National Highway N-5 through Gujranwala and Wazirabad. A dual carriage-way is available between Sialkot and Wazirabad. A new bridge on the Chenab River, called the Shahbazpur Bridge, is under construction these days which is located to the north-east of Gujrat. Once completed, it will connect Sialkot to N-5 at Gujrat. The Sialkot Lahore Motorway (M-11) is also under construction. All the bus and commuter coach stations are located on the Jail Road. A bus service operated by Daewoo Express is available from Sialkot to Rawalpindi, Lahore, Gujranwala and Multan.

Public Transport

117. Sialkot's internal public transit consists almost entirely of informally operated small buses/vans and auto rickshaws which together account for 20% of inner city traffic. Only two formal bus routes operate within the city. In addition, several of the larger industries operate their own employee transport services to facilitate easy access to work and home. The absence of any significant traffic management means that transit operations are not efficient and both constrain and are constrained by the multiple road uses and resulting congestion. For intercity transport there are three bus terminals, including the Daewoo Terminal handling luxury bus connections to Lahore, Islamabad and other urban centers.

118. The Sialkot Chamber of Commerce & Industry (SCCI) has signed an MOU with American bus company FOTON to provide air-conditioned local transport to the citizens with CNG fuel. However main mode of transport within the city at present is the auto rickshaw. Although no proper taxi service exists in the city, there are many rent-a-car service outlets.

Traffic Management

119. Although the road network in the city is well developed and recently executed road improvements carried through joint efforts of Sialkot Chambers of Commerce and Industry (SCCI) and the Government has resulted in improved road surface conditions in most of city areas, the main problems lies in traffic management. Road junction layouts, utilization of road space, absence of pedestrian facilities, uncontrolled road side parking and absence of enforcement of traffic regulatory control measures result in congestion and . Additionally, irrespective of the public transit initiative referenced above, public transport overall is inadequately developed with only two formal bus routes operating in the city.

Rail Transport

120. Sialkot is served by Pakistan Railways through the Sialkot Junction. Sialkot used to be a junction in the British era with trains leaving for Jammu and Gurdaspur. Plans are under consideration to open the border for an international train between Sialkot and Jammu. Express trains to and from Narowal, Lahore, Rawalpindi, Faisalabad, Multan, Bahawalpur

and Karachi are available daily. The Railway station is situated in the center of the city. Other suburban train stations are Ugoki and Sambrial.

Air Transport

121. Sialkot International Airport is the first-ever private-sector airport of Pakistan managed by the SIAL consortium. It is located near Sambrial and is noted for having the longest runway in Pakistan. Direct flights are available from Sialkot International Airport to Karachi, Islamabad, Abu Dhabi, Sharjah, London, Muscat Kuwait, Dubai and Jeddah. Pakistan International Airlines has plans to start non-stop flights from Sialkot to Manchester, London, Barcelona. Hajj flights have started from the Sialkot International Airport last year in 2009.

122. A small Sialkot Cantonment Airport, located in the Sialkot Cantonment, is in use of the aviation wing of the Pakistan Army. This airport has also been used as a public airport by PIA for operating a Helicopter service from Sialkot to Islamabad in 1995- 1996.

Dry Port

123. Sialkot Dry Port carries the honor of being the first-ever private-sector dry port in Asia. It was established in 1986 near Sambrial, about 20 KM from the Sialkot city under the control of the Sialkot Dry Port Trust.

D. Social and Cultural Resources

i. Employment

124. Sialkot has more than 3,000 factories. These provide the majority of employment. This will have a significant impact on present and future Sialkot. The following summary points are of particular interest with respect to the Sialkot District (specific data for Sialkot urban center is not available, but may be somewhat different given the industrial focus):

- Overall labor force participation is below national average: 45% compared to 53.5 nationally
- Official unemployment rate is 6.6% compared to a national average of 5.3%
- Share of employment in the informal sector is close to the national average at 69% for Sialkot compared to 72.9% nationally
- Informal Sector employment comprises:
- 33% in manufacturing
- 16% in construction
- 33% in trade and hospitality, and
- 10% in personal services
- Lowest unemployment for all levels of education compared to national averages and other surveyed Districts
- Distribution of employment by major occupation groups is similar to national averages except with respect to “Craft and Related Trades Workers” where Sialkot exceeds all other Districts and at 33.9% is more than double the national average of 14.8%. This clearly reflects Sialkot’s unique and historical industrial activity.
- With respect to the sub-sector of “Precision, handicraft, printing and related trades workers” Sialkot excels with 20.2%, almost 4 times the national average of 5.5%, again reflecting Sialkot’s unique industries.

ii. Education

125. Sialkot has a fairly well-developed educational infrastructure that comprises a sub-campus of the Fatima Jinnah Women University, a sub-campus of the Virtual University of Pakistan, 8 Degree Colleges for Women, 5 Degree Colleges for Men, 2 Cadet Colleges, 6 Commerce Colleges, one Law College, one Medical College, one Homeopathic Medical College, one Nursing School, one Para- Medical School, one Poly-

Technique Institute, with numerous Inter Colleges, Higher Secondary Schools and over 250 High Schools. The University of Engineering Sciences and Technology (UEST) was recently established in collaboration with the Royal Institute of Technology, Sweden on the Sialkot Lahore Motorway and will also incorporate the development of a Technology Park.

iii. Health

126. This district like others in Pakistan has faced and would continue to face water- borne diseases such as cholera, diarrhea, Respiratory Tract Infections (RTIs), dengue virus, malaria, hepatitis B & C and skin diseases. The district Health Department has also prepared a disaster management plan to deal disastrous situation in the district through its own resources by integrating with other district departments.

127. There are four District Hospitals i.e. Sialkot, Daska, Sambrial and Pasrur, and over 20 other hospitals or specialized care facilities. In addition, there are 27 Basic Health Units in the Sialkot Tehsil alone, with considerably more scattered throughout the other three Tehsils comprising Sialkot District.

iv. Cultural Heritage

128. The old city of Sialkot is a great center of Punjabi culture with many important historical and religious sites and buildings amongst the fascinating labyrinth of narrow streets and crowded bazaars.

129. The centuries-old historical Sialkot fort still remains the victim of un-ending negligence of Sialkot Municipal Corporation (SMC) and archeology department, as this crumbling ancient fort has illegally been surrounded by the encroachers by raising their encroachments, badly damaging the natural beauty of this fort.

130. Although the offices of Sialkot district government and Sialkot Municipal Corporation (SMC) are located in this Fort since long, but the Sialkot district government and Municipal Corporation have never bothered to feel the need of maintenance of this fort, besides, remaining failure in making some direly needed effective measures to preserve and protect this rich heritage for future generation.

V. ASSESSMENT OF ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

131. The overall environmental impacts of the subprojects are positive since these are supposed to provide continuous safe water to the residents, dispose of sewage of the city in safe manner and improve roads and landscaping of the city. These projects shall prevent or alleviate the effects of pollutants on the human and natural environments.

132. This section describes the issues along with description of their impacts both on environment and public health, during the construction and operation stages of the projects. The impact significance is categorized as under by considering severity of risk on environment and human health and probability of occurrence.

A. Assessment of Risk – Environmental Aspects

133. To assess the threat posed by a hazard (*i.e.* risk), the principal factors to be considered are:

a) the likelihood that the threat may be realised; and
b) in the event of realisation of the threat, the nature and extent of the consequences.

134. A qualitative risk assessment methodology has been adopted for this project, comprising the Likelihood and Consequence values detailed in Table-5.1 and Table-5.2.

Table-5.1: Qualitative Likelihood Values

Likelihood Indicator	Likelihood Description	
A	Almost Certain	Is expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Might occur at some time
D	Unlikely	Could occur at some time
E	Rare	May only occur in exceptional circumstances

Table-5.2: Qualitative Consequence Values

Consequence Indicator	Consequence Description	
1	Insignificant	Negligible, reversible, requires very minor or no remediation / minor injury with slight negative health impact
2	Minor	Reversible, requires minor remediation / major, non-fatal health impact to one or more individuals
3	Moderate	Reversible, short-term effect, requires moderate remediation / severe, non-fatal health impact to one or more individuals

Consequence Indicator	Consequence Description	
4	Major	Serious impact, medium term effect, requires significant remediation / single fatality or severe irreversible disability or impairment
5	Catastrophic	Disastrous impact, long term effect, requires major remediation / multiple fatalities, major permanent health impacts on a large number of individuals

135. On the basis of a likelihood and consequence matrix (Table-5.3), each hazard may be categorised into broad 'risk categories' and the required management approach for each risk category can be defined.

Table-5.3: Risk Matrix – Risk Categories and Management Response

		Consequence				
		1	**2**	**3**	**4**	**5**
Likelihood	**A**	M	M	H	H	H
	B	L	M	H	H	H
	C	L	L	M	H	H
	D	L	L	L	M	H
	E	L	L	L	M	M

H = High Risk – Proposed works methods not acceptable and must be altered.
M = Moderate Risk – Detailed management action plan to be prepared, including monitoring program.
L = Low Risk – Routine management procedures to be defined and monitoring requirements to be specified.

B. Anticipated Environmental Impacts

i. Anticipated Environmental Impacts due to Project Location

136. The environmental impacts related to location of the project are mostly in the areas of physical setting, socioeconomic setting, ecological setting and special areas (archaeological sites etc.). Detailed description of these settings is given in Chapter 3. Field evidences reveal that the impacts of the projects due to their locations are mostly in the category of 'insignificant'. No historical site is located in the vicinity or no displacement of inhabitants is involved. The most of the water supply, sewerage and drainage, green spaces development and transport routes improvement projects will be implemented within the city of Sialkot.

ii. Anticipated Environmental Aspects and Potential Hazards – Construction Phase

137. The potential hazards posed by construction activities are presented by environmental aspect in Table-5.4 to Table-5.10. Appropriate management actions for all of the potential environmental hazards shall be developed on the basis of the level of risk assessed to exist for each hazard identified. The potential hazards and assessment of

risks are identified for following elements:

- Air quality;
- Noise;
- Traffic;
- Soil;
- Solid waste
- Sanitary wastewater
- Health & Safety

Table-5.4: Subprojects Activities, Potential Hazards and Assessment of Risk – Soil

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Temporary and localized soil contamination for short period of time at specific place due to spillage of solvent/paint/chemicals on soil during repair and maintenance activities	B1 – Low
Replacement of rusted/damaged pipelines (49 KM)	Temporary and localized soil pollution for short period of time due to spillage of fuel/lubricant from construction camps and maintenance of vehicles and machines	C2 – Low
Replacement of asbestos pipelines (262 KM)	Temporary and localized soil pollution for moderate period of time due to spillage of fuel/lubricant from construction camps and maintenance of vehicles and machines	B2 – Moderate
Sewerage		
Sewerage pipes replacement (27.9 KM)	Temporary and localized soil pollution for short period of time due to spillage of fuel/lubricant from construction camps and maintenance of vehicles and machines	C2 – Low
Transport		
Improvement/up-gradation of bus stand	Temporary and localized soil pollution for moderate period of time due to spillage of fuel/lubricant from construction camps, generators and maintenance of vehicles and machines	B2 – Moderate

Table-5.5: Subprojects Activities, Potential Hazards and Assessment of Risk – Air

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Temporary and localized dust emissions due to excavation and refilling activities for laying the pipelines for moderate period of time	B2 – Moderate
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair,	Temporary and localized dust emissions due to repair and maintenance work for short period of time	B1 – Low

Subprojects/Activities	Potential Hazard	Assessment of Risk
cleaning, valves and pipeline connection)		
Replacement of rusted/damaged pipelines (49 KM)	Temporary and localized dust emission due to excavation and refilling activities for laying pipelines and movement of construction vehicles for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low
Replacement of asbestos pipelines (262 KM)	Temporary and localized dust emission due to excavation and refilling activities for laying pipelines and movement of construction vehicles for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low
Replacement of inappropriate sized pipelines, Realignment of inappropriately laid pipelines at Fateh Garh Distribution System	Temporary and localized dust emission due to excavation and refilling activities for laying pipelines and movement of construction vehicles for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low
Sewerage		
Sewerage pipes replacement (27.9 KM)	Temporary and localized dust emission due to excavation and refilling activities for laying pipelines and movement of construction vehicles for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of pipes and accessories to the sites	B1 – Low
Transport		
Improvement of 3 KM Kashmir Road	Temporary and localized dust emission due to construction activities for short period of time	B1 – Low
Improvement/up-gradation of bus stand	Temporary and localized dust emission due to construction activities (demolition of structures, mixing of material, movement of machines and vehicles) for moderate period of time	B2 – Moderate
	Localized and low intensity vehicular emissions due to transportation of construction material and disposal of construction debris	B1 – Low
	Localized and low intensity generator	B1 – Low

Subprojects/Activities	Potential Hazard	Assessment of Risk
	emissions	

Table- 5.6: Subprojects Activities, Potential Hazards and Assessment of Risk – Noise

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Replacement of pumps and motors (12)	Low intensity localized noise generation due to dismantling and placement of pumps and motors activities under enclosed structures for short period of time	B1 – Low
Provision of switchgear and electrical installation	Low intensity localized noise generation due to installation of electrical appliances activities at tube wells under enclosed structures for short period of time	B1 – Low
Improving efficiency of 57 tube wells (repair and maintenance of pumps and motors)	Low intensity localized noise generation due to repair and maintenance activities under enclosed strictures for short period of time	B1 – Low
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Low intensity localized vehicular noise due to movement of pipes and accessories carrying vehicles and construction machineries for short period of time	B1 – Low
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Low intensity localized noise generation due to repair and maintenance work for short period of time	B1 – Low
Replacement of rusted/damaged pipelines (49 KM)	Low intensity localized noise generation due to pipe laying activities and movement of vehicles and machineries for moderate period of time	B2 – Moderate
Replacement of asbestos pipelines (262 KM)	Low intensity localized noise generation due to pipe laying activities and movement of vehicles and machineries for moderate period of time	B2 – Moderate
Replacement of inappropriate sized pipelines, Realignment of inappropriately laid pipelines at Fateh Garh Distribution System	Low intensity localized noise generation due to pipe laying activities and movement of vehicles and machineries for moderate period of time	B2 – Moderate
Sewerage		
Sewerage pipes replacement (27.9 KM)	Low intensity localized noise generation due to pipe laying activities and movement of vehicles and machineries for moderate period of time	B2 – Moderate

Subprojects/Activities	Potential Hazard	Assessment of Risk
Rehabilitation of disposal stations (8) (Replacement of pump and motor, improvement of electrical panels, repair and maintenance of pumps and motors and civil work)	Low intensity localized Noise generation due to repair and maintenance work at disposal station (enclosed structures) for short period of time	B1 – Low
Transport		
Improvement of 3 KM Kashmir Road	Low intensity localized noise generation due to construction activities for short period of time	B1 – Low
Improvement/up-gradation of bus stand	Low intensity localized noise generation due to construction activities (demolition of structures, mixing of material, movement of machines and vehicles) for moderate period of time	B2 – Moderate
	Low intensity localized noise from generator for short period of time	B1– Low
Green Spaces		
Development of green space along drain side	Low intensity localized noise generation due to movement of machines for short period of time	B1 – Low
Rehabilitation of Gulshan-e-Iqbal and Qila parks	Low intensity localized noise generation due to movement of machines for short period of time	B1 – Low

Table-5.7: Subprojects Activities, Potential Hazards and Assessment of Risk – Traffic

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Replacement of pumps and motors (12)	Low traffic volume increase by the vehicles carrying pumps, motors and accessories	B1 – Low
Provision of switchgear and electrical installation	Low traffic volume increase by the vehicles carrying electrical appliances	B1 – Low
Improving efficiency of 57 tube wells (repair and maintenance of pumps and motors)	Low traffic volume increase by the vehicles carrying pumps, motors and accessories	B1 – Low
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Low traffic volume increase by the vehicles carrying pipes and accessories	B1 – Low
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Low traffic volume increase by the vehicles carrying construction material and accessories	B1 – Low
Replacement of rusted/damaged pipelines (49 KM)	Low traffic volume increase due to transportation of construction material and accessories	B1 – Low

Subprojects/Activities	Potential Hazard	Assessment of Risk
	Localized traffic congestion at pipe laying area for short period of time	B2 – Moderate
Replacement of asbestos pipelines (262 KM)	Low traffic volume increase due to transportation of construction material and accessories	B1– Low
	Localized traffic congestion at pipe laying area for short period of time	B2 – Moderate
Replacement of inappropriate sized pipelines, Realignment of inappropriately laid pipelines at Fateh Garh Distribution System	Low traffic volume increase due to transportation of pipes and accessories	B1 – Low
	Localized traffic congestion at pipe laying area for short period of time	B2 – Moderate
Sewerage		
Sewerage pipes replacement (27.9 KM)	Low traffic volume increase due to transportation of pipes, construction material and accessories	B1 – Low
	Localized traffic congestion at pipe laying area for moderate period of time	B2 – Moderate
Transport		
Improvement of 3 KM Kashmir Road	Localized traffic congestion due to construction and maintenance activities for short period of time	B1 – Low
Improvement/up-gradation of bus stand	Low traffic volume increase due to transportation of construction material and accessories and disposal of debris	B2 – Moderate
	Localized traffic congestion for moderate period of time	B2 – Moderate

Table-5.8: Subprojects Activities, Potential Hazards and Assessment of Risk – Solid Waste

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Replacement of rusted/damaged pipelines (49 KM)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate
Replacement of asbestos pipelines (262 KM)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate
Replacement of inappropriate sized pipelines at Fateh Garh Distribution System	Low volume localized generation of domestic solid waste from construction camps for short period of time	B1 – Low

Subprojects/Activities	Potential Hazard	Assessment of Risk
Sewerage		
Sewerage pipes replacement (27.9 KM)	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate
Transport		
Improvement/up-gradation of bus stand	Low volume localized generation of domestic solid waste from construction camps for moderate period of time	B2 – Moderate
	Low volume generation of construction waste for moderate period of time	B2 – Moderate

Table-5.9: Subprojects Activities, Potential Hazards and Assessment of Risk – Sanitary Wastewater

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Development of DNI zones (Installation of water meters at houses, replacement of pipelines, disposal of old pipes)	Low volume localized generation of sanitary wastewater from construction camps for short period of time	B1 – Low
Replacement of rusted/damaged pipelines (49 KM)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Replacement of asbestos pipelines (262 KM)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Replacement of inappropriate sized pipelines, Realignment of inappropriately laid pipelines at Fateh Garh Distribution System	Low volume localized generation of sanitary wastewater from construction camps for short period of time	B1 – Low
Sewerage		
Sewerage pipes replacement (27.9 KM)	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate
Transport		
Improvement/up-gradation of bus stand	Low volume localized generation of sanitary wastewater from construction camps for moderate period of time	B2 – Moderate

Table-5.10: Subprojects Activities, Potential Hazards and Assessment of Risk – Health & Safety

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Rehabilitation of existing OHRs (replacement of doors/windows, plastering, minor structural repair, cleaning, valves and pipeline connection)	Minor nature health and safety concerns for the construction workers for short period of time	B1 – Low
Replacement of rusted/damaged pipelines (49 KM)	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Replacement of asbestos pipelines (262 KM)	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Replacement of inappropriate sized pipelines, Realignment of inappropriately laid pipelines at Fateh Garh Distribution System	Minor nature health and safety concerns for the construction workers for short period of time	B1 – Low
Sewerage		
Sewerage pipes replacement (27.9 KM)	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate
Transport		
Improvement/up-gradation of bus stand	Minor nature health and safety concerns for the construction workers for moderate period of time	B2 – Moderate

138. Most of the above mentioned subprojects and related project activities will generate environmental impacts during construction phase. The construction phase impacts are in the category of low to moderate risk. No construction phase impact is under high risk. Following section describes construction phase impacts and mitigation measures:

iii. Construction Phase Impacts and Mitigation Measures

139. It is an established fact that almost all major construction projects cause certain impacts on environmental resources. These impacts may create significant temporary hazards to the environmental resources of the project area during the project construction phase. The major construction phase impacts are listed below:

- Generation of dust due to excavation, transportation of construction material, mixing of building material and dumping of construction waste;
- Noise, vibration and air pollution due to construction and erection of electrical and mechanical equipment;
- Traffic volume in the area due to haulage of building material, equipment, construction machinery and transportation of workers at site;
- Soil pollution due to spillage and leakage of fuel and lubricants during cooking, fueling and maintenance activities

- Sanitary wastewater and solid waste generation from residences of construction crew; and
- Communicable disease hazard to workers from lack of sanitation facilities.

140. The construction activities affect the quality of local environment. Noise, fugitive dust emission due to construction and transportation, improper solid waste dumping are the sources of nuisance for the local community.

141. Mainly construction phase impacts are in the range of low to moderate risk. Most of these are not the major construction activities except for bus terminal construction activities. Mostly construction activities impacts can be mitigated by taking certain administrative measures during construction phase as given below:

142. The main responsibilities for mitigation measures during the construction phase of the projects rest with contractors appointed to carry out the water supply, sewerage and drainage, green spaces development and transport routes improvement projects. The SMC Engineers will however, have the responsibility for monitoring the implementation of mitigation actions by the contractors and will need to implement their own system of internal checks to ensure that mitigation actions are carried out satisfactorily. In exceptional circumstances, the SMC may need to use its authority to call a halt to construction activity, if the contractors refuse to adhere to the requirements of the mitigation plan contained in the contract documents.

143. In order to avoid creation of misunderstandings regarding who is responsible for particular mitigation activities recommended for the construction phase, the Construction Phase Environmental Mitigation Plan (CPEMP) should be appended to tender documents. This will ensure that contractors include the cost of mitigation actions into their bids and will provide a reliable mechanism for enforcement. In fact, most of the recommended actions involve no or very little capital investment, but it depends on the contractor's management to adopt a responsible attitude to environmental protection; ensuring construction activity is properly planned and mitigation actions are correctly implemented. The mitigation actions recommended during the construction phase have the following principal objectives:

iv. Dust Suppression

144. Excavation of ground for laying pipelines will generate dust. Regular water sprinkling is recommended at the dust generation points during the construction activities. In addition to this, proper protective equipment such as dust masks, goggles, hats, gloves and safety shoes should also be made available to the construction workers at the site to avoid potential health hazards and accidents.

v. Dumping of Construction Waste

145. At bus terminal revamping activities, construction debris will be generated because of demolition of existing structures. The debris produced during construction should preferably be dumped at nearby depressions rather than throwing unattended. It should be ensured that the leftover material is not dumped into any of the storm water drain or water course, because such practices can clog these man-made and natural drainage systems and cause many other problems for the residents.

vi. Noise

146. Construction activities, movement of construction vehicles and machines, and demolishing of structures will generate noise and affect nearby communities and construction workers.

147. High noise levels result in various health impacts such as hearing loss and number of physiological and other effects.

148. To attenuate noise impacts on workers and nearby community, the following measures should be taken:

- Carry out regular inspection and maintenance of the construction vehicles and equipment;
- Timely replacement of worn and noise producing parts of the construction machinery;
- In case of severe noise, use of sound barriers to avoid dispersion of sound waves into the nearby community; and use of noise protection equipment by the workers, working in noisy area

vii. Traffic Management

149. Construction activities for laying pipelines and revamping of bus terminal will cause traffic issues. Traffic management measures should be implemented as a means of reducing road accidents, improving the residential living environment, and reducing the chance of collisions between vehicles, pedestrians and cyclists and traffic congestion.

150. The construction material carrying vehicles will be instructed to have reduced speed of about 30 km per hour at the residential areas with covering of the material from the top to avoid dispersion of dust in the surroundings. In case of large number of vehicles arriving at the site, it should be planned in such a way that these vehicles arrive at the site in different timings of the day to avoid traffic jam issue and nuisance for the nearby community. As a measure to streamline heavy traffic in the area, proper road marking and signboard posting for safety and speed limit should also be done, particularly at nearby residential and commercial areas.

151. In case of digging of roads, the proper cordon off the digging site and traffic planning for moving traffic to alternate routes will be part of traffic management.

152. The vehicle drivers should be apprised of the local customs and values, and be advised to remain courteous to the local population. The construction material transport activities scheduling should be such that most of the tasks are executed in a manner so as not to cause traffic jams and congestion in the area.

viii. Disposal of Domestic Wastewater

153. During bus terminal revamping and pipe laying activities will take longer and construction crew will stay at campsite. These workers shall generate sanitary wastewater. Generally, during the construction phase, proper disposal of sanitary wastewater is not practiced. Sanitary wastewater should be disposed of into the nearby drain or sewers after passing through the septic tank. The management should plan to have a temporary septic tank for this purpose, for the construction crew.

154. Table-5.11 presents the typical characteristics of untreated domestic wastewater.

Table-5.11: Typical Characteristics of Untreated Domestic Wastewater

#	Contaminants	Concentration (Medium Strength)
1	Total Dissolved Solids (TDS) - mg/L	500
2	Total Suspended Solids (TSS) - mg/L	210
3	Biochemical Oxygen Demand (BOD_5) - mg/L	190
4	Chemical Oxygen Demand (COD) - mg/L	430
5	Chlorides – mg/L	50
6	Sulfate - mg/L	30
7	Oil & Grease - mg/L	90
8	Total Coliform - No./100 mL	10^7-10^9
9	pH	7

Source: Wastewater Engineering - Treatment and Reuse by Metcalf & Eddy, 2003

155. Table-5.12 presents impacts of wastewater on environment and human health.

Table-5.12: Environmental Impacts of Wastewater

Parameter	Impacts
pH	Growth inhibition of bacterial species (responsible for removing organic pollution) under highly acidic or alkaline conditions
	Corrosion of water carrying system and structures with acidic wastewaters having low pH
	Malfunctioning and impairment of certain physico-chemical treatment processes under highly acidic or alkaline conditions
Organic Pollutants	Depletion of dissolved oxygen (DO) levels, of the receiving water body, below limits necessary to maintain aquatic life (4-5 mg/l)
Suspended Solids	Sedimentation in the bottom of water bodies leaving adverse impact on flora and fauna
	Localized depletion of dissolved oxygen in the bottom layers of water bodies
	Reduced light penetration in natural waters and consequent reduction in photosynthesis
	Aesthetic nuisance
Oil and Grease	Reduced re-aeration in the natural surface bodies, because of floating oil and grease film and consequent depletion in dissolved oxygen levels
	Reduced light penetration in natural waters and consequent reduction in photosynthesis
	Aesthetic nuisance

ix. Domestic Solid Waste Management

156. Construction camp at bus terminal and pipe laying sites will also generate domestic solid waste. It should be segregated, packed and disposed of at the designated municipal solid waste dumping site.

x. Occupational Health and Safety

157. The management should be responsible for provision of safe drinking water, maintenance of occupational health and safety equipment, maintenance of sanitation conditions, along with supply of hygienic food and sewerage system for the construction team at the site.

158. The major beneficial impact of the construction phase of the project is employment for local people during construction.

xi. Air Pollution

159. The sources of air pollution at construction sites are the construction vehicles and generators.

160. Generators: Diesel oil is used as fuel in the generators used for standby electricity generation. Diesel-based generators generally emit pollutants such as CO, NOx, SO_2 and particulate matter.

161. Vehicles: At construction sites, traffic will be increased. It will cause fugitive dust and vehicular emissions. The major pollutants present in emissions would be oxides of nitrogen and carbon, particulate matter and un-burnt hydrocarbons. For well-maintained vehicles, the air emission will remain within the PEQS. Table-5.13 presents impacts of air emission on environment (E) and human health (HL).

Table-5.13: Impacts of Air Pollutants on Environment and Human Health and Life

Carbon Monoxide	HL	Heart attack, by reducing the oxygen carrying capacity of blood
		Birth defects including mental retardation and impairment of fetus growth
		Dizziness, headache, and nausea
		Increase in reaction time of the drivers, a threat to the road safety
Oxides of Nitrogen	E	Formation of photochemical oxidants
		Damage to materials and property, by acid rains, resulting from oxidation of oxides of nitrogen to nitric acid, after reacting with water vapors
		Retardation of growth in plants
	HL	Reduction in oxygen carrying capacity of blood
		Impairment of olfactory sense and night vision
		Dryness and roughness of the throat
Particulate Matter	HL	Respiratory diseases
	E	Choking of plant leaves restricting photosynthesis process
		Global cooling of earth by reflecting back the solar radiations
		Impairment of atmospheric visibility affecting the transportation safety
		Deterioration of aesthetic quality of atmosphere, land and water
Oxides of Sulfur	HL	Respiratory diseases, eye and throat irritation

	E	Precursor for acid rain, damage of property, plant and soil
Carbon Dioxide	E	One of the major greenhouse gases, contributing to global warming

xii. Soil Pollution

162. Soil pollution can take place during cooking, fuelling, lubrication and maintenance of vehicles and machines. Following mitigation measures are recommended for soil pollution control:

- Placement of secondary containment under fuel/lubricant containers and generator fuel oil tank to collect spillage and leakage
- Placement of fuel/lubricant container on paved floor at enclosed place
- Properly collect and dispose waste lube oil/oily rags after maintenance
- Avoid spill and leaks of oil, lubricants on floor during maintenance activities
- Immediate cleaning the spillage and leakage from the ground with saw dust/cloth and dispose of as solid waste

xiii. Environmental Aspects and Potential Operational Phase Hazards

163. The potential hazards posed by operational activities are presented by environmental aspect in Table-5.14 to Table-5.15. Appropriate management actions for all of the potential environmental hazards shall be developed on the basis of the level of risk assessed to exist for each hazard identified. The potential hazards and assessment of risks are identified for following elements:

- Noise;
- Health and safety

Table-5.14: Subprojects Activities, Potential Hazards and Assessment of Risk – Noise

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Operation of tube wells	Low intensity localized noise generation due to operation of tube wells under enclosed structures	B1 – Low
Operation of OHRs (operation of tube wells)	Low intensity localized noise generation due to operation of tube wells under enclosed structures	B1 – Low
Sewerage		
Operation of disposal stations	Low intensity localized noise generation due to operation of disposal pumps under enclosed structures	B1 – Low

Table-5.15: Subprojects Activities, Potential Hazards and Assessment of Risk – Health & Safety

Subprojects/Activities	Potential Hazard	Assessment of Risk
Water Supply		
Operation of chlorine facilities for disinfection at tube wells and OHRs	Medium level localized health and safety concerns associated with chlorine storage and handling facilities	B2 – Moderate
Algal growth in OHRs	Moderate impact on community health due to growth of algal in OHRs and contamination of water	B2 – Moderate

164. Operational phase impacts are related with handling and storage of liquid chlorine solution (Sodium Hypochlorite) at tube wells and OHR facilities and algal growth in the OHRs.

165. Handling and Storage of Liquid Chlorine: Mishandling of liquid chlorine (Sodium hypochlorite) and its exposure to the tube well operators may cause burns to the mouth and throat, gastrointestinal irritation, nausea, vomiting and diarrhea. Inhalation and ocular exposure to chlorine gas, produced when sodium hypochlorite is mixed with acidic or alkaline solutions, results in burning of throat and lungs, eye and nose irritation, chest tightness, coughing and sore throat. Exposure to higher concentrations of chlorine may lead to tachypnoea, cyanosis, swelling of the airway and, in severe cases, pulmonary oedema and respiratory failure. Sodium hypochlorite is corrosive and may irritate the skin or cause burning pain, inflammation and blisters.

166. Safe handling and storage of liquid chlorine is proposed. It includes:
Transportation: Sealed containers of chlorine will be transported at site
Storage: Closed and locked storage of chlorine containers, placement of labels, precautions/instructions at storage place in Urdu language, secondary containment for chlorine container, use of spill kit and proper ventilation at storage place
Handling: Only authorized person for the dispensing of chlorine through pump under secondary containment, use of face mask, gloves and apron during chlorine handling activities. Strict monitoring is required from SMC for ensuring that the safe handling and storage practices are being adopted at water supply sites.

167. Algal Growth in Water Reservoirs: Algal growth takes place in the water reservoir with time which contaminates water changes its taste. It is proposed after every year, the reservoirs shall be cleaned and disinfected.

VI. ENVIRONMENTAL MANAGEMENT PLAN

168. The main purpose of the Environmental Management Plan (EMP) is to provide a strategy for environmental protection. According to this plan, all the activities associated with the subprojects are controlled and monitored from the design phase, through construction, commissioning and operations. Problems that occur during the project's development are to be identified and rectified so as to prevent damage to the environment. The EMP addresses specific impacts identified in the IEE. If some issues have been overlooked, then the EMP should be amended, in consultation with the regulatory authorities, so as to ensure effective mitigation is implemented. The EMP aims to ensure that:

- It is implemented at each stage of the project;
- The project activities are managed so as to avoid or reduce the negative environmental and social impacts and enhance positive impacts;
- The surrounding communities are better off after the project is implemented, on social and environmental indicators;
- Precautions are taken against damage, and claims arising from damage are handled, in a timely manner;
- Information flow between the client, consultants, contractors and affected parties, if any, is optimized to ensure that all role players are aware of their particular responsibilities;
- Affected structures, roads and natural features are protected during construction and then rehabilitated according to the guidelines in the EMP;
- Local labor and entrepreneurs from the affected communities are used throughout the project and for project related activities wherever possible;
- Accurate records of the progress of the project (including objections) are maintained so that the concerned can be traced out in the event of claims against the client;
- The monitoring reports are produced for regulatory bodies. Their frequency and content are agreed upon prior to start of the construction phase; and
- The mechanisms are in place for reviewing the efficacy of the mitigation plan and any improvements made in the course of the projects, so that other similar projects may benefit from the experience gained.

169. The EMP contains the following information to be used for its effective implementation:

- Responsibilities or potential skills of individuals, groups, government agencies and NGOs for carrying out mitigation actions identified in the EIA assessment;
- Guidelines for communication between all parties with responsibilities for implementing the mitigation plan;
- Costs of implementing the mitigation measures;
- Institutional and training requirements for implementing the mitigation measures;
- A monitoring program to track project related events and progress in implementing the mitigation measures;
- Community liaison procedures; and
- Mechanisms for improving the mitigation plan.

A. Environmental Management Plan (EMP)

170. The environmental management plan (EMP) for those subproject activities which have environmental impacts of medium risk is provided in Table-6.1. This plan gives an overview of planned mitigation measures, frequency of monitoring, monitoring requirement and responsibilities.

B. Institutional Arrangements

i. Sialkot Municipal Corporation (SMC)

171. Sialkot Municipal Corporation (SMC) is the overall executing agency for the water supply, sewerage, transport routes and green spaces development projects in Salkot. The Mayor of Sialkot is the executive head of the Municipal Corporation. The Deputy Mayor performs the functions of the Mayor if the Mayor is unable to perform functions on account of absence or for any other reason. The Mayor heads the municipal Corporation. He is assisted by the Chief Officer (CO). The CO coordinates and facilitates the performance of functions assigned to the Municipal Corporation under the supervision of the Mayor. The CO is the focal person in the Municipal Corporation. He acts as the coordinating and administrative officer in-charge of the offices and units of the Corporation.

172. There are five Municipal offices of the Corporation including i) Planning and Coordination; ii) Municipal Regulations; iii) Infrastructure; iv) Services; and v) Finance. A Municipal Officer (MO) heads each corporation office. These offices work under CO. The MO Infrastructure and MO Services are responsible for water supply, sewage and sewage treatment and disposal, storm water drainage, sanitation and solid waste, roads and streets, traffic planning, street lighting, firefighting, parks and slaughter houses in the Municipal Corporation. In addition, this office provides all engineering related support to other offices of the corporation (and where requested to the Union Administration).

173. Overall the SMC would be responsible for the implementation and execution of all the above mentioned projects. The water supply, sewerage and drainage and transport routes improvement projects would be executed directly by the SMC through contractors.

ii. The Urban Unit

174. The Urban Unit was established in 2006, as a Project Management Unit (PMU) of the Planning and Development department under the Government of Punjab. In 2012, it underwent significant transformation and converted into an independent private limited company, registered with the Securities and Exchange Commission of Pakistan (SECP). The objective of The Urban Unit is to provide guidance and support to Government departments in developing urban sector reforms and to coordinate the implementation of the reform program.

175. Thematic areas of coverage include GIS, urban planning and design, solid waste management, water and sanitation, urban transport, municipal finance and urban economics, information and communication technology, management information system, capacity development and social and environment safeguards, and monitoring and evaluation (M&E). It is an important partner and interlocutor for PICIIP activities in Sahiwal and Sialkot.

iii. Environmental Safeguard Specialist

176. The Urban Unit established under Punjab Government will facilitate SMC in managing environmental concerns of the proposed projects and implementing environmental safeguard. The environmental safeguard specialist consultants will be hired for providing resources for environmental safeguard management as appropriate and required. The Urban Unit with the assistance of environmental safeguard specialist consultants will be responsible for:

- Monitoring the implementation of environmental management measures required for each subproject.

- Preparing environmental screening checklists and classifying subprojects that have not been yet classified.
- Based on the checklist and as per the requirements of ADB SPS (2009), PEPA1997and relevant provincial Environmental Protection Acts, preparing IEEs and EMPs.
- Submitting the checklists and IEE reports to ADB as part of the approval of subproject.
- Ensuring that EMPs are included in tender documents.
- Ensuring that all regulatory clearances are obtained before starting civil works for the subproject.
- Ensuring that the EMPs, including all proposed mitigation measures and monitoring programs are properly implemented.
- Undertaking monitoring of subprojects and preparing environmental monitoring reports and delivered to ADB.
- In the case of unpredicted environmental impacts occurring during project implementation, preparing and implementing a Corrective Action Plan (CAP).
- In the case that a Category B subproject needs to have its sitting or alignment changed or its environmental classification reconfirmed, reviewing it to determine whether a supplementary study is required. If so, carryout the study and implement any amendments to the original EMP.
- Preparing a project specific EMP for the operations that includes a Site Specific EMP for each of the work areas.
- Providing awareness training in environmental management for all employees working on the subproject.
- Ensuring that meaningful public consultations (including both men and women) are undertaken with affected groups and local NGOs. The list of people attending the consultation, time and locations, subjects discussed during consultation will be recorded in a systematic manner.
- Sharing information and disclosure of environmental safeguard documents (including any Corrective Action Plans prepared in cases of change to original project design) as required

iv. ADB

177. ADB will take the following responsibilities:

- Review project IEEs as a basis for the approval of subprojects.
- Publicly disclose the final IEE before project appraisal, and afterward updated IEE and corrective action plan prepared during project implementation, if any, as well as environmental monitoring reports on the ADB website.
- Monitor the implementation of the EMP and due diligence as part of overall project review mission.
- Provide assistance to the TMA, if required, in carrying out its responsibilities and safeguard capacity building.

v. Civil Contractor

178. For water supply, sewerage and drainage, transport routes improvement and green spaces development projects, civil contractors will be hired directly by SMC. The responsibilities of the civil contractor will be as under:

- Ensure compliance of CPEMP and CSP throughout the construction activities
- Ensure efficient site management for the storage of equipment, stockpiling materials etc.;
- Ensure construction plan devised and agreed with the SMC ;
- Ensure compliance of the construction plan;
- Ensure quality of the infrastructure as per mentioned in the construction contract;

- Recruit labor from local communities first;
- For the construction camp on the site, ensure appropriate sanitary arrangements, accommodation and drinking water availability;
- Liaise with the local communities regarding services and goods supply at the site;
- Liaise with the local communities regarding construction activity, time span, likely nuisances such as noise, dust and disturbance;
- Ensure provision of appropriate night lights (if required) and standby power sources; and
- Plan working hours to provide minimum disturbance to the community.

vi. District Environment Officer (DEO)

179. The district's environment department is the sub department of Works and Services Department of District Government Sialkot and is headed by the District Officer Environment. The major functions of the department include:

- To assist Provincial Environment Protection Agency (EPA) in the discharge of its functions under the Pakistan Environment Protection Act,1997
- Regulate motor vehicles subject to the provision of the Pakistan Environment Protection Act,1997 and the rules and regulations made there under
- To ensure, guide and assist the proponents of new projects in submission of initial environmental examination (IEE)/Environmental Impact Assessment (EIA) to the DG Punjab EPA for approval.
- Identify the needs for legislation in various sector of the environment

180. District Environment Officer (DEO) of Sialkot under Environmental Protection Department (EPD), Punjab will be overall responsible for the enforcement of PEQS through his inspectors. He will be responsible for the compliance of following:

- Municipal and liquid industrial effluent parameters (32) for discharge to in land waters, sewage treatment facilities, and the sea.
- Industrial gaseous emissions (16) into the atmosphere.
- Motor and vehicle exhaust and noise (3)
- Ambient air quality (9)
- Drinking water quality (33)
- Noise for residential, commercial, industrial and silence zones

C. Local Regulations for Acquiring Environmental Approval

181. As per Government of Punjab, the SMC will have to prepare and submit environmental assessment reports of these projects to EPD Punjab to get construction phase No Objection Certificate (NOC), prior to start of construction or implementation. These reports will have to be prepared as per IEE or EIA guidelines. The public hearing and presentation of the project in front of nominated Expert Committee of EPD are also the requirements. After getting NOC, the construction can be started. The construction requires implementation of construction phase EMP, as given in the EIA or IEE report. After the completion of construction, the environmental compliance report, as per EMP of the EIA or IEE, will have to be submitted along with the application for the grant of operational phase NOC. After getting operational phase NOC, the project will then be started.

182. The water supply, sewerage, transport routes and green spaces development projects do not require any NOC from EPD as per EIA/IEE regulation.

D. Environmental Training Needs Assessment

183. For following the environmental compliance and preparing the environmental assessment reports, SMC does not has the capacity. SMC will need support from environmental

consultant for monitoring environmental parameters of the projects and preparing performance reports for ADB. The consultant will be responsible for the preparation of environmental assessment, monitoring and performance reports and submitting it to ADB, training of the SMC staff on ADB's environmental safeguards during construction and operational phases, translation of EMP actions into on ground implementation etc.

184. Frequent training on environmental compliance would be required by those within the SMC Infrastructure and the services officials. Most of this training will be conducted on-the-job and in workshops.

Table-6.1: Planned Environmental Monitoring

Subprojects	Mitigation Measure	Monitoring Requirement	Frequency	Responsible
Construction Phase				
- Water supply pipe replacement - Bus stand	**Soil Pollution Control** - Placement of secondary containment under fuel/lubricant containers and generator fuel oil tank to collect spillage and leakage - Placement of fuel/lubricant container on paved floor at enclosed place - Properly collect and dispose waste lube oil/oily rags after maintenance - Avoid spill and leaks of oil, lubricants on floor during maintenance activities - Immediate cleaning the spillage and leakage from the ground with saw dust/cloth and dispose of as solid waste	Strict monitoring of best practices during fuelling, oiling and maintenance activities with regard to soil contamination	Daily	Contractors Supervision by SMC
- DNI zones - Water supply pipe replacement - Fateh Garh - Sewerage pipe replacement - Bus stand	**Dust Suppression** Regular water sprinkling at dust producing areas during construction activities by the contractor to suppress dust (Construction Phase Environmental Mitigation Plan-CPEMP, would be appended with the contractor bidding document)	Monitoring of water sprinkling practices at construction site	Daily (during construction period)	Contractors Supervision by SMC
- Water supply pipe replacement - Fateh Garh - Sewerage pipe replacement - Bus stand	**Noise Control** - Contractor will operate well maintained vehicles and construction machines to avoid noise at the construction site - Regular maintenance of vehicles and construction machinery would be the responsibility of the contractor (Proper lubrication, oiling and greasing of the moving parts of the machines) - Regular monitoring of vehicular and machines noise - Taking appropriate maintenance measures in case noise level increases to 85dBA	- Review of maintenance record of vehicles and machines - Noise monitoring of vehicles, machines and surrounding areas of the construction sites - Monitoring of noise control measures taken by the contractor (in case noise levels are higher than PEQS and 85 dBA)	- Review of maintenance record for every new vehicle/machine arriving at site - Daily noise monitoring & recording of vehicles/machines and surroundings	SMC

Subprojects	Mitigation Measure	Monitoring Requirement	Frequency	Responsible
	- Vehicle/machines movement is allowed only at day time - High noise producing machines would be enclosed or provided with noise barriers at site to attenuate noise levels - There will be no construction activity or movement of vehicles at night time - Noise control measures would be part of CPEMP		three times (Morning, noon, afternoon)	
- Water supply pipe replacement - Fateh Garh - Sewerage pipe replacement - Bus stand	**Traffic Management** - Vehicles will be instructed to have reduced speed limit of 30 km per hour at the residential areas to avoid accident - Construction material carrying vehicles will be covered from the top to avoid dispersion of dust in the surrounding areas - In case of large number of vehicles arriving at the site, these will be planned in such a way that these should arrive at the site in different timings of the day to avoid traffic jam and nuisance for the nearby community - Proper road marking and sign board posting at residential and commercial areas - Cordon off the construction work areas and diversion of traffic to other sides as per traffic plans - Prior communication of alternative routes to the public to avoid traffic congestion at construction site	- Strict monitoring of speed limits and frequency of arrival at the site - Monitoring of road marking and signboard placing at the road side - Alternative rout plans and communication to public for the affected roads	Daily (during construction period)	SMC
Bus stand	**Construction Waste Disposal** - Disposal of construction waste at depressions - Avoid dumping at residential areas - Avoid dumping in the water bodies - Construction waste dumping practices would be part of CPEMP	Monitoring of construction waste dumping practices	Daily (during construction period)	Contractors, supervision by SMC
- Water supply pipe replacement - Sewerage pipe	**Domestic Solid Waste Disposal** - Contractor will be instructed in the CPEMP for properly collection and dumping of domestic solid	- Monitoring of solid waste management at site regarding proper collection, placement	Daily	Contractors Supervision by SMC

Subprojects	Mitigation Measure	Monitoring Requirement	Frequency	Responsible
replacement - Bus stand	waste at the designated municipal solid waste dumping site	and dumping at designated site		
- Water supply pipe replacement - Sewerage pipe replacement - Bus stand	**Sanitary Wastewater Disposal** Sanitary wastewater will be disposed of nearby drain after treatment in the septic tanks	- Construction and operation of septic tanks at the site - Proper disposal of sanitary wastewater at the drain/sewers - Monitoring of wastewater parameters (pH, BOD_5, COD, TSS, TDS)	- Start of construction activities - Daily - Weekly	Contractors Monitoring by SMC
- Water supply pipe replacement - Sewerage pipe replacement - Bus stand	**Health and Safety of Workers** - Contractor will provide Construction Safety Plan (CSP) along with the bidding and contract document which will be implemented during the construction period - Contractor will be responsible for providing and strictly implementing the use of safety gadgets by the workers during construction activities. - Availability of first aide medical facility at sites	Monitoring that the CSP is properly implemented at the site by the contractor	Daily	Contractors Supervision by SMC
Operational Phase				
Chlorination facility at tube wells and OHRs	<u>Transportation:</u> Sealed containers of chlorine will be transported at site <u>Storage:</u> - Closed and locked storage of chlorine containers - Labelling, precautions/instructions at storage place in Urdu language - Secondary containment for chlorine container - Use of spill kit - Proper ventilation at storage place <u>Handling:</u> - Only authorized person for the dispensing of chlorine through pump under secondary containment - Use of face mask, gloves and apron during chlorine handling activities	Regular monitoring of safe handling and storage practices	Daily	SMC

Subprojects	Mitigation Measure	Monitoring Requirement	Frequency	Responsible
Algal growth in OHRs	Cleaning and disinfection of OHRs	Ensure that OHRs are being cleaned as per OHR cleaning procedure	Annually	SMC

E. Grievance Redress System

185. A Grievance Redress System (GRS) will be established by the SMC to facilitate resolution of community complaints and grievances about the subproject environmental performance, in line with the requirements of ADB's SPS 2009. Under this mechanism, a Grievance Redress Cell (GRC) will be established.

186. The civil contractors will maintain a Community Complaints Management Register (CCMR) at site for logging complaints and grievances. This register will be filled and maintained with the assistance of SMC. All written and oral grievances will be recorded in the Register. The information recorded will include the date of the complaint and particulars of the complainant; a description of the grievance; the follow-up action required; the person responsible for implementing the action; and a target date for its completion. Each contractor will primarily be responsible for redressing the grievances within its jurisdiction under overall supervision of SMC. Construction-based grievances will mainly be dealt with by the SMC. The CCMR will be frequently checked by the SMC and necessary actions will be taken in case the contractor is not following up.

187. Affected communities and their representatives will be identified during the project preparation stage. The SMC will work towards resolving the grievances recorded in the CCMR in conjunction with the contractors within seven calendar days.

F. Environmental and Social Complaint Register

188. SMC project management team will maintain an environment and social complaints register at site offices to document all complaints received from the local communities. The register will also record the measures taken to mitigate these concerns. The final report will be communicated to the ADB. The SMC monitoring team will monitor the implementation of social and environmental mitigation measures as per the ADB Safeguard Policy Statement.

G. Environmental Management Cost

189. The total cost of environmental management includes human resources, mitigation measures during the construction and operational phases, and laboratory testing charges. The estimated cost of EMP implementation is given in Table-6.2.

Table-6.2: Cost Estimate for Environmental Management

Particulars	Detail	Unit Rate (Rs)	No. of Units	Total Amount (Rs)
Environmental Safeguard Specialist	One person for 6 months responsible for compliance of ADB requirements and training of SMC staff	150,000/month	6	900,000
Construction Phase Compliance of CPEMP	Contractors will be responsible for implementing Construction Phase Environmental Mitigation Plan (as appended with the bidding and contract documents). These costs will be included in their bids and will be part of their overall construction cost	-	-	-
Laboratory	i) PM monitoring	i) 3,000 ii) 3,000	i) 15 ii) 75	510,000

Particulars	Detail	Unit Rate (Rs)	No. of Units	Total Amount (Rs)
Testing Charges Construction Phase (6 months)	ii) Stack flue gas analysis for generators and vehicles iii) Wastewater analysis iv) Water quality analysis v) noise	iii) 6,000 iv) 6,000 v) 200	iii) 15 iv) 15 v) 300	
Personal Protective Equipment (6 months)	i) Dust masks ii) Face masks iii) Ear plugs iv) Ear muffs v) Safety helmet vi) Safety shoes vii) Safety gloves viii) First aid boxes ix) Firefighting equipment	Contractor		
Environmental Training of the SMC Staff	i) General environmental awareness ii) ADB safeguard requirements iii) GoPb environmental legislation and compliance requirements iv) Monitoring requirement v) Health and safety vi) Firefighting	Lump Sum		300,000
Total				**1,710,000**

VII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

190. Public consultations have been carried out during the prefeasibility study stage and during this feasibility study, with different stakeholders. These stakeholders included the local communities directly or indirectly affected either positively or negatively by the project components, NGOs, government departments, and private sector bodies. At the feasibility study stage the consultations have been carried out during preparation of the Gender Analysis and Gender Action Plan, the Poverty Analysis and Social Development Plan, and the Land Acquisition and Resettlement Action Plan. The summary of these consultations is presented in this chapter.

191. The objective of the Public Consultation process was to involve stakeholders from the earliest stages. The viewpoints of the stakeholders have been taken into account and their concerns and suggestions for possible improvements have been included where appropriate. Much of the consultation process to date has resulted in positive feedback from the stakeholders. They appreciated the project components which would improve their lives, but with some concerns relating to land acquisition reimbursement.

192. There is also a requirement for ongoing consultation for preparation of Land Acquisition and Resettlement Plan (LARP), which is being documented separately. It is expected that this process will continue through all stages of the subproject in order to accommodate stakeholders' aspirations and to orient the stakeholders positively towards the project implementation and where possible to harness cooperation over access issues in order to facilitate timely completion.

193. The environmental assessment process under the Pakistan Environmental Protection Act only requires disclosure to the public after the statutory IEE/EIA has been accepted by the relevant EPA. In this IEE, the consultation process was performed to satisfy the ADB requirements.

A. Results of Public Consultation

194. This section provides results of various public consultations carried out during prefeasibility and feasibility study stages.

i. Prefeasibility Study Stage Public Consultations

195. In the social surveys undertaken under the PFS, water supply emerged as the main issue for people living in poor areas. These people are not satisfied with the available water, such that in some areas they have disconnected the supply due to poor quality and odors that appear as a result of the mixing of water and sewerage systems. Most people use the water supply for washing purposes and are fetching the water from the filter plants installed in the various parts of the city. In some areas water is pumped from private wells installed by the households.

196. People are concerned that the poor quality of the water is causing diseases such as hepatitis, diarrhea, worm infections, and malaria. Regarding costs, they are paying on average Rs.626 on quarterly basis.

197. The proposed underpass development that is part of the transport improvement project will affect the livelihood of 53 families during the construction stage of the project. Land acquisition and resettlement is not required, as it only disrupts the

commercial areas, affecting the businesses both sides of the proposed corridors. The displaced people do not have alternate sources of income, being entirely dependent on these businesses. Although the full extent of the subproject is not yet clear, especially how this facility will be developed, people shared their views after consultation, as discussed below;

- The general public is very happy with the proposed under-pass project. They held the view that excess traffic failure is a problem, having adverse effects on local schools, especially Allama Iqbal Degree College for Girls. The under pass will result in the smooth flow of traffic in the area.
- There is a Nullah (drain) located close to the project area, and during construction of the underpass, the entire residential area will be cut off from the drainage system, so there will need to be alternative drainage options identified prior to the commencement of construction.
- Traffic will likely be affected during the project construction stage, so an alternate route must be given to avoid larger traffic failure.
- People were worried that their commercial structures will be affected during the project execution stage. In case their structures are damaged, they will need to be compensated.
- Encroachment by other businesses and mobile vendors will affect livelihoods during the construction stage.
- Some people have doubts that the project will not be completed on time and will create problems for them.
- The project may lead to the loss of business, negatively affecting livelihoods.
- The movements of local residents, especially female students, will be hindered severely, so they should be provided with an alternate route.
- The DPs should be provided with an alternate source of income prior to commencement of civil work to account for the expected loss of income.

ii. Feasibility Study Stage Public Consultations

198. Following are the summary points of the public consultations carried out during feasibility stage:

- Women participants of the Focal Group Discussions (FGDs) in both cities reported that health related expenditures form a significant portion of their total monthly expenditures. There is anecdotal evidence that a large majority of the population relies on private sector health facilities.
- Women and men in all FGDs, in both cities, have noted that there is a high prevalence of hepatitis which they attribute to contaminated water and inadequate solid waste disposal.
- According to primary data from FGDs, there is no development activity, donor assisted projects or initiatives. The civil society representatives provided a different perspective but it can be stated that with the exception of some philanthropic activity for installation of water filters, none of the sample areas are being targeted under any urban services improvement programs.
- Women residents talked at length on the poor or non-existent services available to them in terms of the quality and quantity of water, sanitation, health or education.
- Poor communities do not have gas and no proper arrangements for water supply, sewage or solid waste management.
- At an institutional level, it is observed that there are no specific gender mainstreaming strategies or mechanisms at the level of the TMAs in both Sahiwal and Sialkot and it would not be an exaggeration to state that these public services institutions are gender-blind. None of the TMAs mentioned having any policies and resources to this effect and indeed the facilities and working environment is very unfriendly towards women despite the fact that both employ women, at least in the workers' category.

- Overall, the issues in water access and quality are common across both cities. These include poor water quality, erratic supply and mixing of water pipelines with sewage.
- Government water supply follows fixed timings and is mostly available three times a day for an hour each time (roughly same finding for both cities). Water quality has been reported to be poor to very poor and unsafe for drinking, in all cases. Some residents e.g. UC Mianapura, Sialkot noted that water quality is so bad that it is even unfit for bathing. For drinking purposes, almost all households resort to either boiling water or collecting it from the various public and private water filtration plants installed in different areas. While a small number of people reported that they are making do with collecting water from filters, most of the women and men stated that filter plants are either far away or are dysfunctional.
- Due to the unavailability of municipal water supply, the majority depend on motor-operated pumps and pay heavy electricity bills (ranging between Rs 3,000-4,000 per month)
- The FGD in UC New Mianapura East, Sialkotrevealed that even the pumped water they get within their houses is not good and they have to go to the nearest filter plant which is half an hour away on foot to get water.
- The main points of conclusion, from the consultations around the sewage system, are as follows: the public system is a badly planned, haphazard, outdated, inefficient, faulty collection of old rusty pipes and open and semi-covered and covered drains. All primary data confirms a perpetual problem of clogged and overflowing drains, flooding of streets and lanes with filth and sewage with *adhoc* arrangements being made in emergency situations that only provide temporary relief. The severity of the situation varies but is particularly alarming in middle or low income areas. Women respondents in all FGDs mentioned great difficulty faced by them due to this problem and the health, hygiene and mobility constraints they face because of this situation.
- Rain water is gathered and remains standing for days and many areas reportedly remain inundated for days on end. The functioning of the TMA is considered to be highly unsatisfactory and people have mentioned that there are severe staff shortages. According to city residents, the cleaning and operation of the sewerage system is a combination of luck, chance or circumstance where an active UC chairman or councillor will take action to mobilise resources.
- In UC Model town, Sialkot, residents reported the presence of households who have kept livestock (cows and buffaloes) within their homes and animal dung and other waste is being collected and disposed of directly at street level. Residents have unsuccessfully lodged complaints and tried to take action on this matter.
- The FGD respondents mentioned that solid waste collection staff are limited; containers are not placed evenly across the city; neighborhood and lane level disposal is not thought out; the dumpers are often faulty; and, timing schedules are not adhered to. Moreover, it was noted that SWMC sanitary workers often refused to work on the pretext that they are on strike. TMA has alleged that the separation of solid waste sanitary staff has created a difficult situation whereby they sweep garbage directly into open lines and let the TMA staff attend to it. Residents of New Mianapura East, Sialkot also mentioned that SWMC only collect from major market roads and there is unattended industrial waste as well in their area. The landfill site had not been finalized at the time of field-work and according to the SWMC all suitable options had been exhausted to no avail.
- The only mode of transportation for a large majority of the population are *qingchis* and auto rickshaws and these are reportedly unaffordable. Most of the women noted that they travel on *qingchis* at a flat rate for Rs 20 within the city but more for travel to far off places and this places a huge financial burden especially for those who have to go out every day for education or employment purposes. Women in the FGD (UC Kareempura, Sialkot) noted difficulties in having to sit next to male passengers and said they would very much like a metro bus system which they can avail for Rs 10 as in bigger cities.
- It is evident that the city residents (men and women) in Sahiwal and Sialkot feel that there are not adequate, safe, reliable, consistent or regular services vis-à-vis water

supply, sewage, solid waste management or transportation. It is also evident that women, due to their multiple productive and reproductive roles, are inconvenienced and burdened due to limitations in service provision. Men and children are also involved in terms of both time and labour (water carrying/collecting, garbage collection). The proposed project, therefore, stands to benefit everyone and does not have any adverse impacts.

- The field findings from the FGDs indicate community prioritisation of needs as follows:
  - Better sewage and sanitation
  - Water supply
  - Solid waste management
  - Health facilities/improvements
  - Community spaces/centres
  - Transportation
- Another equally important and oft-mentioned concern by almost all women is their aspiration for *a women-friendly public space that is open to all and where they can come together for various purposes.* "A centre run for women and by women" is how many different women put it – a space where they can congregate for various purposes in a safe and unhindered manner.
- The civil society organizations (e.g. in Sahiwal) emphasized clean water, sewage system, health and education. The CSOs in Sialkot reiterated the same as those of Sahiwal with the addition of awareness raising and sensitization of civic and legal rights and obligations, implementation of existing laws and labor standards relating to women, jobs and skills training for skilled and unskilled labor.
- Willingness to pay for the amenities was explored under all sectors and in all data collection instruments for primary data collection. By and large, all respondents in both cities with the exception of women respondents in UC Waterworks (Sialkot) reported that they are not *able* to pay any additional charges for water supply or solid waste because they are already barely able to make ends meet. "The Rs 626 is already too high and we sometimes have to pay this amount in installments" is how the women in UC Kareempura, Sialkot put it.
- The respondents in the more affluent UC Waterworks reported, however, that their willingness to pay depends on the suitability of proposed arrangements and they indicated that perhaps 50 percent of the households are in a position to pay an extra Rs 100-200 for improved (efficient and regular) water supply and solid waste management.
- Households are already paying fees for privately acquired services, such as electricity bills for water or rickshaw fares. These fees are usually higher than municipal service charges, and this therefore suggests a willingness to pay.

VIII. FINDINGS AND RECOMMENDATIONS

199. This study was carried out at the feasibility study stage of the PICIIP. Primary and secondary data were used to assess environmental impacts. The report has provided a picture of all potential environmental impacts associated with the project, and recommended suitable mitigation measures.

200. Most of the water supply, sewerage and urban development improvement projects have minor environmental impacts during the construction phase, and these are manageable through implementation of the CPEMP with overall supervision by the SMC. However, the staff of the SMC will require training on EMP implementation during the construction phases

201. The water supply, sewerage, transport routes and green spaces projects do not require No Objection Certificates from the government. The information provided in this report can form the basis of any further submission to ADB as required.

202. Construction phase environmental mitigation plan (CPEMP) and construction safety plans are also required to be prepared before awarding construction contract to the contractors. These plans will be part of the bidding documents.

203. These projects will not pose any negative social impact. However, if land acquisition is required, compensation to the APs and concerned parties will be provided. The LARP; Gender Analysis and Gender Action Plan; Poverty Analysis and Social Development Plan; and, Land Acquisition and Resettlement Plan have been completed in tandem with this IEE. These studies have:

- *Examined and assessed the overall social and poverty profile of the project area on the basis of the primary and secondary data sources and prepared socio-economic profiles of the project areas.*

- *Prepared a social and poverty analysis, taking into account socio-economic and poverty status of the project area of influence, including the nature, extent and determinants of poverty. In addition, estimation of the likely socioeconomic and poverty reduction impacts of the project were included.*

- *Held consultations with relevant officials from the government, including consultation with affected communities to assess responses to the project and ascertain the nature and scope of local participation in project planning and implementation.*

- *Identified, analyzed and, where appropriate, quantified the potential resettlement Impacts (minimal) of the proposed project on the area and the population.*

204. Baseline monitoring activities have not been carried out during the project feasibility stage. The requirement for baseline monitoring, prior to the commencement of construction and operation activities, shall be integrated into contract documentation in order to establish performance thresholds, pollution limits and contingency plans for the contractor's performance.

205. During the operational phase, the monitoring of environmental parameters should ensure that statutory requirements have been achieved. Monitoring activities will focus on

periodic recording of environmental performance and proposing remedial actions to address any unexpected impacts.

IX. CONCLUSIONS

206. The water supply, sewerage and urban development projects under PICIIP are feasible and sustainable from engineering, environmental, and socioeconomic points of view. Implementation of the EMP is required and the environmental impacts associated with the subprojects need to be properly mitigated. Existing institutional arrangements are available for the implementation of the EMP. Additional human and financial resources will be required by SMC to comply with environmental safeguard requirements. The proposed mitigation and management plans are practicable but require additional resources.

207. This IEE, including the EMP, should be used as a basis for an environmental compliance program and as guidelines for the preparation of construction related EMP document which should be included as an Appendix to the contract document. The EMP shall be reviewed at different stages of the project and be updated as per requirement. In addition, any subsequent conditions issued by EPA Punjab as part of the environmental clearance should also be included in the environmental compliance program. Therefore, continued monitoring of the implementation of mitigation measures and implementation of the environmental conditions for work should be properly carried out and reported at least twice a year as part of the project performance report.

ANNEXURE-1
REA CHECKLISTS

Rapid Environmental Assessment (REA) Checklist

SEWAGE TREATMENT

Instructions:

- ❑ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional Sustainable Development Department.
- ❑ This checklist is to be completed with the assistance of an Environmental Specialist in a Regional Department.
- ❑ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on i) involuntary resettlement, ii) indigenous peoples planning iii) poverty reduction, iv) participation, and v) gender and development.
- ❑ Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: PAKISTAN/Punjab Intermediate Cities Improvement Investment Project (PICIIP)

Sector Division: Water and other urban infrastructure and services

SCREENING QUESTIONS	Yes	No	REMARKS
A. Project Siting Is the project area			
➢ Densely populated?	☐	■	
➢ Heavy with development activities?	☐	■	
▪ Adjacent to or within any environmentally sensitive areas?			
➢ Cultural heritage site	☐	■	
➢ Protected area	☐	■	
➢ Wetlands	☐	■	
➢ Mangrove	☐	■	
➢ Estuarine	☐	■	
➢ Buffer zone of protected area	☐	■	
➢ Special area for protecting biodiversity	☐	■	
➢ Bay	☐	■	
B. Potential Environmental Impacts			

SCREENING QUESTIONS	Yes	No	REMARKS
Will the Project cause			
▪ Impairment of historical/cultural monuments/areas and loss/damage to these sites?	☐	■	
▪ Interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.??	■	☐	Transient impacts possible during replacement of sewer lines. Mitigation measures proposed as part of the EMP
▪ Dislocation or involuntary resettlement of people?	☐	■	
▪ Impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?	☐	■	Situation is unchanged from current scenario in the absence of treatment plant facilities.
▪ Overflows and flooding of neighboring properties with raw sewage?	☐	■	Situation is unchanged from current scenario in the absence of treatment plant facilities.
▪ Environmental pollution due to inadequate sludge disposal or industrial waste discharge illegally disposed in sewer?	☐	■	Situation is unchanged from current scenario in the absence of treatment plant facilities.
▪ Noise and vibration due to blasting and other civil works?	■	☐	Transient impacts during construction. Mitigation measures proposed as part of the EMP.
▪ Discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?	☐	■	Situation is unchanged from current scenario in the absence of treatment plant facilities.
▪ Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?	☐	■	No treatment plants
▪ Social conflicts between construction workers from other areas and community workers?	☐	■	
▪ Road blocking and temporary flooding due to land excavation during rainy season?	■	☐	Transient impacts during construction. Mitigation measures proposed as part of the EMP. Scheduling of works to avoid the rainy season
▪ Noise and dust from construction activities?	■	☐	Transient impacts during construction. Mitigation measures proposed as part of the EMP.

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Traffic disturbances due to construction material transport and wastes?	■	□	Transient impacts during construction. Traffic management measures proposed as part of the EMP.
▪ Temporary silt runoff due to construction?	■	□	Transient impacts during construction. Mitigation measures proposed as part of the EMP.
▪ Hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?	□	■	Situation is unchanged from current scenario in the absence of treatment plant facilities.
▪ Deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?	□	■	Situation is unchanged from current scenario in the absence of treatment plant facilities.
▪ Contamination of surface and ground waters due to sludge disposal on land?	□	■	Situation is unchanged from current scenario in the absence of treatment plant facilities.
▪ Health and safety hazards to workers from toxic gases and hazardous materials which may be contained in sewage flow and exposure to pathogens in sewage and sludge?	□	■	Situation is unchanged from current scenario

Rapid Environmental Assessment (REA) Checklist

URBAN DEVELOPMENT

Instructions:

- ❑ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional Sustainable Development Department.
- ❑ This checklist is to be completed with the assistance of an Environmental Specialist in a Regional Department.
- ❑ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on i) involuntary resettlement, ii) indigenous peoples planning iii) poverty reduction, iv) participation, and v) gender and development.
- ❑ Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: PAKISTAN/Punjab Intermediate Cities Improvement Investment Project (PICIIP)

Sector Division: Water and other urban infrastructure and services

SCREENING QUESTIONS	Yes	No	REMARKS
C. Project Siting Is the project area			
➢ Densely populated?	☐	■	
➢ Heavy with development activities?	☐	■	
▪ Adjacent to or within any environmentally sensitive areas?			
➢ Cultural heritage site	☐	■	
➢ Protected area	☐	■	
➢ Wetlands	☐	■	
➢ Mangrove	☐	■	
➢ Estuarine	☐	■	
➢ Buffer zone of protected area	☐	■	
➢ Special area for protecting biodiversity	☐	■	
➢ Bay	☐	■	
D. Potential Environmental Impacts Will the Project cause			

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Impacts on the sustainability of associated sanitation and solid waste disposal systems and their interactions with other urban services?	☐	■	
▪ Deterioration of surrounding environmental conditions due to rapid urban population growth, commercial and industrial activity, and increased waste generation to the point that both manmade and natural systems are overloaded and the capacities to manage these systems are overwhelmed?	☐	■	
▪ Degradation of land and ecosystems (e.g. loss of wetlands and wild lands, coastal zones, watersheds and forests?	☐	■	
▪ Dislocation or involuntary resettlement of people?	■	☐	Social safeguard report under preparation for parties affected by plans to redevelop the bus terminal
▪ Degradation of cultural property, and loss of cultural heritage and tourism revenues?	☐	■	
▪ Occupation of low lying lands, floodplains and steep hillsides by squatters and low income groups, and their exposure to increased health hazards and risks due to polluted industries?	☐	■	
▪ Water resource problems (e.g. depletion/degradation of available water supply, deterioration of surface and ground water quality, and pollution of receiving waters?	☐	■	
▪ Air pollution due to urban emissions?	☐	■	
▪ Social conflicts between construction workers from other areas and local workers?	☐	■	
▪ Road blocking and temporary flooding due to land excavation during rainy season?	■	☐	Traffic management measures required as part of the EMP. Scheduling of construction work to avoid rainy season
▪ Noise and dust from construction activities?	■	☐	Transient impacts from construction activities. Mitigation measures proposed as part of the EMP

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Traffic disturbances due to construction material transport and wastes?	■	□	Traffic management measures required as part of the EMP. Transient impacts
▪ Temporary silt runoff due to construction?	■	□	Construction activities to be confined to dry season/dry weather. Scheduling to be stipulated in the EMP
▪ Hazards to public health due to ambient, household and occupation pollution, thermal inversion, and smog formation?	□	■	
▪ Water depletion and/or degradation?	□	■	
▪ Overpaying of groundwater, leading to land subsidence, lowered groundwater table, and salinity?	□	■	
▪ Contamination of surface and ground waters due to improper waste disposal	□	■	
▪ Pollution of receiving waters resulting in amenity losses, fisheries and marine resources depletion, and health problems?	□	■	

Rapid Environmental Assessment (REA) Checklist

WATER SUPPLY

Instructions:

- ❑ This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional Sustainable Development Department.
- ❑ This checklist is to be completed with the assistance of an Environmental Specialist in a Regional Department.
- ❑ This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on i) involuntary resettlement, ii) indigenous peoples planning iii) poverty reduction, iv) participation, and v) gender and development.
- ❑ Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: PAKISTAN/Punjab Intermediate Cities Improvement Investment Project (PICIIP)

Sector Division: Water and other urban infrastructure and services

SCREENING QUESTIONS	Yes	No	REMARKS
E. Project Siting Is the project area			
➢ Densely populated?	☐	■	
➢ Heavy with development activities?	☐	■	
▪ Adjacent to or within any environmentally sensitive areas?			
➢ Cultural heritage site	☐	■	
➢ Protected area	☐	■	
➢ Wetlands	☐	■	
➢ Mangrove	☐	■	
➢ Estuarine	☐	■	
➢ Buffer zone of protected area	☐	■	
➢ Special area for protecting biodiversity	☐	■	
➢ Bay	☐	■	
F. Potential Environmental Impacts Will the Project cause			

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?	☐	■	
▪ Impairment of historical/cultural monuments/areas and loss/damage to these sites?	☐	■	
▪ Hazard of land subsidence caused by excessive groundwater pumping?	☐	■	
▪ Social conflicts arising from displacement of communities?	☐	■	
▪ Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?	☐	■	
▪ Unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?	☐	■	
▪ Delivery of unsafe water to distribution system?	■	☐	Disinfection system proposed at production and storage facilities
▪ Inadequate protection of intake works or wells, leading to pollution of water supply?	☐	■	
▪ Over pumping of groundwater, leading to salinity and ground subsidence?	☐	■	
▪ Excessive algal growth in storage reservoir?	■	☐	Preventative maintenance required for all production and storage facilities
▪ Increase in production of sewage beyond capabilities of community facilities?	■	☐	Improvements to sewerage system proposed in parallel with this project
▪ Inadequate disposal of sludge from water treatment plants?	☐	■	
▪ Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?	☐	■	
▪ Impairments associated with transmission lines and access roads?	☐	■	
▪ Health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals?	■	☐	Handling and storage procedures built into the EMP

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Health and safety hazards to workers from the management of chlorine used for disinfection and other containments?	■	□	Handling and storage procedures built into the EMP
▪ Dislocation or involuntary resettlement of people	□	■	
▪ Social conflicts between construction workers from other areas and community workers?	□	■	
▪ Noise and dust from construction activities?	■	□	Noise and dust control measures to be specified in the EMP. Impacts are transient.
▪ Increased road traffic due to interference of construction activities?	■	□	Traffic management plan to be specified in the EMP. Impacts are minor and transient.
▪ Continuing soil erosion/silt runoff from construction operations?	□	■	
▪ Delivery of unsafe water due to poor O&M treatment processes (especially mud accumulation in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?	■	□	Preventative maintenance required for all production and storage facilities. Monitoring requirements to be specified in the Monitoring Plan
▪ Delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?	■	□	Preventative maintenance required for all production and storage facilities. Monitoring requirements to be specified in the Monitoring Plan
▪ Accidental leakage of chlorine gas?	□	■	
▪ Excessive abstraction of water affecting downstream water users?	□	■	
▪ Competing uses of water?	□	■	
▪ Increased sewage flow to increased water supply	□	■	
▪ Increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant	■	□	Improvements to sewerage system proposed in parallel with this project

ANNEXURE-2
DETAIL OF PUBLIC CONSULTATION PARTICIPANTS

Name	Title/Designation and Organisation	Date, Place
Sialkot		
Mohd Zafar Qureshi	Tehsil Municipal Officer	4th Nov
Mohd Shiraz	Managing Director, SWMC	4th Nov
Mustansar Khan	Chief Sanitary Inspector	5th Nov
Ashraf Bajwa	Assistant Tehsil Officer, Water Supply	5th Nov
Muzammil Yaar	District Officer, Social Welfare	5th Nov
Mohd Sharif Ghumman	Deputy District Officer, Social Welfare	5th Nov
Fakhira Yasmin Tazeem Akhtar	Superintendent Dar-ul-Falah, Mother and Child Home Deputy Teacher, Dar-ul-Falah, Mother and Child Home	7th Nov
Asma Ahmed Erum Shehzadi	Superintendent, Shelter home/dar-ul-aman Second In charge, Shelter home/dar-ul-aman	7th Nov
Hina Nasreen	President, Baidaari	7th Nov
Mohd Ijaz Noori	Chairman Pakistan Council for Social Welfare and Human Rights	7th Nov
Shakir Husain	Representative, Fair Trade Asia Pacific	7th Nov
Mohammad Ishfaq	President, Roz Human Rights	7th Nov
Shakila Ijaz	Lady Health Visitor, Union Council Waterworks	8th Nov

Sialkot
FGD 1: New Mianapura East **Participants:** 1. Mouzma Anwar 2. Sehrish Anwar 3. Shumaila Ajmal 4. Saba Iqbal 5. Razia Iqbal 6. Razia Munir 7. Parveen Akhtar 8. Sidra Bilal 9. Shama Yasin 10. Shehnaz Asghar 11. Sheena Taha 12. Ms Nayyar
FGD 2: Union Council Kareempura, Mohallah Raja Baazar (5th Nov) **Participants:** 1. Riffat Sultana 2. Kaneez Fatima 3. Razia Begum 4. Roohi Bano 5. Mohammad Tasleem 6. Nasreen Tariq
FGD 3: Old Model Town/Union Council Mubarikpura (now Mianapura) 7th Nov **Participants:** 1. Sabiha Jalal 2. Shabana Zia 3. Rafia Abid 4. Ms Ejaz 5. Mian Aftab Jahangir 6. Sohail Mir
FGD 4: Union Council Waterworks (8th Nov) **Participants:** 1. Maqsooda Begum 2. Yasmin Razzak 3. Nazeera Begum 4. Shazia Nasir 5. Sadia Usman

REFERENCES

1- Medium Term Integrated Climate Resilient Urban Infrastructure Investment Progaram and Pre-feasibility Study, Final Report Sialkot Pakistan, April 2016
2- Initial Environmental Examination, Pak: MFF Power Transmission Enhancement Investment Program Tranche 4- Dispersal of Power from 747 MW Power Plant at Guddu to Muzzafargarh, NTDC June 2016
3- Initial Environmental Examination, BAN: Third Urban Governance and Infrastructure Improvement (Sector) Project – Kishoregonj Roads and Drains Improvement Subproject (Phase-2), Local Government Engineering Department, Bangladesh, October 2016
4- Initial Environmental Examination, IND: Kolkata Environmental Improvement Investment Program (Tranche 2) – Sewerage and Drainage, Kolkata Municipal Corporation, Government of West Bengal India, September 2016
5- Policy Paper, Safeguard Policy Statement, Asian Development Bank, June 2009
6- Disaster Risk Management Plan, district Sialkot Government of Punjab, District Disaster Management Authority, DCO Office Sialkot, November 2008
7- Environmental Assessment Guidelines, Asian Development Bank, 2003
8- Inception Report, Punjab Intermediate Cities Improvement Investment Program, Saaf Consult B.V., Netherlands, Joint Venture with Dev~Consult, Pakistan & NEC Consultants (Pvt) Limited, Pakistan, October 2016
9- Wastewater Engineering - Treatment and Reuse by Metcalf & Eddy, 2003