ISLAMIC REPUBLIC OF PAKISTAN
WATER AND SANITATION AGENCY FAISALABAD (WASA-F)

ISLAMIC REPUBLIC OF PAKISTAN

THE PROJECT FOR WATER SUPPLY, SEWERAGE AND DRAINAGE MASTER PLAN OF FAISALABAD

FINAL REPORT

VOLUME II MAIN REPORT

FEBRUARY 2019

JAPAN INTERNATIONAL COOPERATION AGENCY
（JICA）

NIHON SUIDO CONSULTANTS CO., LTD.
JAPAN TECHNO CO., LTD.
YOKOHAMA WATER CO., LTD.

Foreign Exchange Rate:
Master Plan
US$ 1 = JPY 111.29
US$ 1 = PKR 104.85
(As of December 2017)

FINAL REPORT
ON
THE PROJECT FOR WATER SUPPLY, SEWERAGE AND DRAINAGE
MASTER PLAN OF FAISALABAD

GENERAL TABLE OF CONTENTS

(In addition to the above reports, a Completion Report summarizing the results, outcomes, and recommendations obtained from the pilot activities of this Project will be prepared in May 2019 as a supplemental report.)

VOLUME II
MAIN REPORT

TABLE OF CONTENTS

PART B WATER SUPPLY

PART C SEWERAGE AND DRAINAGE

LIST OF TABLES

PART A GENERAL STATEMENTS ON THE WATER SECTOR

PART B WATER SUPPLY

PART C SEWERAGE AND DRAINAGE

LIST OF FIGURES

PART A WATER SECTOR GENERAL STATEMENT

PART B WATER SUPPLY

PART C SEWERAGE AND DRAINAGE

ABBREVIATIONS AND TERMINOLOGY

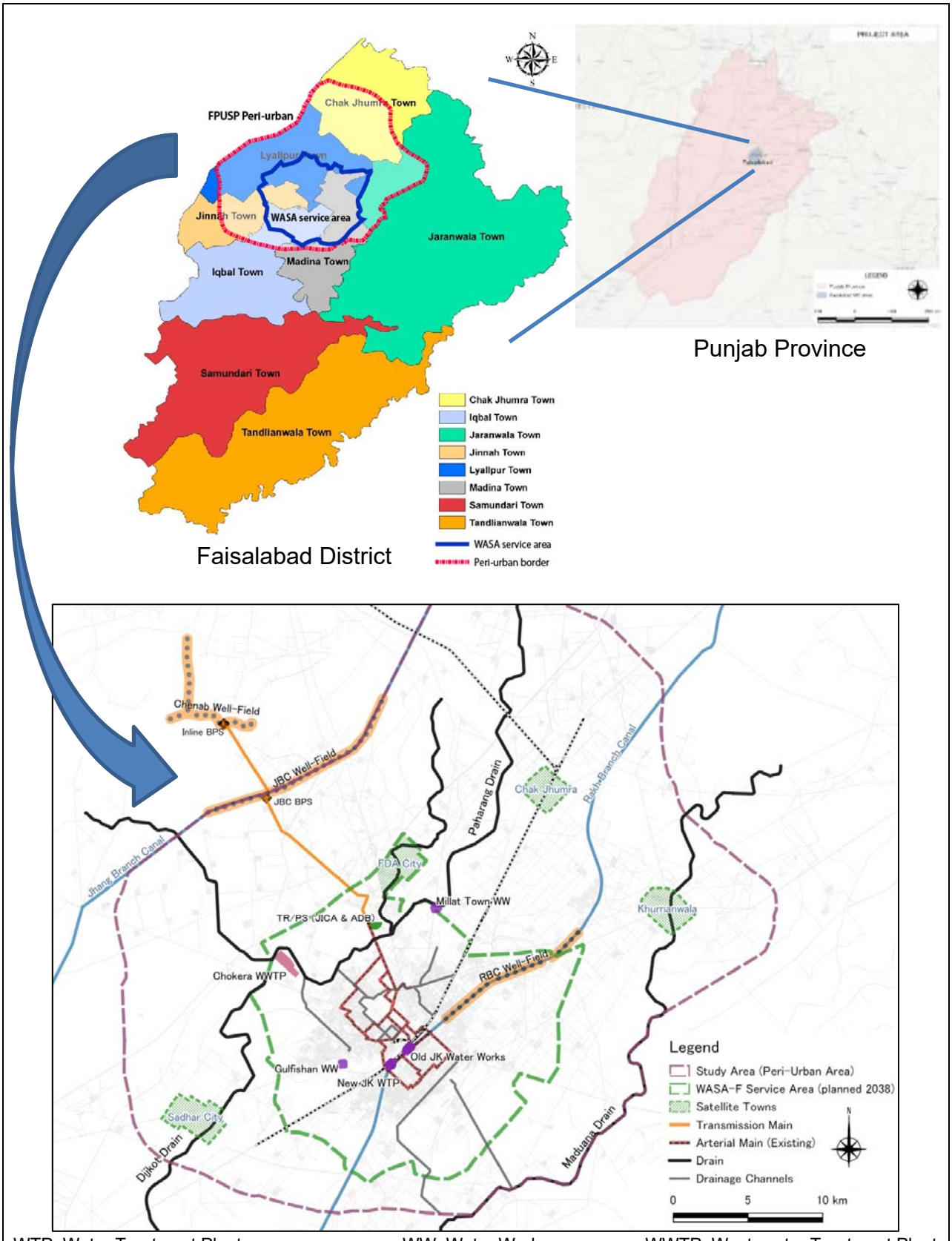
AC	Asbestos Cement
ACP	Asbestos Cement Pipe
AD	Assistant Director
ADB	Asian Development Bank
ADP	Annual Development Programme
AFD	Agence Française de Development
AIDS	Acquired Immunodeficiency Syndrome
APHA	American Public Health Association
APTPMA	All Pakistan Textile Processing Mills Association
ARTR	Account Receivable Turnover Rate
As	Arsenic
AWWA	American Water Works Association
B/C	Benefit Cost Analysis
BC	Branch Canal
BOD	Biochemical Oxygen Demand
BOO	Build Own Operate
BPJM	Business Plan Joint Meeting
BPS	Booster Pumping Station or Basic Pay Scales
BR	Balancing Reservoir
CA	Capacity Assessment
CAD	Computer Aided Design
CAPEX	Capital Expenditure
CBO	Community Based Organization
CCA	Cultivable Command Areas
CCI	Chambers of Commerce and Industry
CD	Capacity Development
CDGF	City District Government Faisalabad
CDIA	Cities Development Initiative for Asia
CDM	Clean Development Mechanisms
CI	Cast Iron
CLC	Citizen Liaison Cell
CLTS	Community-Led Total Sanitation
CMC	Complaint Management Cell
COD	Chemical Oxygen Demand
C/P	Counterpart
CPEC	China Pakistan Economic Corridor
CRC	Customer Relations Center
Cusec, cfs	cubic feet per second＝0.0283 m^3/s
d, D	day
DANIDA	Danish International Development Agency
D/E	Debt Equity Ratio
DC	Distribution Center
DCIP	Ductile Cast Iron Pipe
DCO	District Coordination Officer
DCZ	Distribution Center Zone
DEO	District Environment Officer
DF/R	Draft Final Report
DI	Ductile Iron
DMA	District Metered Area

DMD	Deputy Managing Director
DMZ	District Metered Zone
DN	Diameter Nominal
DPS, DP/S	Disposal Pumping Station
DWC	Dry Weather Condition
EBIT	Earnings Before Income Tax
ECNEC	Executive Committee of National Economic Council
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
E/N	Exchange of Notes
ENPV	Economic Net Present Value
EPA	Environmental Protection Agency
EPA-F	Environmental Protection Agency, Faisalabad
EPC	Engineering, Procurement, and Construction
EPD	Environmental Protection Department
ESMMP	Environmental and Social Management and Monitoring Plan
FC, F.C.	Foreign Currency
FC/R	Final Completion Report
FDA	Faisalabad Development Authority
FESCO	Faisalabad Electric Supply Company
FIRR	Financial Internal Rate of Return
FPUSP	Faisalabad Peri-Urban Structure Plan
F/R	Final Report
F/S	Feasibility Study
FSD	Faisalabad
FWMC	Faisalabad Waste Management Company
FY	Fiscal Year
GAAP	Generally Acceptable Accounting Principle
GBC	Gugera Branch Canal
GDP	Gross Domestic Product
GI	Galvanized Iron
GIS	Geographic Information System
GL	Ground Level
GOJ	Government of Japan
GOP	Government of Pakistan
GOPb	Government of Punjab
GPRS	General Packet Radio Service
GPS	Global Positioning System
GR	Ground Reservoir
GRC	Grievance Resolution Committee
GRP	Glass Reinforced Plastic
G/W	Groundwater
HDPE	High Density Polyethylene
HIES	Household Integrated Economic Survey
HIV	Human Immunodeficiency Virus
h, hr, H	Hour, Head
HP	Horse power
HPP-F	Housing and Physical Planning Faisalabad
HRMS	Human Resource Management System
HUD&PHED	Housing, Urban Development and Public Health Engineering Department
HWL	High Water Level

IBP	Indus Basin Plan
I&C	Information and Communication
IC/R	Inception Report
IDFCRC	Irrigation, Drainage and Flood Control Research Council
IEE	Initial Environmental Examination
IMF	International Monetary Fund
IRR	Internal Rate of Return
IT	Information Technology
IT/R	Interim Report
IUWM	Integrated Urban Water Management
IWRM	Integrated Water Resources Management
JBC	Jhang Branch Canal
JCC	Joint Coordinating Committee
JC	Job Description
JICA	Japan International Cooperation Agency
JK	Jhal Khanuana
JMT	JICA Mission Team
JPY	Japanese Yen
k	kilo-
km	Kilo-meter
KPI	Key Performance Indicator
kVA	Kilo-volt amps
KW	kilo Watt
l, L, lit	liter
LAA	Land Acquisition Act
LC, L.C.	Local Currency
LCC	Lower Chenab Canal
LG	Local Government
LHR	Lahore
LPS, LP/S	Lift Pumping Station
LWL	Low Water Level
m	meter
m^2	Square meter
m^3	Cubic meter
MAF	Million Feet Per Acre
MD	Managing Director
mg	milligram
MGD	Million Gallon* per Day (*1 gallon = 4.546 liters)
min	Minutes
MIS	Management Information System
MS	Mild Steel
M/M	Minutes of Meetings
MMCFD	Million Cubic Feet per Day
MoU	Memorandum of Understanding
M/P	Master Plan
MTDF	Medium-Term Development Framework
Nazim	The Chief elected official of the District
NBP	New Business Plan
ND	Nominal Diameter
NDMA	National Disaster Management Authority
NEQS	National Environmental Quality Standards

NGO	Non-governmental Organization
NIBGE	National Institute for Biotechnology & Genetic Engineering
NPO	Nonprofit Organization
NPV	Net Present Value
NRP	National Resettlement Policy
NSDWQ	National Standards for Drinking Water Quality
NRB	National Reconstruction Bureau
NRW	Non-Revenue Water
NOC	No Objection Certificate
NTU	Nephelometric Turbidity Unit
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OHR	Over Head Reservoir
OJT	On the Job Training
OPEX	Operating Expenditure
O&M	Operation and Maintenance
PBC	Performance-Based Contract
PC	Personal Computer
PC-1	Planning Commission Document-1
PCGIP	Punjab Cities Governance Improvement Project
PCRWR	Pakistan Council of Research in Water Resources
PDCA	Plan Do Check Action
P&D	Planning & Design, or Planning & Development
PEPA	Pakistan Environmental Protection Act
PEQS	Punjab Environmental Quality Standards
PFI	Private Finance Initiative, Power Factor Improvement
PFS	Pre-feasibility Study
PG/R	Progress Report
PGSHF	Punjab Government Servant Housing Foundation
pH	Potential of Hydrogen
PHED	Public Health Engineering Department
PI	Performance Indicator
PIDA	Punjab Irrigation & Drainage Authority
PIU	Project Implementation Unit
PKR, Rs.	Pakistan Rupee
PMD	Pakistan Meteorological Department
PPM, ppm	Parts Per Million
PPP	Public Private Partnership
PQ	Pre-qualification
PS, P/S	Pumping Station
PVC	Polyvinyl Chloride
PWOP	Pakistan Water Operator Partnerships
q, Q	Capacity
Qty	Quantity
RAP	Resettlement Action Plan
RBC	Rakh Branch Canal
R/D	Record of Discussions
R/O	Reverse Osmosis
R&R	Revenue & Recovery
RTU	Remote Terminal Unit
RWR	Raw Water Reservoir

SC	Sea Concentration
SCADA	Supervisory Control and Data Acquisition
SCF	Standard Conversion Factor
SDGs	Sustainable Development Goals
SDR	Social Discount Rate
SE	Sub Engineer
SEA	Strategic Environmental Assessment
s, sec	Second
SMART WASA	Supply Management and Revenue Team WASA Faisalabad
SOP	Standard Operating Procedure
SS	Suspended Solids
S/W	Surface Water
SWD	Sewerage District
TC	Technical Committee
TDS	Total Dissolved Solids
Tehsil	Administrative sub-divisions of the District
Temp.	Temperature
TEPA	Traffic Engineering Planning Agency
TMA	Tehsil Municipal Administration
TOR	Terms of Reference
TR	Terminal Reservoir
T-N	Total Nitrogen
T-P	Total Phosphorus
TSS	Total Suspended Solids
UASB	Up-flow Anaerobic Sludge Blanket
UBC	Utility Basic Checklist
UC	Union Council (Smallest unit of local government)
UFW	Unaccounted for Water
UN	United Nations
USD	US Dollar
USPMSU	Urban Sector Planning & Management Services Unit
UTC	University of Engineering & Technology, Lahore
UU	The Urban Unit
VAT	Value Added Tax
VFD	Variable Frequency Drive
WAPDA	Water and Power Development Authority
WASA	Water and Sanitation Agency
WASA-F	Water and Sanitation Agency Faisalabad
WASCO	Water & Sanitation Community Organization
WB	World Bank
WDM	Water Distribution and Management
WHO	World Health Organization
WSP	Water and Sanitation Program
WSZ	Water Supply Zone
WTP	Water Treatment Plant
WW	Water Works
WWF	World Wildlife Fund
WWTP	Wastewater Treatment Plant
µg/lit	micrograms per liter



WTP: Water Treatment Plant WW: Water Works WWTP: Wastewater Treatment Plant

Location of the Project Area

PART A GENERAL STATEMENTS ON THE WATER SECTOR

A series of master plans have drafted over the last 40 years to improve the general quality of life and environment in the city Faisalabad, particularly with regard to water. Almost all of the master plans have proposed various measures for overall improvement, again with a special emphasis on water supply and sanitation. Yet due to shortages of funds and resulting lack of implementation, the desired outputs have not been attained. This report discusses the practical and realistic development plans of Faisalabad City with regard to the water supply, sewerage, and drainage sectors.

CHAPTER A1 INTRODUCTION

A1.1 Background

Faisalabad is the second largest city of Punjab Province and the third largest city of Pakistan, with a population of about 2.7 million in its urban area as of 2015[1]. The population of the city is growing at an estimated rate of 1.8% per annum and is expected to reach about 3.1 million by 2023 and 4.1 million by 2038.

With such rapid population growth, securing adequate quantities of water for supply has been difficult both in terms of infrastructure development and resource development. As of 2015, the total design capacities of existing water supply facilities amounted to 500,000 m^3/day (110 MGD) and fulfilled only about 77% of the total water demand of 650,000 m^3/day (143 MGD). The difference of 149,000 m^3/day (33 MGD) constitutes the shortage of the present water supply capacity. Due to the scarcity of water resources and delay in the development of water supply facilities, only 60%[2] of the households in the current service area of the city have access to municipal water supply. Most residents supplement municipal water with groundwater from private wells located on their premises. It will therefore be crucial to tap and acquire additional water resources and further develop water supply facilities in the city.

The only sewerage plant in Faisalabad (stabilization pond process), a facility constructed in 1998 with the support of the Asian Development Bank (ADB), has a treatment capacity of 90,000 m^3/day (20 MGD). The sewerage coverage ratio in the current service area is about 72%. This puts the areas without sewerage in chronically unsanitary conditions, with household and industrial wastewater flowing into storm water drains caused by malfunctions of the existing facilities such as insufficient capacity of the sewer pipes, sedimentation inside of the pipes, and chaotic situation of drainage facilities. Although there are standards for wastewater release into drains, the rules are lax and untreated industrial wastewater flows directly into the drains. Areas with sewerage drains also face maintenance challenges such as the clogging of sewer pipes with soil, sand, garbage, and dumped food residues.

In the water supply and sewerage billing system, the Water and Sanitation Agency Faisalabad (WASA-F) operates both a volumetric tariff system (a meter rate system) and fixed tariff system (a fixed rate system by lot area). The meter rate system, however, is not actually applied in the city in practice. The fixed rate system is effectively adapted to almost all households instead, as new household water meters have only recently been installed. WASA-F has recently resolved to install water meters to households throughout the whole length and breadth of the city in order to shift from the current fixed rate system to the future meter rate system. As the water rates are low, WASA-F is in poor financial condition and relies heavily on

[1] Population and other data are based on estimations by the Government of Punjab Province.
[2] WASA-F officially reported 60% of the water supply coverage as of 2015; however, JICA Mission Team (JMT) estimated, with some assumptions, 42% of that from population in service area and population served at 2015. The estimate is presented in Section 5.3.2 in Chapter B5 of Part B, Water Supply Master Plan.

subsidies from the Government of Punjab (GOPb). Non-Revenue Water (NRW) also makes up quite a high portion of the total water supply, around 33%[3] or more according to past survey reports.

The water supply and sewerage master plan of Faisalabad was established in 1976 with support from ADB. It was revised in 1993 with support from the World Bank. No reviews have been performed for over 20 years as of this writing, and the target year for revision, 2018, is approaching. A review of the water supply, sewerage, and drainage master plan is therefore imminent.

In this context, the Government of Pakistan (GOP) requested the Government of Japan (GOJ) to provide support in establishing a long-term plan for appropriate water resource development, facility investment linked to urban planning, the proper maintenance of existing facilities, increased water and sewerage revenue, improved financial performance, and sustainable operation of water supply and sewerage services. JICA conducted a detailed project planning survey in 2015 and signed with GOPb in a Record of Discussion[4] (R/D) on March 3, 2016, before initiation of the Project for Water Supply, Sewerage, and Drainage M/P of Faisalabad (hereinafter referred to as "the Project"). Including the R/D, key minutes relevant to the Project are shown in **Appendix AA1.1, Minutes for the Project,** in the **Supporting Report**.

A1.2 Objectives of the Study

The following are the main objectives of the study:

- To develop an integrated Master Plan to be authorized as WASA-F's official development plan for water supply, sewerage, and drainage in Faisalabad City (hereinafter referred to as the "Master Plan" or "M/P")
- To enhance the institutional capacity for implementation of the M/P

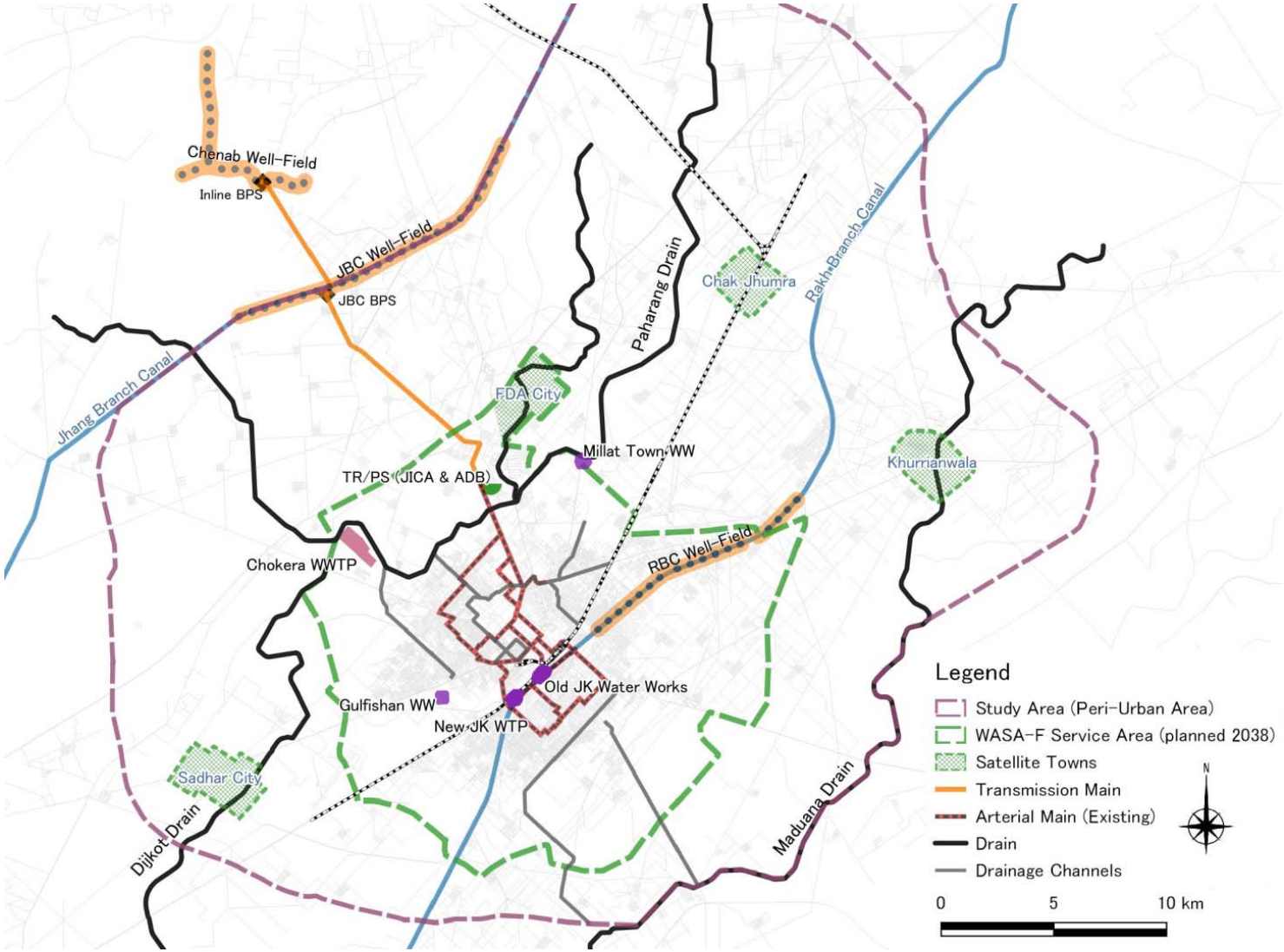
A1.3 Study Area

The study area is the area enclosed within the boundary of the Peri-Urban Structure Plan of Faisalabad.

Under Rule 11 of the Punjab Land Use Rules, 2009, the Peri-Urban area is defined as the area that spans the landscape between contiguous urban development and rural countryside, has a low population density, is predominantly used for agricultural activity, and is likely to be urbanized in the next twenty years. These area serves as a transitional zone between the city and its hinterlands and accommodates intensive flows of natural resources, goods, and people to and from the city. It also serves as an interface between the urban, rural, and natural areas, has dynamic and mixed physical and socioeconomic attributes, and is growing at a relatively rapid pace.

In this regard, the Government of Punjab has already outlined the Peri-Urban area around Faisalabad City (see **Figure A1.3.1**).

[3] WASA-F officially reported 33% of the NRW as of 2015; however, French Funded Project estimated 55% of that in 2015.
[4] The Project was formulated by the Detailed Planning Survey (2015). The scope of the Project was mutually agreed between GOJ and GOPb based on the R/D on March 3, 2016.



WTP: Water Treatment Plant WW: Water Works WWTP: Wastewater Treatment Plant

Figure A1.3.1 Map Showing Study Area

A1.4 Scope of Work

As described previously, rapid population growth has led to an increase in water demand. WASA-F is facing a range of difficulties such as deteriorated infrastructures, insufficient operation and maintenance capacity due to a lack of trained staff, and a shortage of operation costs due to low revenue. The city suffers a serious imbalance in water supply and demand as a consequence.

The Scope of the Project encompasses the following: (1) an analysis of the present situation, (2) a capacity assessment, (3) recommendations for improvement of institutional management, and (4) a future investment plan covering a selection of priority projects for water supply, sewerage, and drainage in Faisalabad City, as described in the R/D. The study area is the area within the boundaries of the Peri-Urban Structure Plan.

According to the plan, the following activities are to be undertaken to achieve the project objectives:

Basic Study

1) Review of the Faisalabad Environmental Infrastructure M/P in the year 1993
2) Collection and analysis of data and information
   - Urban development and land use plan
   - Natural and socioeconomic conditions
   - Current status of the water resources and water supply facilities
   - Groundwater potential
   - Current status of the sewerage and drainage facilities
   - Laws and regulations, policies, and organizations related to water, sewerage, and drainage
   - Organization, operation, and financial management of WASA-F
3) Water quality survey (water sources, raw and treated wastewater, industrial wastewater)
4) Public awareness survey (socioeconomic survey)
5) Identification of issues on water supply, sewerage, and drainage

Formulation of the M/P

A. Water Supply

1) Capacity Assessment of WASA-F's Operation and Management
2) Survey for water supply schemes not served by WASA-F
3) Setting of the planning strategy and goal for the water supply plan
4) Delineation of the water supply service area
5) Planning basis (population, per capita water consumption, non-domestic water supply volume, etc.)
6) Water demand projection
7) Water sources development plan
8) Water supply pipeline plan (raw water and treated water transmission, distribution network)
9) Distribution water storage and pumping plan
10) Water treatment plant (WTP) plan
11) Phased implementation plan
12) Project cost estimation
13) Economic and financial evaluation
14) Environmental and social considerations
15) Project evaluation
16) Recommendations on priority projects
17) Preliminary design for priority projects

B. Sewerage and Drainage

1) Setting of the planning strategy and goal for the sewerage and drainage plan
2) Delineation of the sewerage and drainage planning area
3) Planning basis (population, per capita wastewater generation, design influent / effluent quality, etc.)
4) Trunk sewer plan and preliminary design
5) Wastewater treatment plant (WWTP) plan and preliminary design
6) Drainage plan and preliminary design
7) Phased implementation plan
8) Project cost estimation
9) Economic and financial evaluation
10) Environmental and social considerations
11) Project evaluation
12) Recommendations on priority projects

C. Institution and Finance

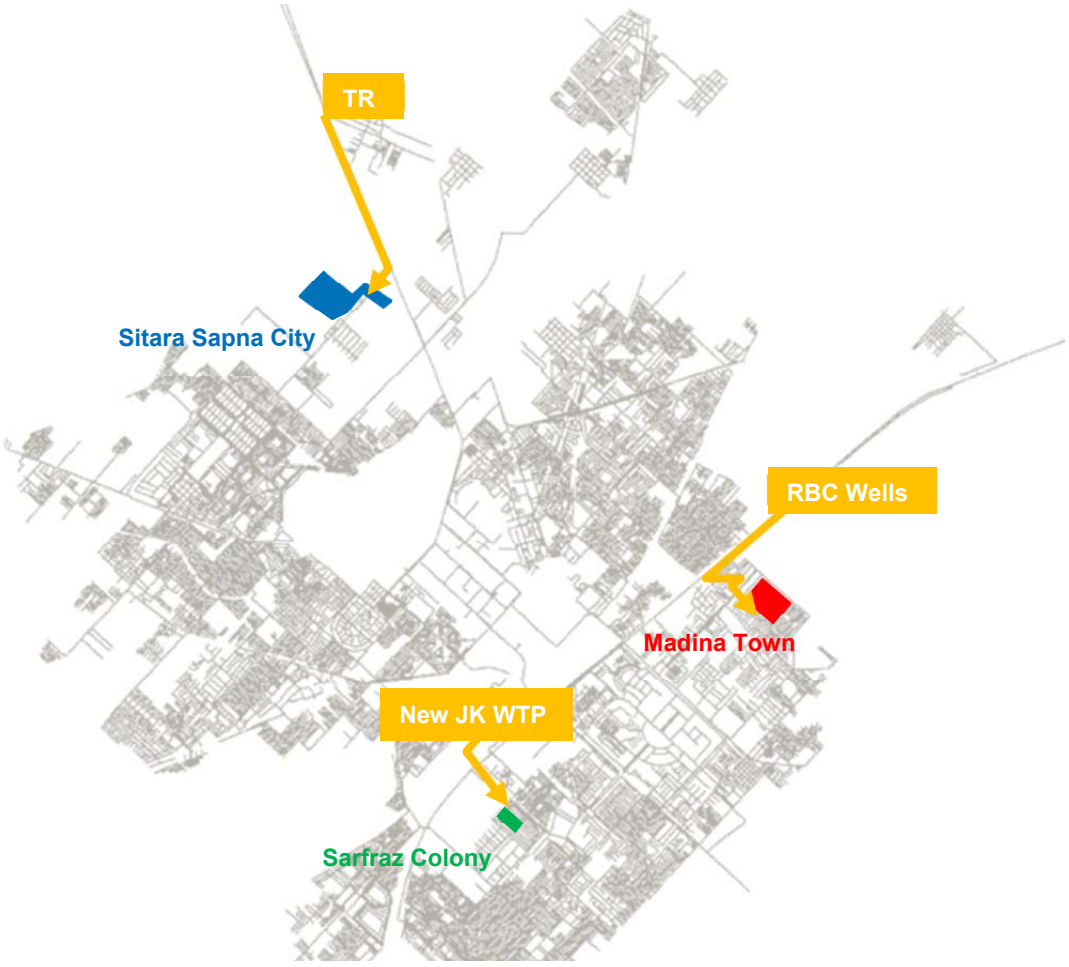
1) Organization and management improvement plan
2) Finance plan

D. Pilot Activities for Water Supply

1) Planning of pilot activities
2) Selection of a pilot activity area
3) Hydraulic isolation of the pilot activity area
4) Improvement of distribution
5) Activities to promote water meter installation
6) Leakage detection and repair works
7) Legalization of illegal connections
8) Improved bill collection
9) Training of meter readers
10) Evaluation and recommendations

A1.5 Pilot Activities

The M/P formulated in the Project must be verified through the pilot activities to ensure that it will remain useful in the future. For the purpose of testing and verifying the plans and assumptions included in the M/P as realistic plans, pilot activities have been carried out in three (3) areas: Sarfraz Colony, Madina Town, and Sitara Sapna City (see **Figure A1.5.1**).



TR: Terminal Reservoir
New JK WTP: New Jhal Khanuana Water Treatment Plant
RBC Wells: Rach Branch Canal Wells

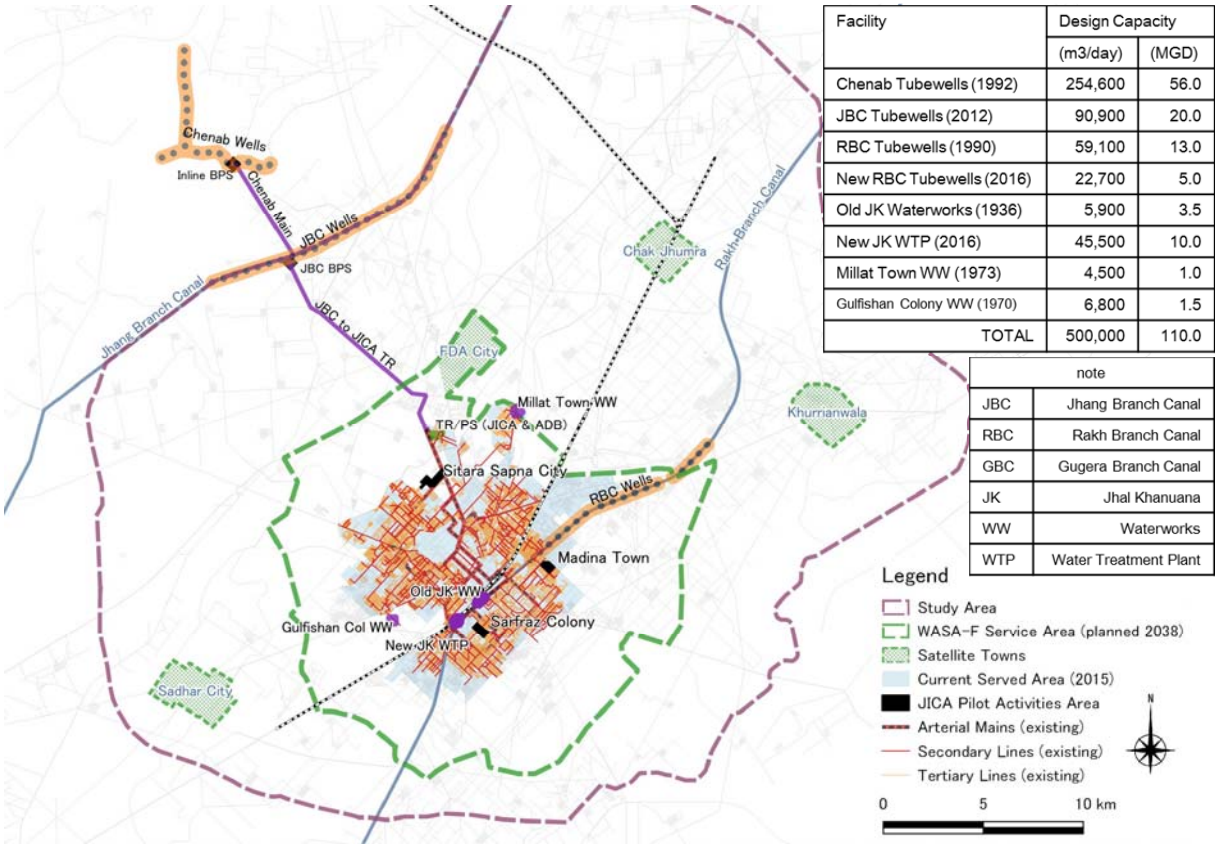
Figure A1.5.1 Locations of the Pilot Areas

Taskforce Team, SMART WASA, for the Pilot Activities

The pilot activities attempt to demonstrate the effectiveness and practicability of the newly formulated M/P. From the results and outcomes of the pilot activities, a Completion Report is prepared with recommendations on encouraging implementation of the M/P. In concrete terms, the pilot activities to establish a district metered area (DMA), detect and repair leaks, and launch public campaigns aim to improve water distribution management, reduce non-revenue water (NRW) amounts, and improve revenue within the pilot areas selected. To conduct these activities effectively, a taskforce team called **SMART WASA** (Supply Management and Revenue Team WASA Faisalabad) was set up inside WASA-F in November 2016. SMART WASA is composed exclusively of WASA-F personnel. WASA-F administrative staff and technical staff in SMART WASA work as a cross-organizational team, while headquarters staff and field staff work as a cross-hierarchical team.

A1.6 Current WASA-F Facilities

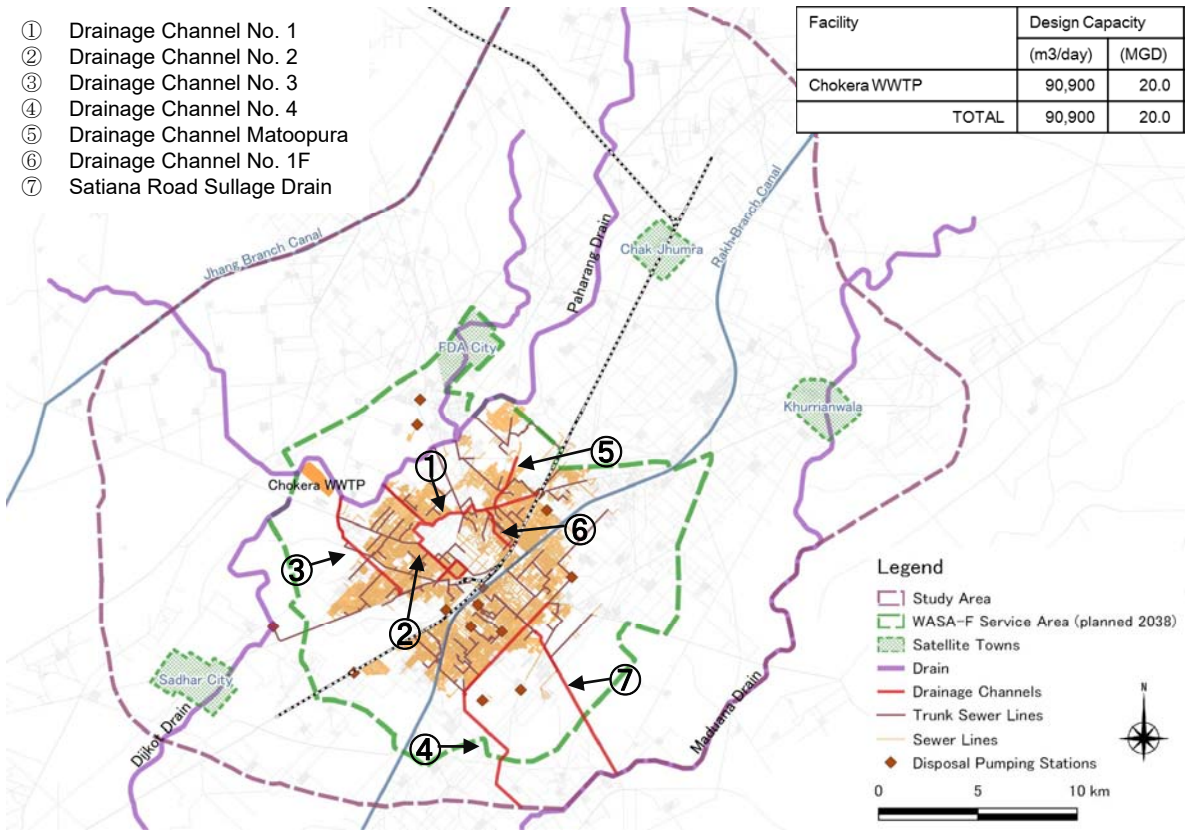
Table A1.6.1 and **Table A1.6.2** summarize the current water supply, sewerage, and drainage facilities of WASA-F and their actual conditions. **Figure A1.6.1** below shows their locations.



Facility	Design Capacity	
	(m3/day)	(MGD)
Chenab Tubewells (1992)	254,600	56.0
JBC Tubewells (2012)	90,900	20.0
RBC Tubewells (1990)	59,100	13.0
New RBC Tubewells (2016)	22,700	5.0
Old JK Waterworks (1936)	5,900	3.5
New JK WTP (2016)	45,500	10.0
Millat Town WW (1973)	4,500	1.0
Gulfishan Colony WW (1970)	6,800	1.5
TOTAL	500,000	110.0

note	
JBC	Jhang Branch Canal
RBC	Rakh Branch Canal
GBC	Gugera Branch Canal
JK	Jhal Khanuana
WW	Waterworks
WTP	Water Treatment Plant

Figure A1.6.1a Current WASA-F Facilities (Existing Water Supply Facilities)



Facility	Design Capacity	
	(m3/day)	(MGD)
Chokera WWTP	90,900	20.0
TOTAL	90,900	20.0

Figure A1.6.1b Current WASA-F Facilities (Existing Sewerage and Drainage Facilities)

Table A1.6.1 Actual Operational Condition of Water Supply Facilities

<table>
<tr><th>Facility</th><th>Item</th><th>Actual Condition</th></tr>
<tr><td>Intake Facilities</td><td>Tubewells</td><td>
a) Chenab Well-Field
▪ 25 tubewells in Chenab Well-Field were constructed in 1990 with the support of ADB, together with an Inner Booster Pumping station and terminal reservoir. The pumping capacity was later reduced due to the lowering of the groundwater table, so four tubewells were added in 2000 to compensate. One of the four added tubewells has yet to be furnished with a pump.
▪ The design discharge and operation hours are 4 Cusec per tubewell (about 400 m^3/hour) and 20 hours a day, respectively.
▪ The target of water supply at this source is a pumped water volume of 254,600 m^3/day (56 MGD) when operating 28 tubewells in total.

b) JBC Well-field
▪ Twenty-five tubewells in the JBC Well-field were constructed in 2011 with the support of JICA, and operation started in 2012.
▪ Two are designed as spares. Twenty-three of the tubewells are designed to stay in operation at all times.
▪ The design discharge is 200 m^3/hour (2 Cusec) per tubewell over an operation period of 20 hours per day, satisfying a total water supply target of 90,900 m^3/day (20 MGD) when operating 23 tubewells.

c) RBC
▪ There used to be more than 50 tubewells along RBC, but excessive pumping degraded the water quality and many tubewells were used in a wasted condition. As of 2017, there are 28 tubewells in operation. Six of them were constructed in 1983, ten, in 2003, and twelve, in 2008. Another ten tubewells were constructed in 2016 with AFD support.
▪ The design specifications for the tubewells along the RBC specify a discharge of 100 m^3/hour (1 Cusec) per tubewell
▪ The tubewells operate for 6 to 8 hours per day.
▪ The total water supply target for the 28 operating tubewells is from 16,800 to 22,400 m^3/day (3.5 to 5 MGD)

d) O&M
▪ Compared with the specified operating hours in the pump designs, the pumps operate at actual rates of 66% in Chenab, 75% in JBC, and only 33% in RBC.
▪ WASA's electricians and mechanics handle minor repair work for the tubewells and pumping machinery. When major repairs or replacements are required, WASA also outsources the work.
</td></tr>
<tr><td></td><td>Pumping Stations</td><td>
a) Pumping stations for Chenab line (Inline BPS (Booster Pump Station); Old TRPS (Terminal Reservoir Pump Station))
▪ Booster Pump and Distribution Pump
▪ Existing Pumping Station (Chenab line)

<table>
<tr><th>Type</th><th>Pump size</th><th>Specification</th><th>Set</th></tr>
<tr><td rowspan="2">Booster Pump (at inline BPS)</td><td>Large pump 3,200 m^3/hour (32 Cusec)</td><td>600 x 600 mm</td><td>4</td></tr>
<tr><td>Small pump 1,600 m^3/hour (16 Cusec)</td><td>400 x 400 mm</td><td>3</td></tr>
<tr><td rowspan="2">Distribution Pump (at Old TRPS)</td><td>Large pump 2,200 m^3/hour (22 Cusec)</td><td>500 x 400 mm</td><td>7</td></tr>
<tr><td>Small pump 1,600 m^3/hour (16 Cusec)</td><td>500 x 350mm</td><td>3</td></tr>
</table>
▪ Actual Condition of Inline BPS, Old TPRS
✓ All equipment is deteriorated due to aging.
✓ The pumps of the Old TRPS have been damaged heavily due to cavitation phenomena.
✓ Mechanical troubles often occur.
✓ Some pumps of the Inline BPS have been out service for years due to control panel breakdowns.
✓ Erroneous pump performance design has rendered half of the reservoir capacity unusable.
</td></tr>
</table>

<table>
<tr><th>Facility</th><th>Item</th><th>Actual Condition</th></tr>
<tr><td></td><td></td><td>
✓ A considerable amount of water is leaking from the reservoir.

b) Pumping Station for the JBC line
▪ Booster Pump and Distribution Pump
▪ Existing Pumping Station (JBC line)

<table>
<tr><th>Type</th><th>Pump size</th><th>Specification</th><th>Set</th></tr>
<tr><td>Booster Pump
(at JBC BPS)</td><td>Large pump
1,500 m^3/hour (15 Cusec)</td><td>450 x 350 mm</td><td>4</td></tr>
<tr><td rowspan="2">Distribution Pump
(at JICA TRPS)</td><td>Large pump
3,700 m^3/hour (37 Cusec)</td><td>600 x 450 mm</td><td>3</td></tr>
<tr><td>Small pump
1,700 m^3/hour (19 Cusec)</td><td>450 x 300 mm</td><td>2</td></tr>
</table>
▪ Actual Condition of the Pumping Station for the JBC line
✓ Each reservoir is internally split with a wall for maintenance work.
✓ A flow meter is installed in each discharge header pipe before the pipes are connected with each other.
✓ The flow rates and reservoir water levels are recorded by a SCADA installed under the French Funded Project.

c) Flow Sheet from tubewells to the city
Tubewells →Collector Main →Booster Pump Station (BPS) →Transmission Main →Terminal Reservoir (TR) → Arterial main → the city
</td></tr>
<tr><td>Water Treatment Plants</td><td>Slow sand filtration</td><td>
a) Jhal Khanuana (Original)
Water Source: Rakh Branch Canal, Year of Operation Start: 1975. Present Production capacity: 6,800 m^3/day (1.5 MGD), design capacity: 15,900 m^3/day (3.5MGD)

b) Millat Town
Water Source: Seram Wala D. Canal, Rakh Branch Canal. Year of Operation Start: 1973. Present Production capacity: 4,500 m^3/day (1.0 MGD).

c) Gulfishan Colony
Water Source: Rakh Branch Canal. Year of Operation Start: early 1970s. Under rehabilitation.

d) General Flow Sheet for the Slow Sand Filtration Plant:
Raw water intake channel → Storage cum Pre-settling tanks (two or three tanks with large-capacities) →Raw water pumping* → Slow sand filters → Clear water reservoir(s) → dosage of breeching powder for disinfection → treated water transmission pump station → transmission to service area (either directly or through Overhead Reservoir(s) (OHR).

e) O&M
▪ Due to the high turbidity of the water inflowing to the filters and short filter run, the filters in actual use declined to about 50 ~ 60% of the total number of filters provided. Due to this operation condition, the provided treatment capacity is less than the installed capacity (heavy work for sand scraping is required).
▪ No flow-measuring or flow-control devices are installed in any part of the slow sand filtration plant.
▪ According to the information on the plant provided, the slow sand filter structure lacks any devices for flow or filtration rate control.
</td></tr>
<tr><td></td><td>Rapid Sand Filtration Plant</td><td>
a) Jhal Khanuana (New)
Water Source: Rakh Branch Canal, Year of Operation Start: 2016. Present Production Capacity 45,500 m^3/day (10 MGD).

b) Flow sheet of the plant:
Raw water intake channel → Raw water pump station → Distribution chamber → Flash mixing tanks (two) → Flocculation tanks (two) → Sedimentation tanks (four) → Rapid gravity sand filters (eight) → Chorine dosage for disinfection → Clear water tank (one) → Finished water transmission pump station → Service area (inject arterial distribution main).

c) The following chemicals are applied:
▪ Alum for coagulation is fed into the inlet of each flash mixing tank.
</td></tr>
</table>

Facility	Item	Actual Condition
		▪ Polymer used as a coagulation aid is fed into the inlet of each flocculation tank and filter inlet leader channel. ▪ Lime for pH adjustment is also fed into the inlet of each flocculation tank and liquid chlorine for disinfection is fed in at the effluent of the filter. No pre-chlorination is provided. d) O&M ▪ Water purification operation was judged to be adequate when observed. ▪ The raw water turbidity in the sedimentation tank was reduced from 100 NTU to 4 NTU. The finished water turbidity was 0.4 NTU. ▪ A SCADA system has been provided to monitor the operation status of the plant and control of the equipment.
Distribution Facilities	Arterial main (Primary main)	a) Pipe size: 400 mm ~ 1,600 mm b) Pipe material: DIP and ACP (88% DIP) c) Pipe length: 101.1 km d) Function: The pressure is difficult to manage because there is no separation between the transmission and distribution functions.
	Secondary & tertiary line	a) Pipe size: 75 mm~300 mm. In principle, the service connection is branched from 75 mm and 100 mm. b) Pipe material: ACP, DIP, PVC, MS, CIP (98% ACP) *MS: mild steel c) Pipe length: 1,308.9 km *MS is used for repairs only. *WASA-F still uses ACP for new installation. *To respond to health problems associated with aging pipe, WASA-F is now replacing the aging pipes using Gastro Project[5] funds from the Annual Development Plan (ADP). The duplication of pipelines, however, is a problem.
	Ground Reservoir (GR) and Over Head Reservoir (OHR)	a) 33 GRs (operating: 21 GRs, including WTP reservoirs and TR) b) 42 OHRs (operating: 19 OHRs) *12 GRs and 23 OHRs are not operating, WASA-F plans to rehabilitate or newly construct them using PBC-NRW Project funds from the ADP. c) GR Capacity: 100 to 4,500 m^3 (25,000~1,000,000 gallons). TR Capacity: 47,000 m^3 (10,350,000 gallons). Reservoir Capacity in New JK WTP: 5,200 m^3 (1,150,000 gallons). Most of the reservoirs have capacities of 450 m^3 (100,000 gallons), which is too little for the water supply area. d) OHR Capacity: 135 to 2,250 m^3 (30,000~500,000 gallons). Most have capacities of 50,000 gallons, which is too little for the water supply area. e) OHR height: 12~27 m. (very low average height of 18～23 m). *PHED previously constructed the OHRs for each colony, and WASA-F transferred them. The capacities and heights are therefore insufficient. *An OHR has no supply area boundary, so WASA-F is unable to control the water pressure. Hence, the pressure has disappeared. f) Manual: No operation manual is available.
	O&M	a) Valve: valves are minimally installed in the distribution pipelines except at the outlets of the OHR and the arterial mains. As a result, WASA-F is unable to carry out complicated water controls or operations. When water supply is suspended, the affected area becomes wide. b) Maintenance: WASA-F can now maintain the pipeline during supply hours because the water pressure is low. When the water pressure improves in the future, WASA-F will be unable to do so. c) Leakage repair: WASA-F repairs leakages based on information from customers contacting the Customer Relation Center. WASA-F has no leakage investigations planned or records of leakage repairs. d) Safety management is insufficient. (No retaining structures are installed, even when WASA-F excavates more than 2 m for repairs.) e) Construction skills and quality controls are flawed. (A pipeline was damaged during the back filling after repair.)
	SCADA	a) A SCADA already established with French Funds makes it possible to measure the flow volume and the water pressure from the Arterial Main to each DMZ. (Construction, however, has not been completed: 6 DMZs are fully constructed, 5

[5] Development budgets for ADP are distributed from the GOPb to five (5) WASAs. Out of ADP, budgets are sometimes allocated for the replacement of outlived rusty & leaking pipelines and extensions to distribution system (new) under the so-called Gastro Project.

Facility	Item	Actual Condition
		DMZs are partially constructed, and the others are just planned). The flow volume into each DMZ cannot be measured at present because all of the boundary valves are left open at all times.
	Drawings/GIS	a) As-built drawing: WASA-F has no as-built drawing for the pipeline, as no regulations have been put in place to require contractors to submit as-built drawings to WASA-F after completion of installation. b) GIS (arc GIS of WASA-F): the distribution pipelines are already input in the whole of supply area, though the attribute information is limited to the pipe dimensions and offers no details on the valves. A large gap between the GIS data and site will necessitate a confirmation survey.
	DMZ/DMA	a) DMZ: The service area was divided into 16 DMZs by the French Funds. This division is linked to the SCADA system. The flow volume into the DMZs can be measured, though measurement equipment is only partially installed. No hydraulic separation is achieved between the DMZ, as the boundary valves are left open at all times. b) DMA: The service area was divided into 90 DMAs by the French Fund, and WASA-F later added several more DMAs. No hydraulic separation of the DMAs is achieved, however, as the boundary valves are left open at all times. c) The water balance cannot be grasped, as the meters have not been completely installed
Service Connection	Service pipe	a) Service pipe is installed by licensed contractors, but no inspections take place after installation and no customer ledger has been created. b) ¼-inch ferrules are adopted to prevent the surplus use of water by flat-rate customers. The water pressure is low as a result. c) Pipe material: The pipe material is specified under the WASA-F Regulation, but some customers ignore the specification and use poor material.
	Meter installation	a) Meter specification: Revised in 2016 by the Punjab Government. b) French-made meters: As of 2015, 20,000 meters were purchased and 18,516 meters were installed as of 2017. Some meters were damaged by the installation of illegal suction pumps. c) British-made meters: 76 meters were installed in 2012 as a trial. Most of them have been broken because the British meters are of a vertical-type (rolling-piston type) unsuitable for intermittent water supply. *Although a tariff table for metering is being prepared, WASA-F has no meter-rate customers at present. d) *The meter locations and installations are not managed by WASA-F.
	Water supply time	a) The official water supply time totals 6 hours (2 hours x 3 times) *In fact, some customers close to water sources are always supplied water (e.g., Shahbaz Nagar), while other customers far from water sources never have water (e.g., Peoples Colony). b) *Some customers can get water for only 1 hour because the power supply is unstable and WASA-F cannot lift the water up into the OHRs. (e.g., G.M. Abad) c) *This intermittent water supply has forced customers to depend on groundwater, which is brackish and has a TDS of about 2,000 mg/L.
	Water pressure and quality at tap	a) Design criteria: The terminal water pressure should be more than 12 m. b) Water pressure: The water pressure is very low, which usually prevents water from reaching the rooftop water storage tanks of customers. (Especially low water pressure is observed in in the East area of Faisalabad. In Sarfraz Colony, for example, the water pressure is less than 2m.) c) Water quality: E. Coli was detected at some taps.
	Pipeline inside the house	a) Illegal suction pump: many customers are compelled by low pressure to connect pumps to the service pipes to suck out water from the distribution pipeline directly. This causes further declines in the water pressure in the distribution pipeline. b) Rooftop water storage tank: many customers install tanks on their roofs to compensate for the intermittent water supply. c) Groundwater-dependent pipelines inside houses: These pipelines are connected to the groundwater and not the WASA-F system. d) Illegal suction pumps: Customers connect pumps to the WASA-F line and store water in tanks.

Source: JICA Mission Team

Table A1.6.2 Actual Operational Conditions of the Sewerage and Drainage Facilities

Facility	Item	Actual Condition
Sewer Network	Actual condition of the sewer network system	a) Collection system: Separate sewer system Collection system is basically separate sewer system, but in some areas without drainage system stormwater is discharged to sanitary sewers. Consequently in wet weather overflow of sewer pipes occurs due to the lack of the capacity. b) Branch sewer Diameter: 225 - 450 mm. Length: 1,578.5 km. Material: Mainly concrete pipe. c) Trunk sewer Diameter: 500 – 2,250 mm. Length: 193.2 km. Material: Mainly concrete pipe. d) Actual condition Structure: The sewers have been installed since 1987. The oldest sewers have been in service for about 30 years. No information on the year of sewer installation is available from WASA's information systems such as the GIS system. Condition: Due to the flat topography of the city and the manual cleaning work required for sewer maintenance, there may be large amounts of sediments in the sewer pipeline system and stagnant wastewater. Some branch sewer pipes lack sufficient capacity, which causes an overflow of wastewater from the infiltration or cross connection of stormwater in the wet season. Some houses in the areas with sewers are not connected to the sewerage system.
	Sewer cleaning work	a) Sewer cleaning work done manually The O&M offices have many personnel for sewer cleaning. The cleaners clean the sewer pipe using buckets and long wire cables. The cleaners are unable to completely remove all of the sediments in the branch sewer pipes, so considerable amounts of sediment may remain. b) Sewer cleaning work by machinery Sewer jet cleaning machines or sewer suction machines are used when manual work cannot be performed, so the occupancy rate of those areas is not so high. Sewer jetting machines: 8. Sewer suction machines: 4.
	GIS	A GIS system for the sewer pipeline system has been established, but the inaccuracy and paucity of the data make it difficult to use the system for actual O&M works.
Pumping Stations	General	a) Lift (Intermediate or Relay) Pumping Stations: 15 These stations are constructed at the center of each sub-division or at locations where the sewers are installed at deeper positions, i.e., where the collected wastewater must be lifted up once and conveyed to the following sewers by gravity flow. b) Disposal Pumping Stations: 17 These stations are constructed at the locations where the trunk sewers end and discharge the wastewater to the Paharang Drain and Madhuana Drain of the Irrigation Department, or where the trunk sewers end and discharge the wastewater to drainage channels both in the east and western zones.
	Civil engineering structure	Pumping stations have been developed since 1987, so the oldest pumping stations have been used for 30 years. While the civil works are aged, they city still manages to use them.
	Electromechanical facilities	The main disposal pumping stations along the Paharang Drain in the western area and along the drainage channels in the eastern area are generally in good physical and operational conditions because some of them have been rehabilitated and newly constructed. The other disposal pumping stations and lift pumping stations, however, are aged and only operable with the replacement of equipment or spare parts.
	O&M	a) All equipment, including pumps and screens, are currently operated manually. b) The operators write out all of the records on the pump operation times, estimated discharge quantities, power consumption, etc. in daily handwritten operation reports. The records aren't preserved as electric data. c) All equipment is maintained by the breakdown maintenance approach.
Wastewater Treatment Plant	General	a) Number of treatment plant: 1 b) Treatment Process: Stabilization pond c) Design Capacity: 90,000 m^3/day (Average Daily Flow) d) Design Wastewater Quality: BOD_5 concentrations of 380 mg/L (Influent) and 26 mg/L (Effluent)

Facility	Item	Actual Condition
	O&M	a) Commissioned: since 1998 b) No electromechanical equipment is installed. c) Sludge ponds have never used for sludge treatment of the anaerobic ponds. d) Results of flow rate measurement: 99,400 m^3/d (Influent), 46,700 m^3/d (Effluent). The balanced wastewater (more than half of influent) is withdrawn at the inlet gate to facultative ponds for use as irrigation water. e) Results of wastewater quality survey BOD_5 concentration: 580 mg/L (Influent), 165 mg/L (Effluent). The results on effluent quality does not meet the effluent standard of 80 mg/L.
Drainage Facilities	Drainage Channel	a) Number of Drainage Channels: 7 b) Type of channel: Open channel c) Length: 3,000 m – 11,590 m, in total 53,290 m d) Bed width: 1,275 – 3,300 mm e) Actual condition: Raw wastewater is discharged into drainage channels, which contaminates them and brings in abundant sediments.
	Branch Drainage Channel	Actual condition: Too few branch drainage channels have been constructed, so stagnant stormwater has accumulated in many places.
	O&M of Drainage Channel	a) Desilting of the drainage channels: All of the drainage channels are desilted in dry season (from March to June). b) Desilting of the sewer pipelines: The branch and main sewers that collect stormwater in the wet season are desilted twice before the wet season begins. c) Equipment: Bucket cranes, Dump trucks
	Emergency Camp	Ten temporary emergency camps are set up in the wet season to cope with inundations. Fifty-eight de-watering sets are prepared and temporary work charge personnel are hired.

Source: JICA Mission Team

CHAPTER A2 DESCRIPTION OF THE STUDY AREA

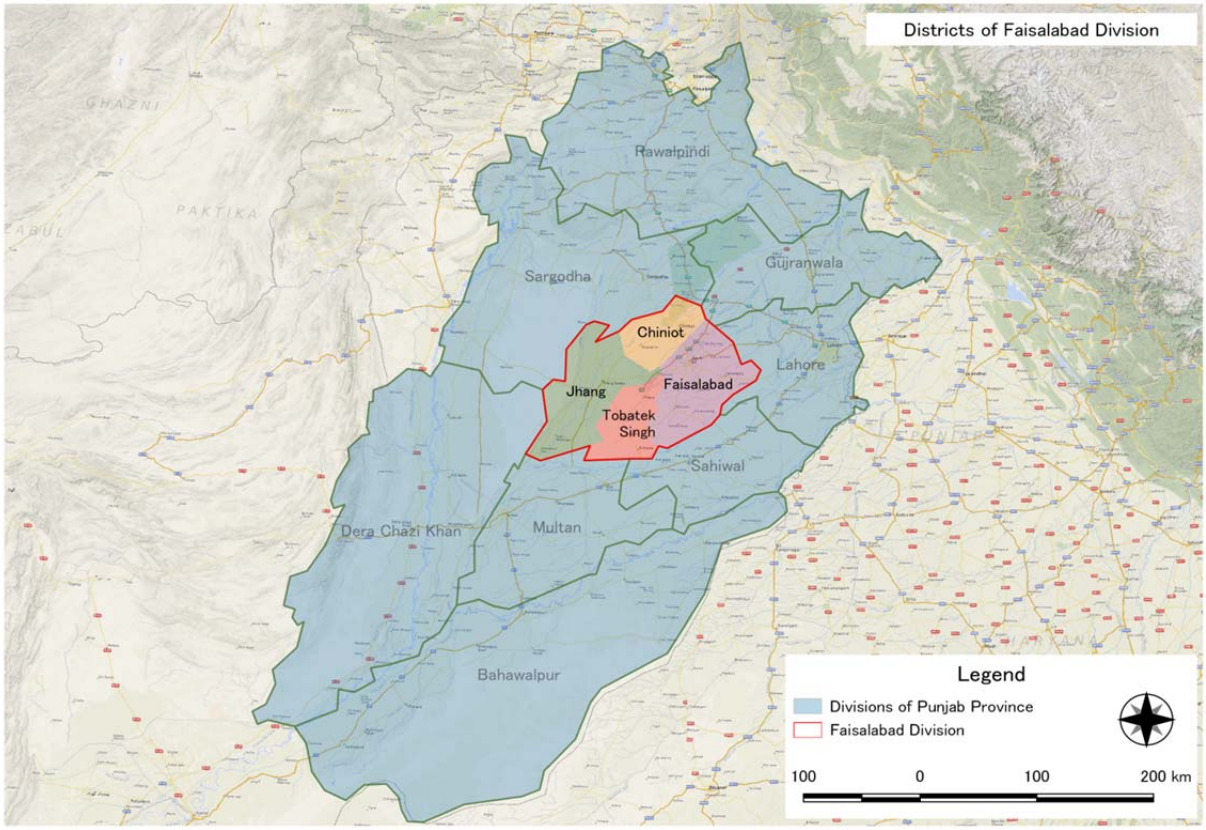
In the previous survey of the Project, "the Project for Updation of Water Supply Sewerage and Drainage Master Plan of Faisalabad City", carried out in November, 2015, the study area for this M/P was discussed among concerned parties including JICA, Planning and Development Department (P&D) in GOPb, Housing, Urban Development & Public Health Engineering Department (HUD & PHED) in GOPb, Economic Affairs Division (EAD) in GOPb, Faisalabad Development Authority (FDA), and WASA-F. Then, all concerned parties confirmed that the study area of the M/P would be the same as Peri-Urban Structure Plan boundary area6, as a result of comparison with FDA boundary, and as this is regarded as the current basis of the urban development in Faisalabad.

This Chapter investigates and analyzes the present situation such as: urban development and land use plan, natural and socioeconomic conditions, public awareness survey results, in the study area.

A2.1 Administrative System of Faisalabad

Faisalabad Division is an administrative unit comprising the following four districts:

- Faisalabad District,
- Chiniot District,
- Jhang District,
- Tobatek Singh District



Source: JICA Mission Team

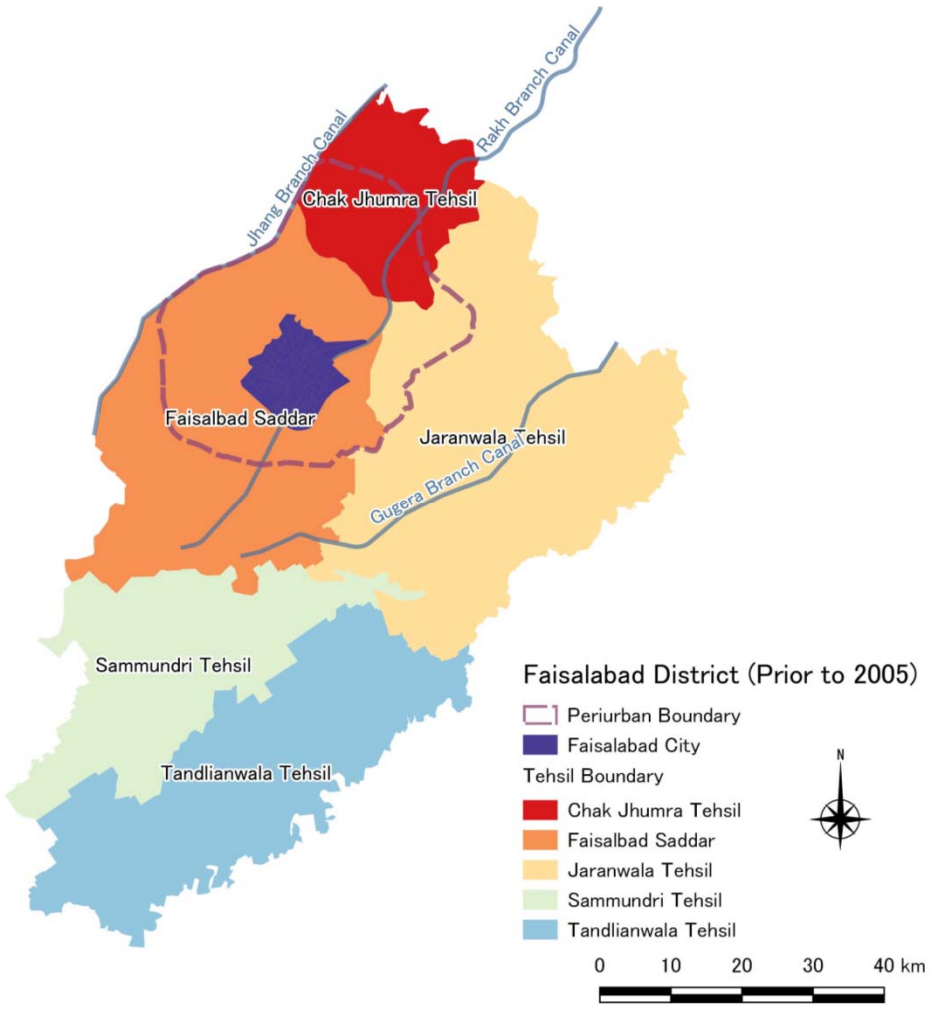
Figure A2.1.1 Map of Punjab Province and Faisalabad Division

6 The study area of the M/P has been specified in the Minutes of Meetings (M/M) on the previous survey dated on 18th November 2015, and also in Record of Discussions (R/D) signed on 3rd March 2016.

Under a Punjab local government ordinance in 2001, Faisalabad District is divided into the following six tehsils, all of which are subdivisions of Faisalabad District (a tehsil is an administrative sub-division of a District):

- Faisalabad City,
- Faisalabad Saddar,
- Chak Jhumra,
- Jaranwala,
- Sammundri
- Tandlianwala

Each district was formerly governed by a District Nazim (the chief elected official of the District) and each tehsil was governed by its own Tehsil Nazim. Faisalabad District has a total area of 5,856 km^2. Between the years of 2001 and 2004, Faisalabad City occupied 168 km^2 of that area.

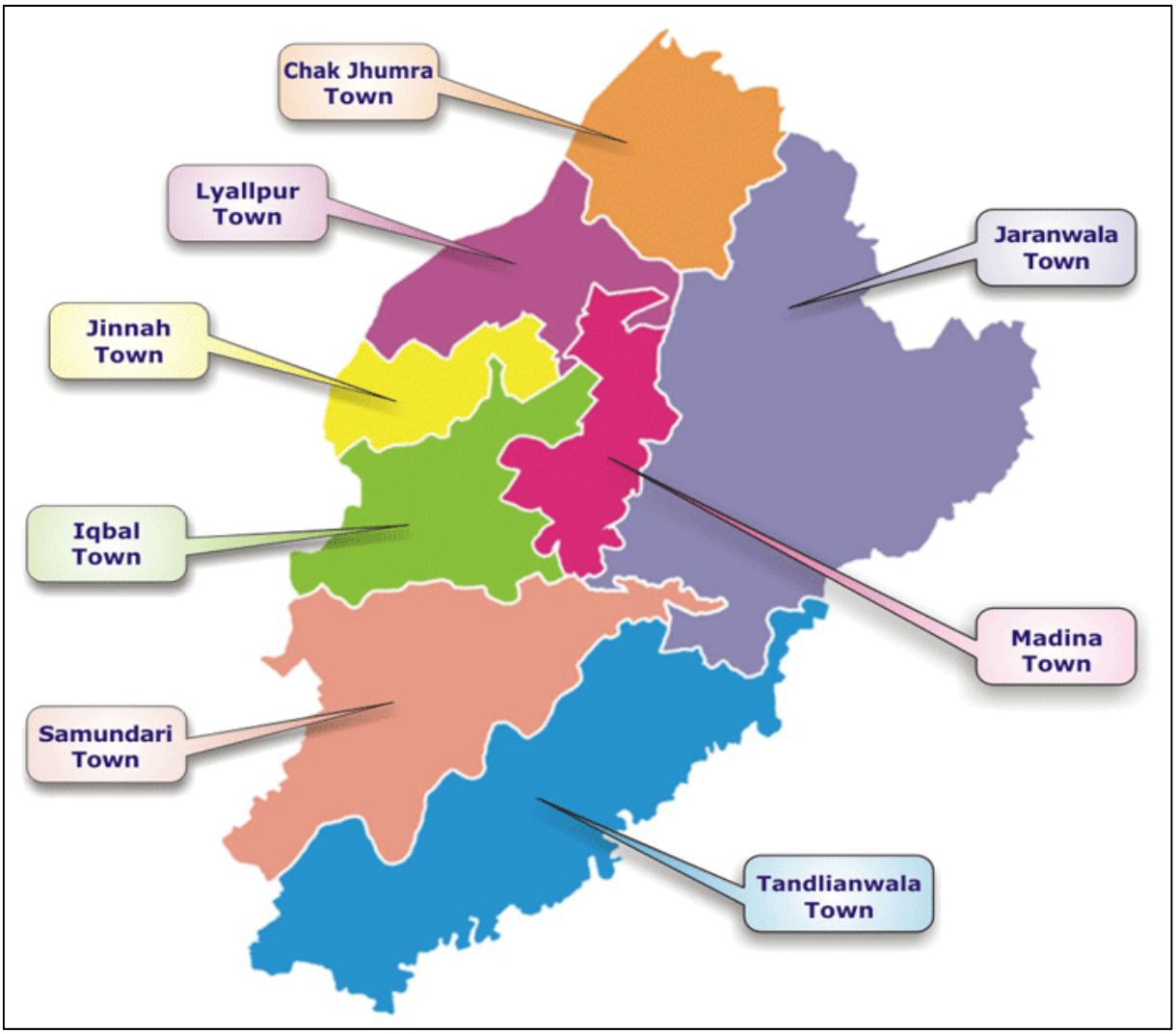


Source: JICA Mission Team

Figure A2.1.2 Map of Faisalabad District Before 2005

In 2005, all districts of Punjab, including Faisalabad District, were given the status of City Districts. Faisalabad City District was formed as a result. Each of the above tehsils of Faisalabad was re-designated as a Town fall under the jurisdiction of the City District.

Faisalabad City and Saddar Tehsil have been replaced by four towns. Now the district comprises 8 towns, namely: Lyallpur Town, Jinnah Town, Iqbal Town, Madina Town, Jaranwala Town, Chak Jhumra Town, Sammundri Town, and Tandlianwala Town.



Source: Government of Punjab, Faisalabad

Figure A2.1.3 Map of Eight Towns in Faisalabad District after 2005

According to the Punjab Development Statistics 2015, each town consists of Union Councils (UCs). The Union Councils of the urban and rural areas are summarized in the following table.

Table A2.1.1 Towns and UCs in Faisalabad District

No.	Name of Town	No. of Union Councils		
		Urban	Rural	Total
1	Iqbal Town	28	15	43
2	Jinnah Town	28	11	39
3	Lyallpur Town	21	17	38
4	Madina Town	31	10	41
5	Chak Jhumra Town	2	13	15
6	Jaranwala Town	7	50	57
7	Sammundri Town	3	25	28
8	Tandlianwala Town	3	25	28
Grand Total		123	166	289

Source: Punjab Development Statistics 2015, Bureau of Statistics, GOPb

Note that Faisalabad City was once located in Faisalabad District, in 2001 - 2004. Currently, however, actual administrative boundaries for Faisalabad City have no longer existed since 2005, and only the phrase of "Faisalabad City" is familiar with local. Faisalabad City was separated into parts of the four towns of Iqbal, Jinnah, Lyallpur, and Madina, as shown in **Table A2.1.2**.

Table A2.1.2 Administrative Relationship of Districts, Tehsils, Towns, Cities, and WASA-F Service Areas

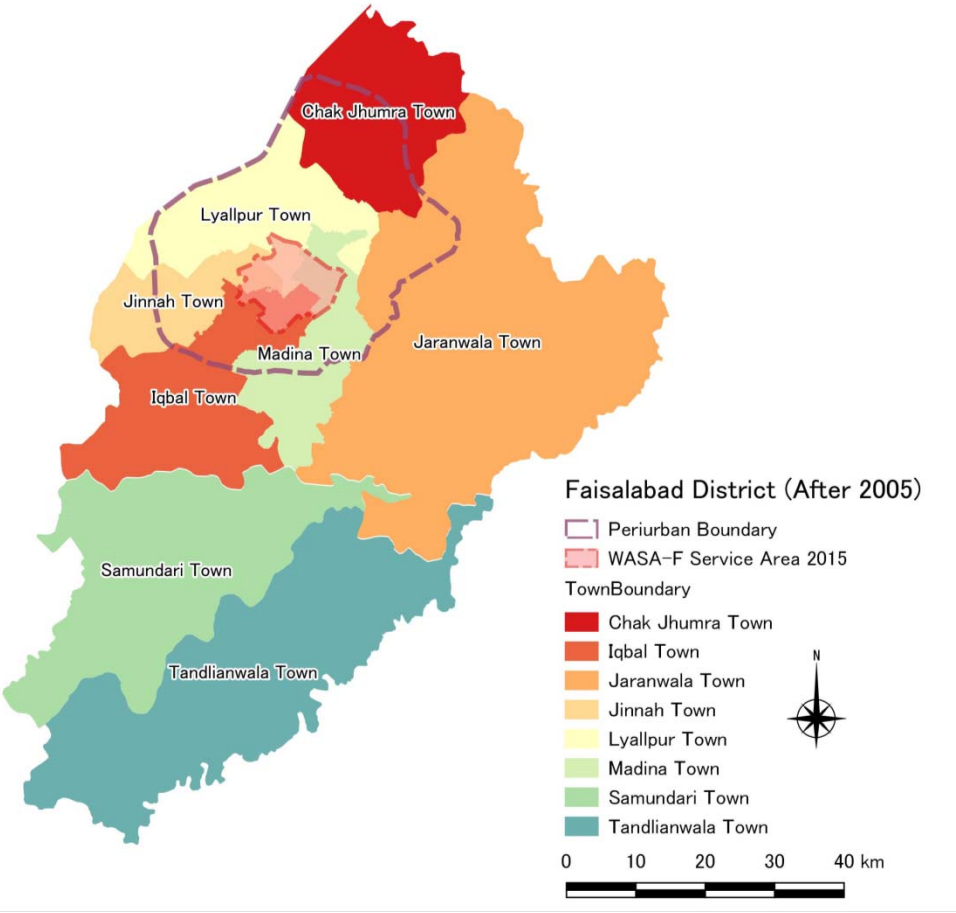
District	Tehsil (2001-2004)	Town (Since 2005)	Faisalabad City	WASA-F Service Area 2015	Peri-urban Boundary 2035	WASA-F Service Area 2038
Faisalabad	Faisalabad City, Faisalabad Saddar	Jinnah	One part of Jinnah	One part of Jinnah	One part of Jinnah	One part of Jinnah
		Lyallpur	One part of Lyallpur	One part of Lyallpur	One part of Lyallpur	One part of Lyallpur
		Madina	One part of Madina	One part of Madina	One part of Madina	One part of Madina
		Iqbal	One part of Iqbal	One part of Iqbal	One part of Iqbal	One part of Iqbal
	Chak Jhumra	Chak Jhumra	—	—	One part of Chak-Jhumra	Satellite town of Chak-Jhumra
	Jaranwala	Jaranwala	—	—	One part of Jaranwala	Satellite town of Jaranwala
	Sammundri	Sammundri	—	—	—	—
	Tandlianwala	Tandlianwala	—	—	—	—

Source: JICA Mission Team

After re-designation into eight towns in Faisalabad District, the following four towns were called the Faisalabad Municipal Corporation (Faisalabad MC).

- Lyallpur Town
- Madina Town
- Jinnah Town
- Iqbal Town

The service area of WASA-F also comprises the area of Faisalabad City, although the actual administrative boundary no longer exists. When this report mentions Faisalabad City, therefore, the implied location is the WASA-F service area. The Study Area, or area encompassed by the Peri-urban boundary, makes up part of the six towns shown in **Figure A2.1.4**.



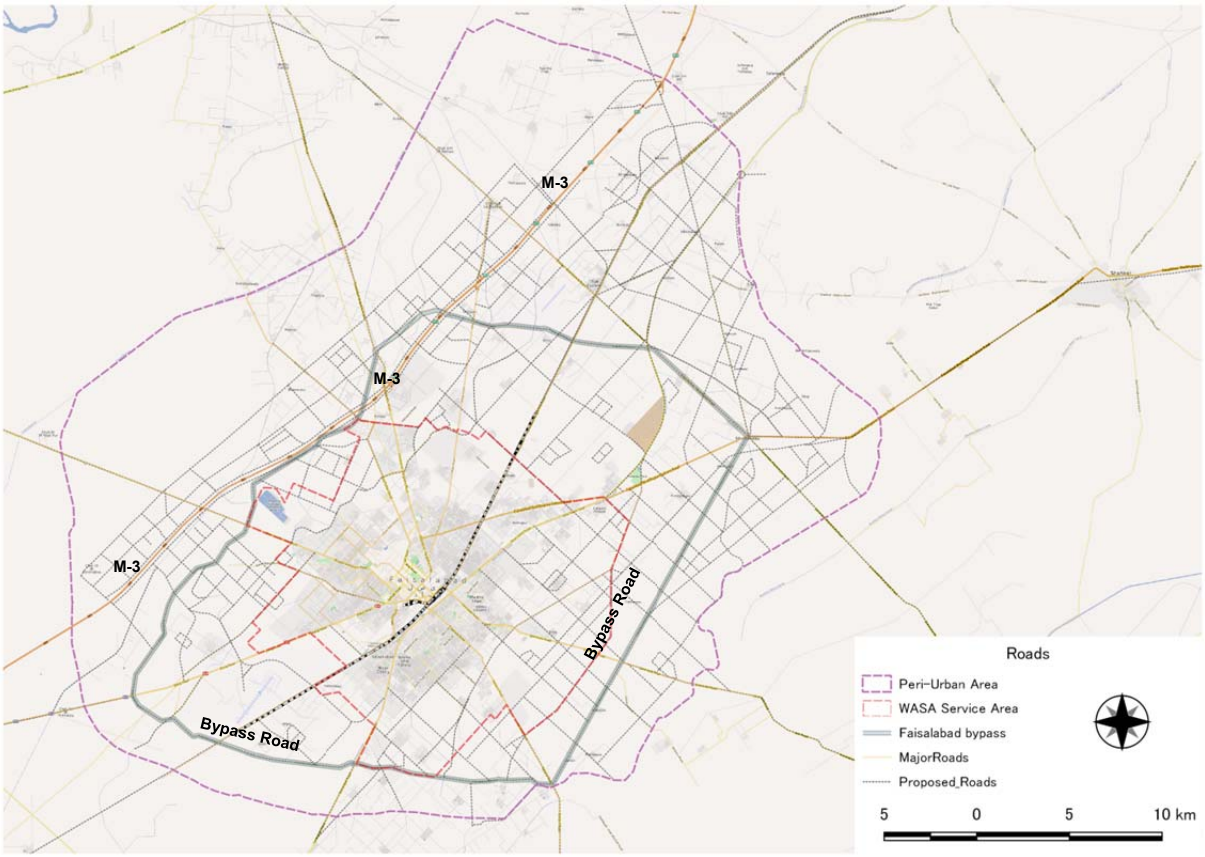
Source: JICA Mission Team

Figure A2.1.4 Locations of the Towns, WASA-F Service Area, and Peri-Urban Boundary

Peri-Urban Area

Under Rule 11 of the Punjab Land Use Rules (Classification, Reclassification, and Redevelopment) issued in 2009, the Peri-Urban area is defined as area that spans landscapes between contiguous urban developments, consists of rural countryside, has low population densities, is predominantly used for agriculture activity, and is likely to be urbanized in next twenty years.

According to the Faisalabad Peri-Urban Structure Plan (FPUSP) 2015-35, the Peri-Urban area of Faisalabad City largely consists of areas of rural, low-intensity development. Development, however – especially low-density residential development– has continued to creep northward, southward, and eastward over the last decade. The Faisalabad By-pass road has been the chief identifiable cause behind the outward residential development. The Motorway M-3 section also acted as a larger investment area accommodating tremendous levels of new housing and industrial development by both the public and private sectors.



Source: JICA Mission Team

Figure A2.1.5 Proposed Road Map in the Study Area

Faisalabad Development Authority (FDA), a body established in 1982, is responsible for regulating, supervising, and implementing development activities in this large area covering almost 1,300 km^2 of the region. WASA-F is currently working under the administrative control of FDA and bears responsibility for providing water supply, sewerage, and drainage, along with other services,

WASA-F currently provides services to a limited city area under FDA and accordingly plans to expand its services. In a previous JICA survey, the Detailed Planning Survey on the Project for the Updating of the Water Supply Sewerage and Drainage Master Plan of Faisalabad City, the survey area discussed for this M/P was either the FDA boundary or Peri-Urban boundary. As the current basis of the urban development in Faisalabad City, the area enclosed by the Peri-Urban boundary was selected as the survey area for this study.

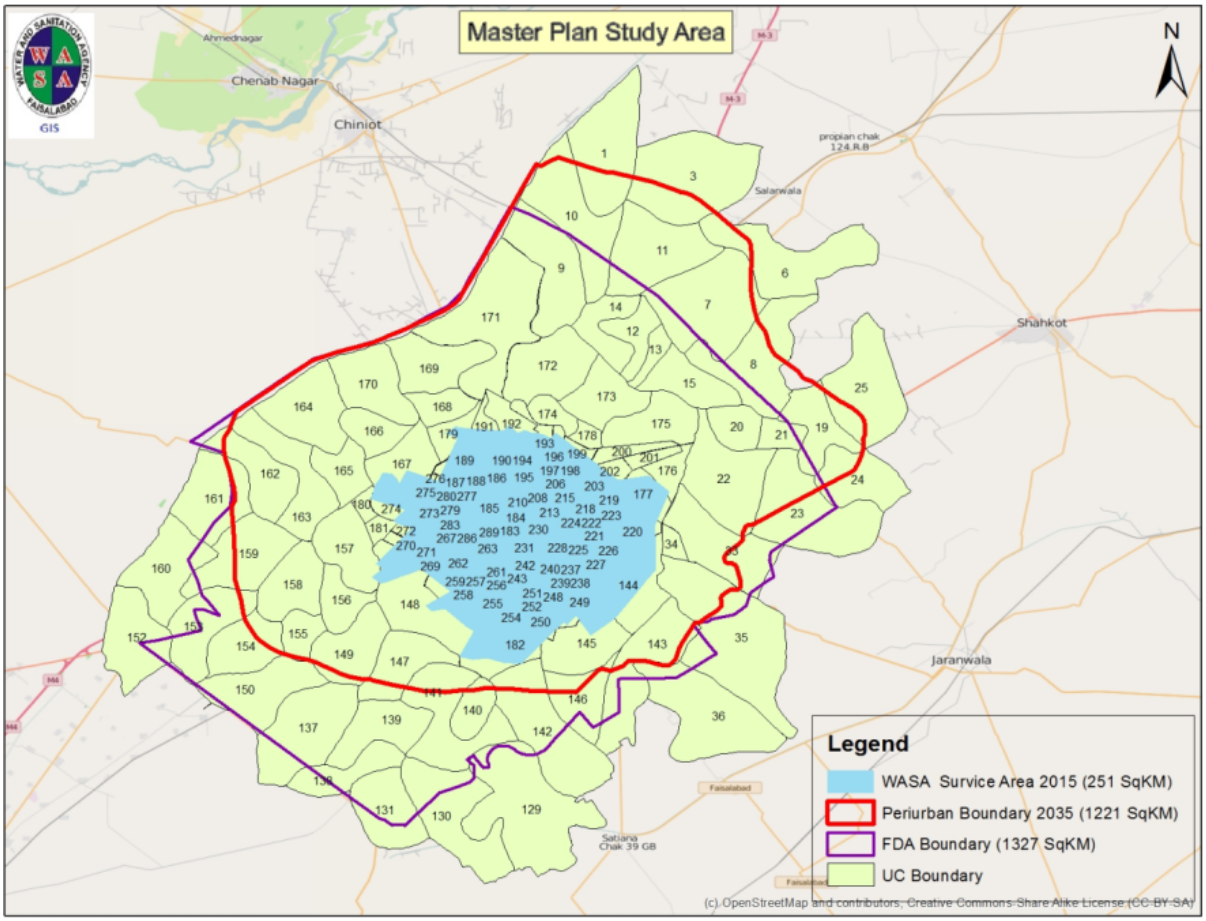


Figure A2.1.6 Boundaries of the WASA Service Area, FDA, and Peri-Urban Area

A2.2 Natural Conditions

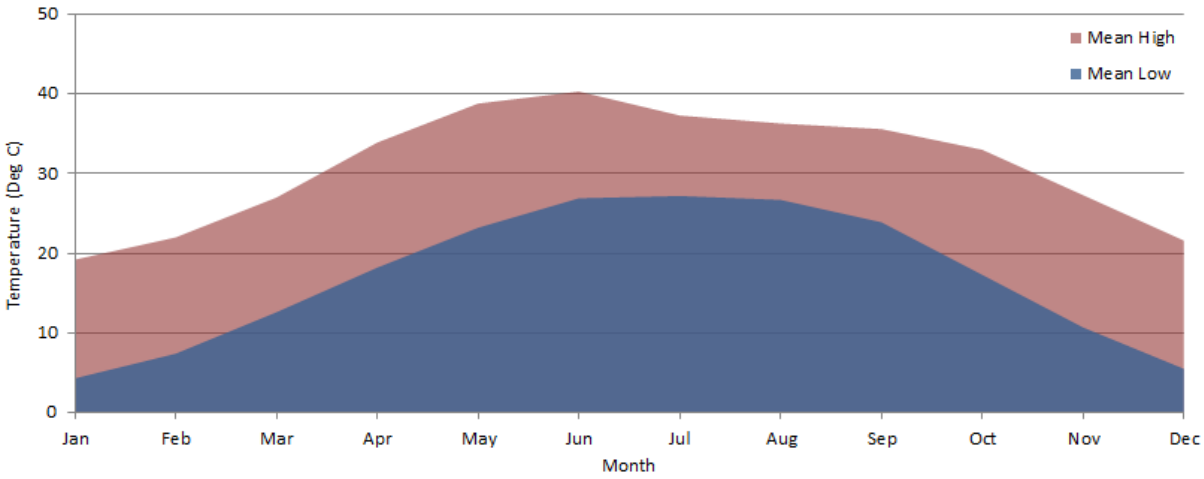
2.2.1 Meteorology

(1) General Climate

Faisalabad City is located in the north eastern part of Punjab Province. It is generally classified as a hot desert climate (Koppen-Geiger climate classification: BWh), with an average annual rainfall of 375 mm and temperatures ranging from 17 degrees C to 32 degrees C. Temperatures drop in the city in the cold season from mid-December through mid-February of every year. The rainy season comes in July and August, bringing most of the annual rainfall. The dry, arid climate promotes the production of dust, which reduces visibility in some seasons.

(2) Temperature

June is the warmest month of the year in Faisalabad City, with mean high and low temperatures of 40 deg C and 27 deg C, respectively. The temperature may climb to an extreme high of 48 deg C (e.g., July 1, 2005). The lowest temperatures come in December, with mean high and low temperatures of 22 deg C and 6 deg C, respectively. The average monthly temperatures are summarized in **Figure A2.2.1**.

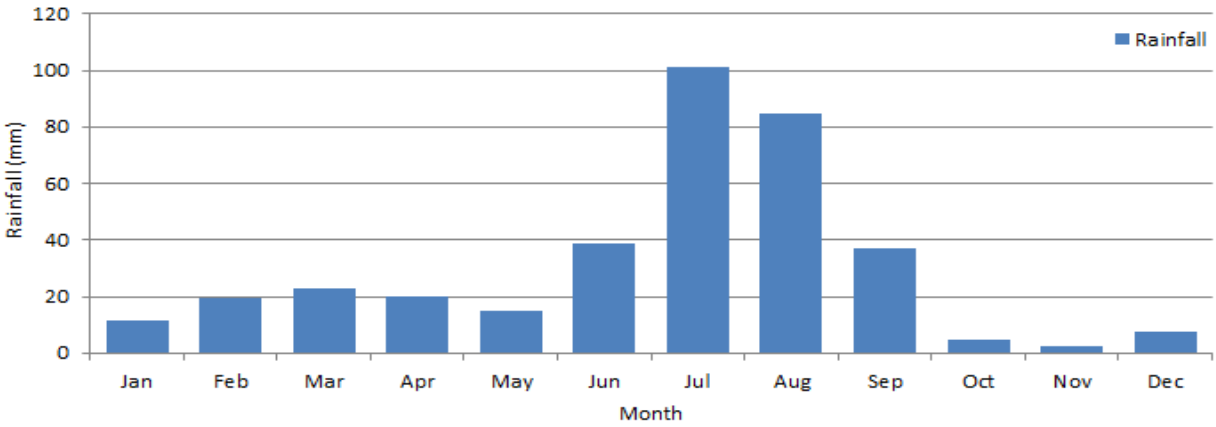


Source: JICA Mission Team, based on data acquired from Pakistan Meteorological Department, PMD

Figure A2.2.1 Average Monthly Maximum and Minimum Temperatures (1961-2009)

(3) Precipitation

Rain is sparse in Faisalabad City, with most coming in July and August. The average monthly precipitation is plotted out in **Figure A2.2.2**.



Source: JICA Mission Team, based on data acquired from PMD

Figure A2.2.2 Average Monthly Precipitation (1961-2009)

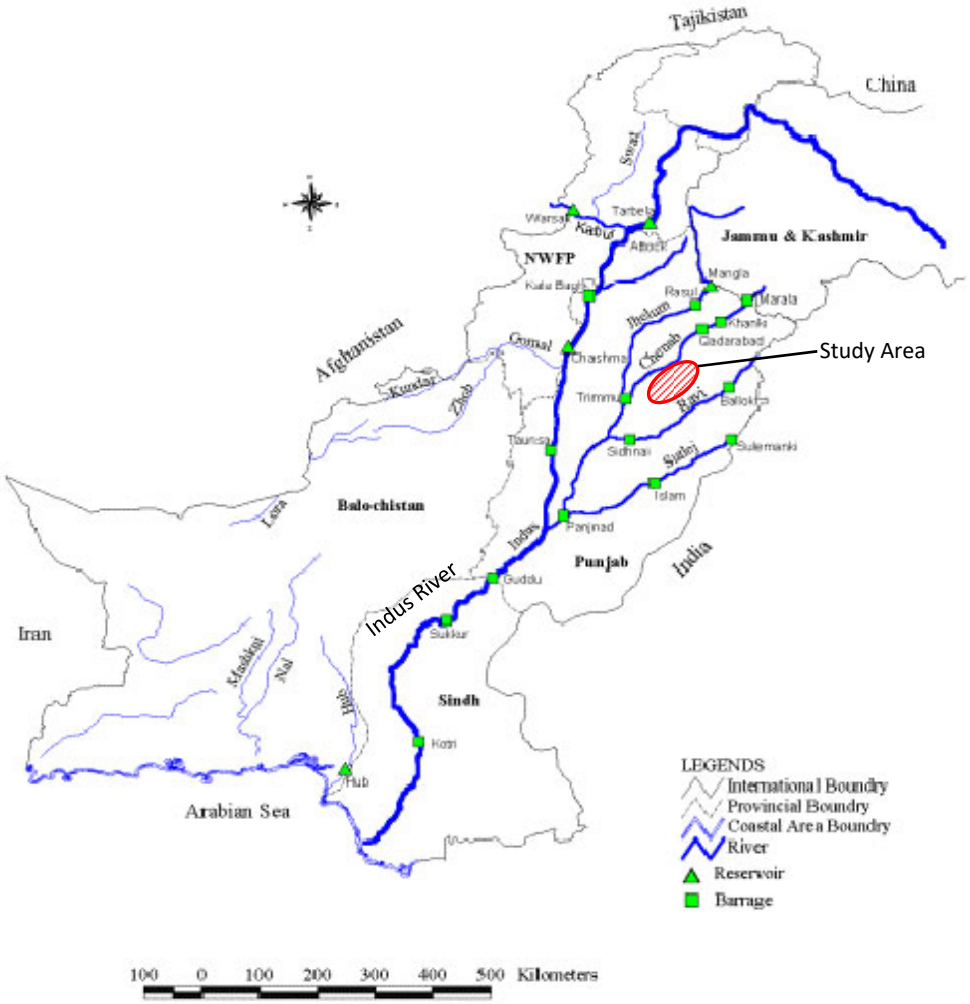
2.2.2 Topography

The city is located between the Chenab and Ravi Rivers in the area known as the lower Rachna Doab. The area is slightly higher than the surroundings and mildly sloped from the northeast to southwest. The topography is generally flat, with few hills, but valleys and local depressions may be found.

2.2.3 Hydrology

1) Overall Network of Rivers and Irrigation Canals in Punjab Province

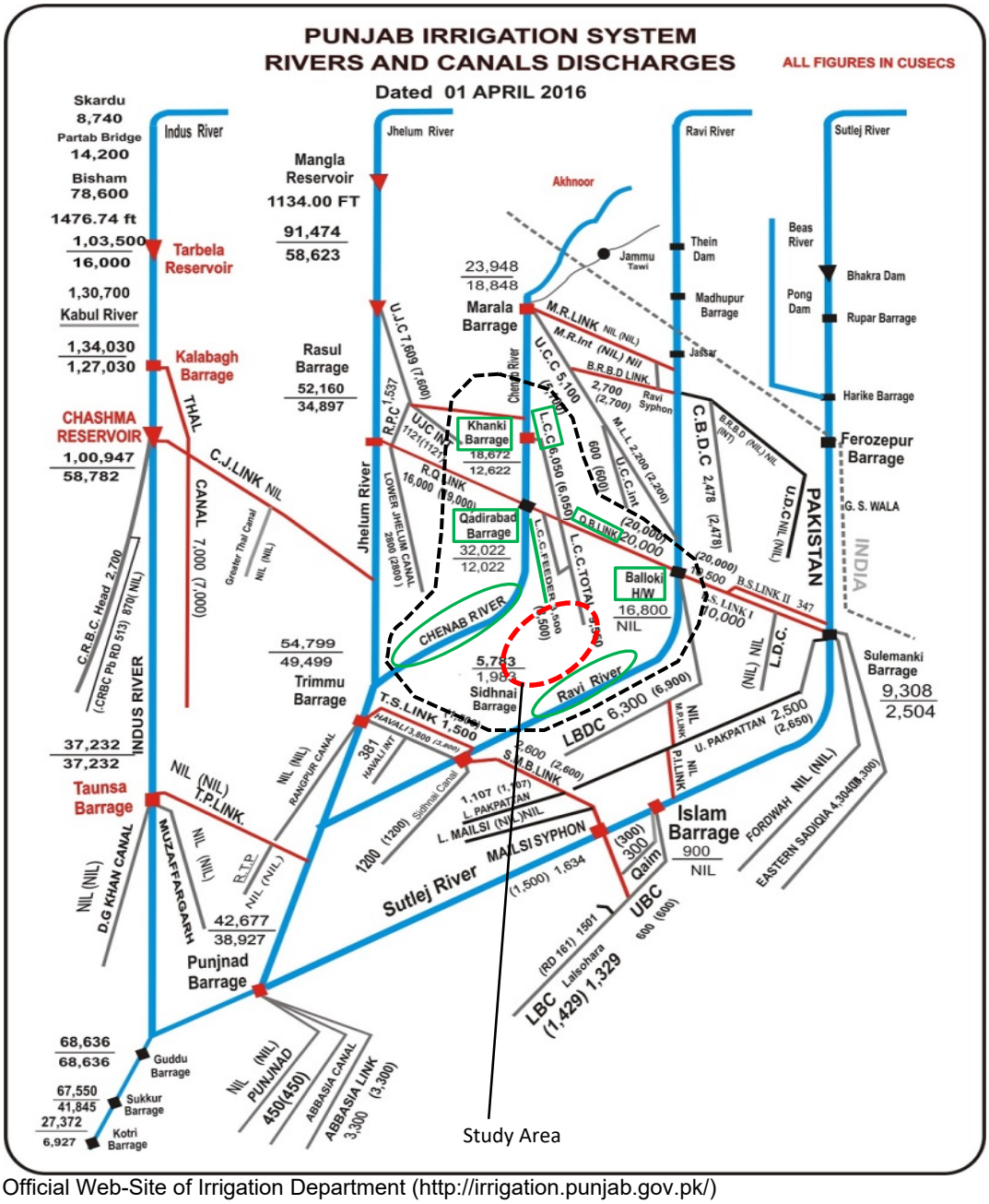
Most of Punjab province is located inside the Indus River Basin. The Study Area is located in the area between the Chenab River and Ravi River, two major tributaries of the Indus River, as shown in **Figure A2.2.3**.



Source: http://www.democraticunderground.com/

Figure A2.2.3 Indus River Network and Study Area

The rivers in Punjab Province create a large-scale irrigation network with large-scale reservoirs, barrages, water works, inter-river canals, and irrigation canals. **Figure A2.2.4** depicts the irrigation network in Punjab Province. **Figure A2.2.4** denotes the actual inflow or allocated discharge on the reference date (01 April 2016). The red circle in the figure indicates the location of the Study Area. The black dotted line encloses the major relevant facilities, rivers, and canals composing the irrigation system around the Study Area. The irrigation system in the Study Area is dependent on water supply from the following sources: 1) Lower Chenab Canal (LCC) (L.C.C. in the figure), the upstream end of which connects to the Khanki Headworks (Khanki Barrage in the figure) constructed on the Chenab River; 2) the LCC Feeder canal (L.C.C. Feeder in the figure) separated from the Q.B. Link canal that starts from Qadirabad Barrage in the Chenab River and connects to Balloki Headworks in the Ravi River.

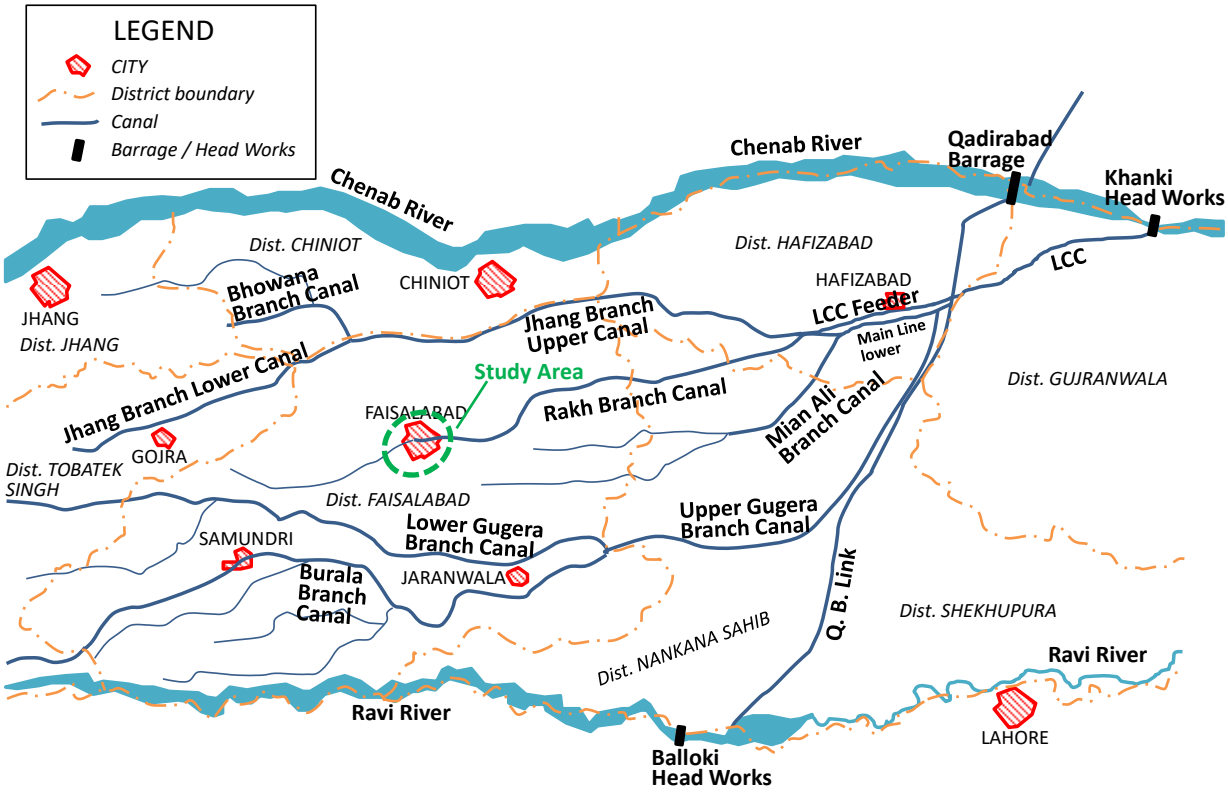


Source: Official Web-Site of Irrigation Department (http://irrigation.punjab.gov.pk/)

Figure A2.2.4 Punjab Irrigation System and Study Area

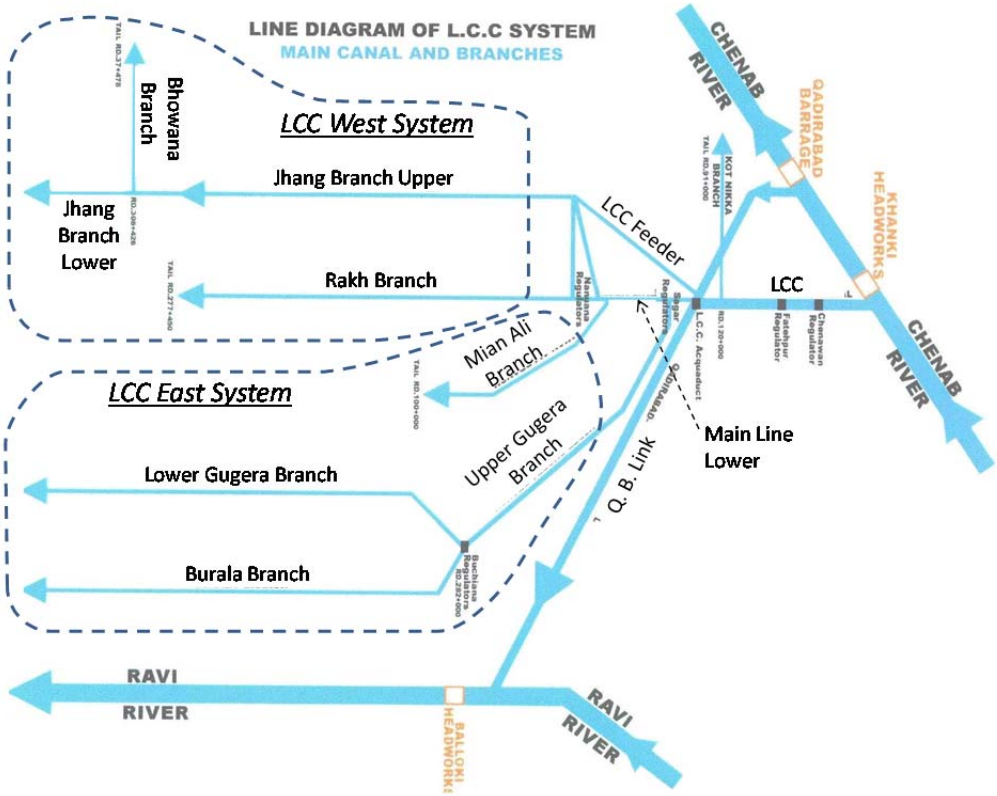
(2) Detailed Network of Rivers and Irrigation Canals around Faisalabad District

Figure A2.2.5 shows the detailed network of rivers and irrigation canals around Faisalabad District. The Chenab River water is withdrawn at Khanki Headworks and flows through the LCC, the main canal of this area. The water is then supplied to the two branch canal systems of the LCC East System and LCC West System, receiving additional water from Qadirabad Barrage through the LCC Feeder. The LCC East system consists of four branch canals flowing in the eastern and southern parts of the area, namely, the Upper Gugera Branch Canal, Lower Gugera Branch Canal, Burala Branch Canal, and Mian and Ali Branch Canal. The LCC West System consists of four branch canals supplying water in the north and west parts, namely, the Rakh Branch Canal, Jhang Branch Upper Canal, Jhang Branch Lower Canal, and Bhowana Branch Canal. Each branch canal is connected to several distys (distributaries) that feed water into minors (minor canals).



Source: JICA Mission Team, based on information from the official website of the Irrigation Department (http://irrigation.punjab.gov.pk/fsdzone.aspx)

Figure A2.2.5 Network of Rivers and Canals around Faisalabad District



Source: Official website of the Irrigation Department (http://irrigation.punjab.gov.pk/lcclinediagram.jpg)

Figure A2.2.6 Network of Rivers and Canals around Faisalabad District

Table A2.2.1 shows surface water quality at Khanki Headworks where the river water diverts to an irrigation canal from Chenab River.

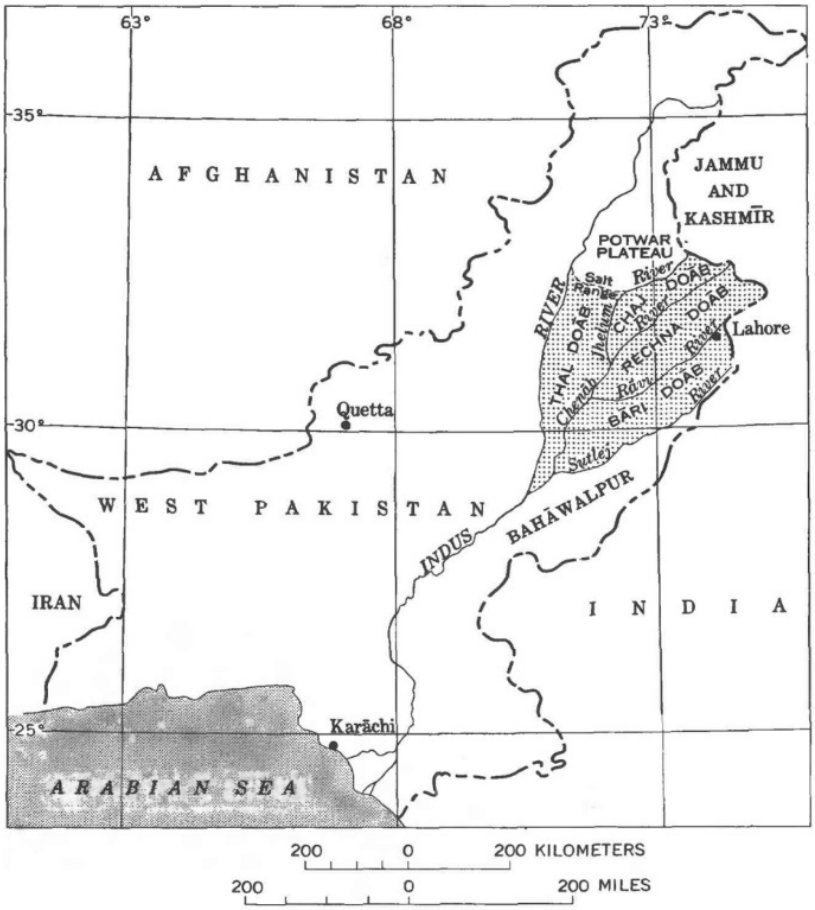
Table A2.2.1 Surface Water Quality of Chenab River at Khanki Head Works

No.	Parameter	Unit	Standard Values for Pakistan	WHO Guideline (2011)	Chenab River At Khanki Head Works
				Sampling Date	2011/07/08
1	Temperature	˚C	-	-	30
2	Turbidity	NTU	5	5	-
3	Colour	TCU	15	15	-
4	pH		6.5-8.5	(6.5-8.5)[1)]	7.4
5	EC	µs/cm	-	-	-
6	Hardness	mg/L	500	-	-
7	Total alkalinity	mg/L	-	-	-
8	Chloride (Cl^-)	mg/L	250	(250)[2)]	8.4
9	Total dissolved solids (TDS)	mg/L	1,000	(1,000)[3)]	110
10	TSS	mg/L	200	-	567
11	DO	mg/L	-	-	-
12	Nitrite-N (NO2-)	mg/L	NO_2^--N:0.9 NO_2^-:3	NO_2^--N:0.9 NO_2^-:3	-
13	Nitrate-N (NO3-)	mg/L	NO_3^--N:19 NO_3^-:50	NO_3^--N:11 NO_3^-:50	-
14	Ammonia	mg/L	-	-	0.55
15	CODCr	mg/L	150	-	40
16	BOD5	mg/L	80	-	18.0
17	Grease & Oil	mg/L	10	-	0.0
18	Phenolic Compound	mg/L	0.1	-	BDL[7)]
19	Sulphide (S)	mg/L	1.0	0.05	0.091
20	Sulphate (SO_4^{2-})	mg/L	-	(500)[4)]	18.0
21	Fluoride (F^-)	mg/L	1.5	1.5	0.08
22	Manganese (Mn)	mg/L	0.5	(0.4)[5)]	0.154
23	Iron (Fe)	mg/L	0.3	-	-
24	Calcium (Ca)	mg/L	-	-	-
25	Sodium (Na)	mg/L	-	(200)[2)]	-
26	Magnesium (Mg)	mg/L	-	-	-
27	Aluminum (Al)	mg/L	0.2	0.2	-
28	Antimony (Sb)	mg/L	0.005	0.02	-
29	Barium (Ba)	mg/L	0.7	0.7	BDL
30	Cadmium (Cd)	mg/L	0.01	0.003	BDL
31	Chromium (Cr)	mg/L	0.05	0.05	0.01
32	Copper (Cu)	mg/L	2	2	0.04
33	Lead (Pb)	mg/L	0.05	0.01	BDL
34	Mercury (Hg)	mg/L	0.001	0.006	-
35	Nickel (Ni)	mg/L	0.02	0.07	0.02
36	Selenium (Se)	µg/L	10	10	BDL
37	Zinc (Zn)	mg/L	5	(3)[6)]	0.07
38	Cyanide (CN-)	mg/L	0.05	(0.07)[5)]	0.005
39	Total Arsenic (As)	mg/L	0.05	0.01	0.01
40	Standard plate count bacteria	MPN/100mL	-	-	-
41	E. coli	MPN/100mL	0	0	-

1) Value for corrosion control in pipeline.
2) Value for taste.
3) Guideline value in year 1984.
4) Recommended value from point view of gastrointestinal effects.
5) Guideline value in year 2004.
6) Recommended value from point view of consumers' acceptability.
7) BDL: Below Detection Limit.
Source: Initial Environmental Examination, MFF-Punjab Irrigated Agriculture Sector Development T2 (New Khanki Barrage Project), August 2011.

2.2.4 Hydrogeology

More than 80% of the total area of Punjab Province is an alluvial plain (Indus plain). The Indus River and its four tributaries (Jhelum, Chenab, Ravi, and Sutlej tributaries) flow through the plain. Smaller plains between two rivers are known as Doabs, and the Faisalabad City area is located on the so-called Rechna Doab, as shown in **Figure A2.2.7**.

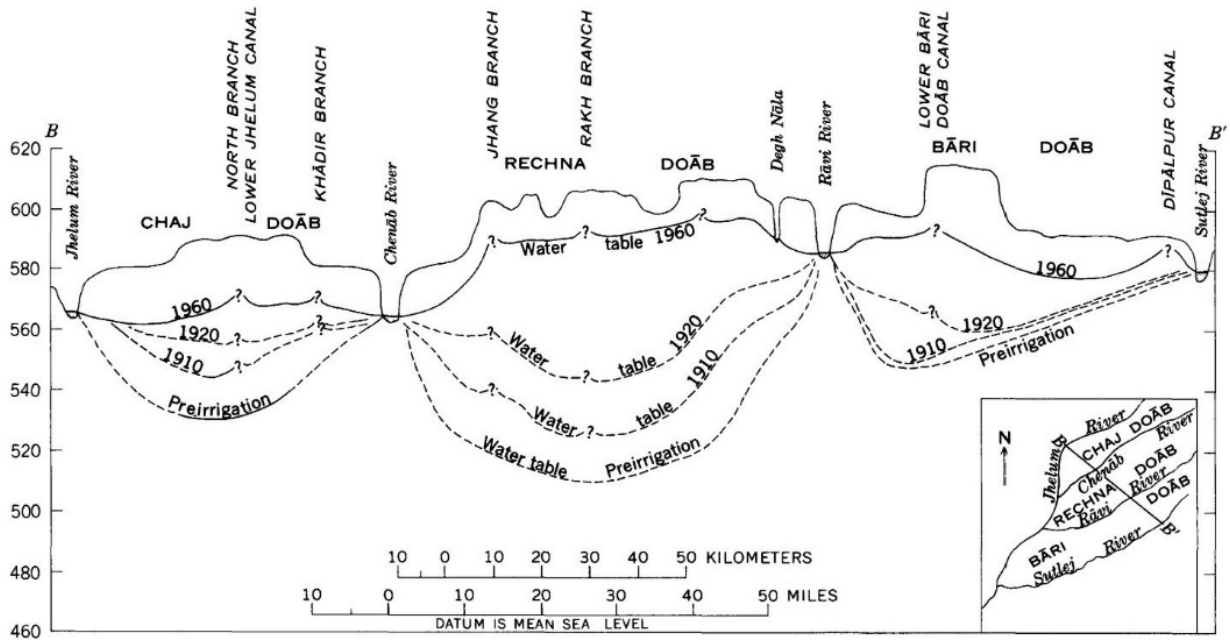


Source: Groundwater Hydrology of the Punjab, West Pakistan with Emphasis on Problems Caused by Canal Irrigation (1968)

Figure A2.2.7 Locations of the Respective Doabs in Indus Plain, Punjab Province

The sediments in the alluvial plain of Rechna Doab are mainly sand intercalated with silt and clay, with a thickness of 200 meters or more. Basement rocks make up only a small part of the earth within this depth. The permeability of the sand layer is relatively good, forming the main aquifer. The silt and/or clay layers have poor continuity and usually low permeability, so the groundwater in the area is considered to be unconfined.

This area was once a vast desert. The groundwater level in the central part of Doab was originally considerably lower than the river, but the groundwater levels have gradually risen due to seepage from the Branch Canals since the Lower Chenab Canal (LCC) was constructed, as shown in **Figure A2.2.8**.

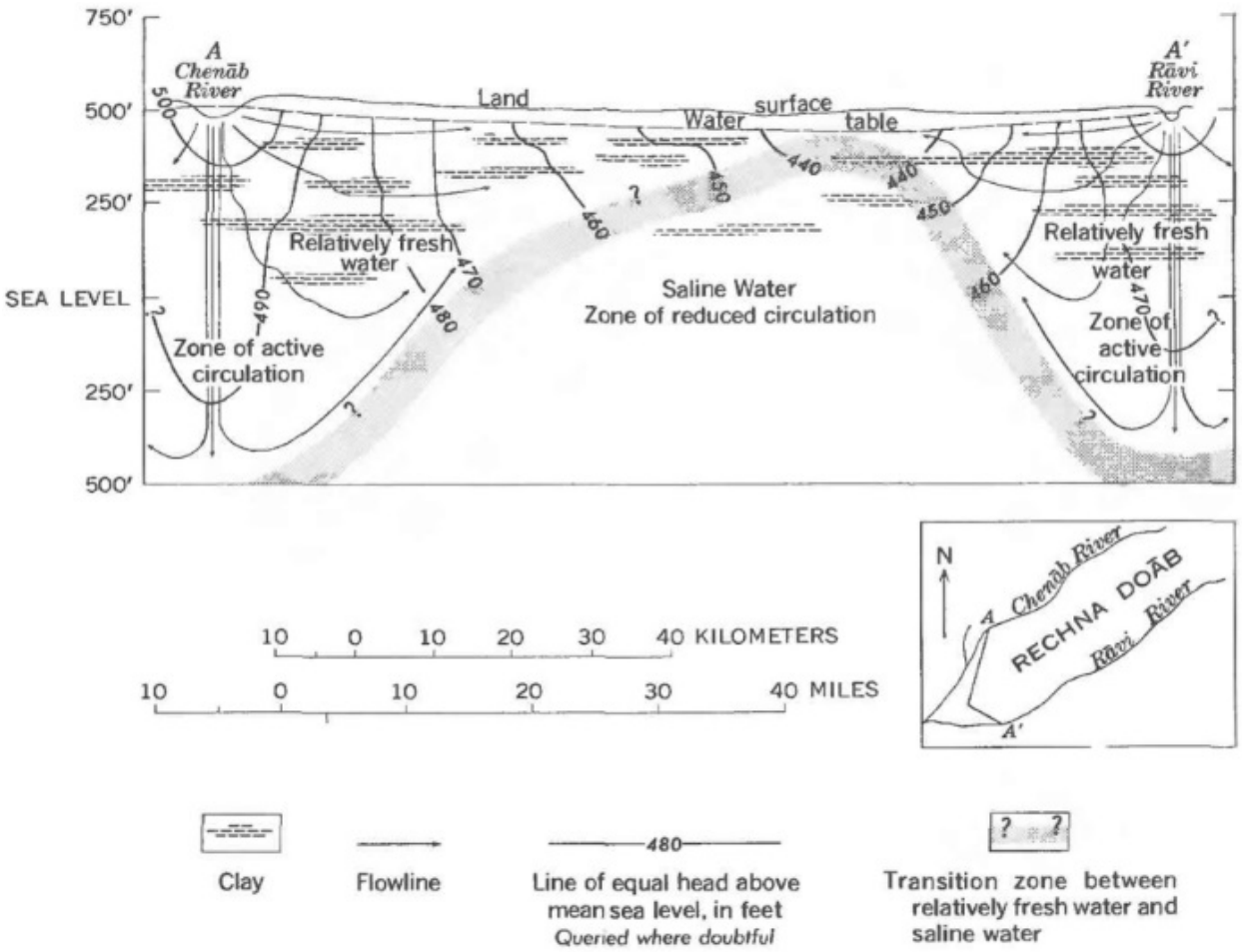


Source: Groundwater Hydrology of the Punjab, West Pakistan with Emphasis on Problems Caused by Canal Irrigation (1968)

Figure A2.2.8 Status of the Rising Groundwater Level in Each Doab

According to the long-term monitoring record of the observation wells in the area by the Punjab Irrigation Department, the groundwater level was 27 meters deep or deeper before the construction of the LCC and has risen 0.43 meters every year since the construction of the LCC.

Total Dissolved Solids (TDS), an indicator of salinity in groundwater, is relatively low in the vicinity of the river, at around 500 mg/L, a level suitable for water supply. The TDS values in the central part of the Doab, however, are higher, at around 2,000 to 5,000 mg/L. **Figure A2.2.9** shows a general cross-sectional view of the salty groundwater distribution.



Source: Groundwater Hydrology of the Punjab, West Pakistan With Emphasis on Problems Caused by Canal Irrigation (1968)

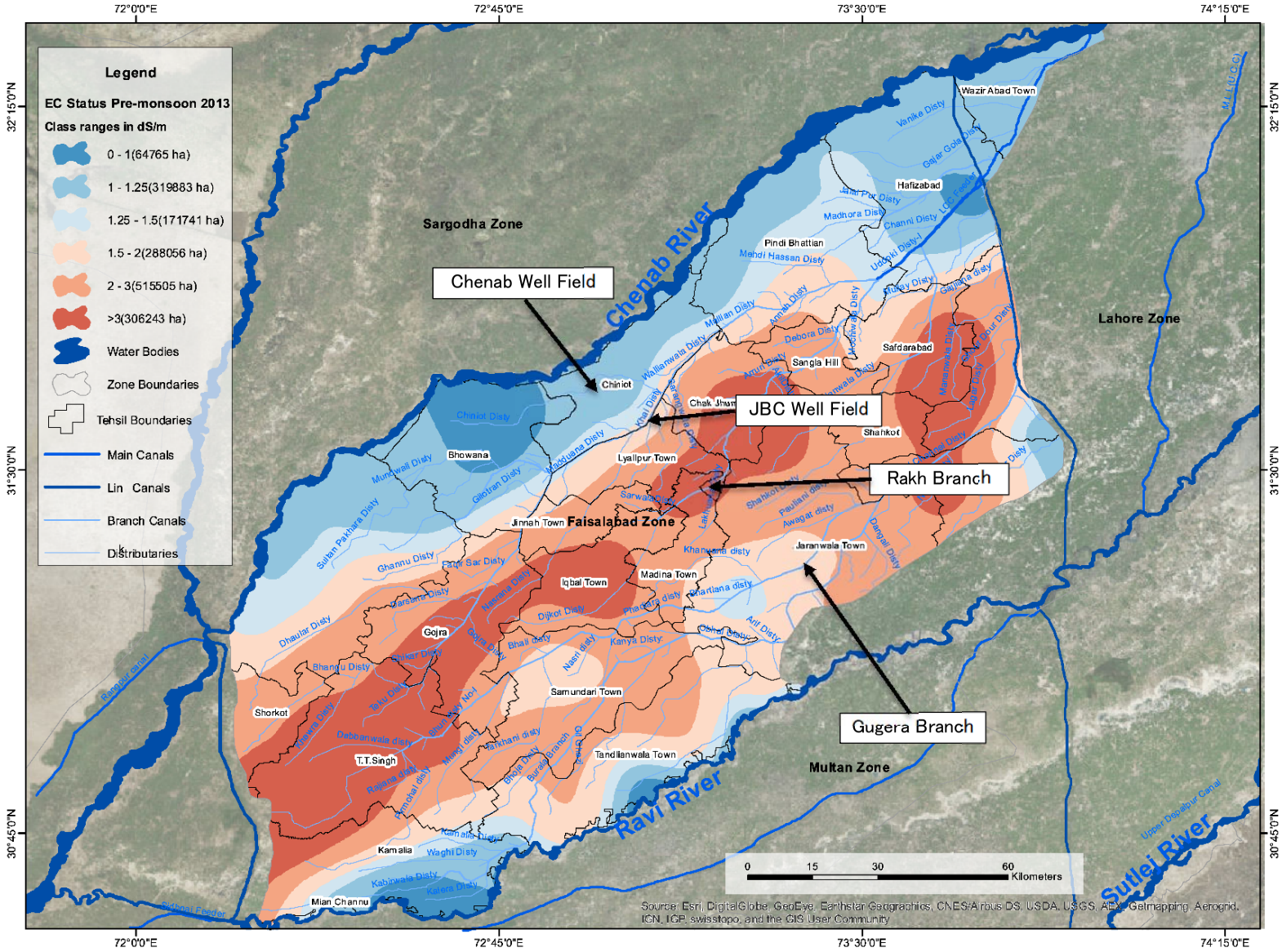
Figure A2.2.9 Direction of Seepage from the Rivers and an Outline of the Cross-sectional Distribution of Saline Groundwater in Rachna Doab, Faisalabad Zone

Observation wells operated by the Punjab Irrigation Department also measure the electrical conductivity (EC) of the groundwater in the area. A distribution plan view map of the EC in groundwater was drawn up from the 2016 data (see **Figure A2.2.10**).

TDS and EC are related. The general relation can be expressed by the formula EC (μS/cm) = 1.0 to 2.0 TDS (ppm or mg/L), where EC is assumed to be 1.5 TDS on average. The approximate limits for drinking water under the World Health Organization's (WHO) drinking water standard are TDS ≤ 1,000 mg/L, EC = 1,500 μS/cm (1.5 dS/m).

As shown in the **Figure A2.2.10**, drinkable groundwater with an EC of 1,500 μS/cm (1.5 dS/m) or less is distributed over a 10 to 20 km wide band along the Chenab River. In the central part of the Doab, however, the water is brackish, with an EC higher than the prescribed limit.

Groundwater with an EC of 1,500 μS/cm (1.5 dS/m) or less is also distributed along the Ravi River, but over a more limited area compared with that along the Chenab River. Some lenticular fresh water zones are formed by seepage from the Branch Canals in the belt-like zone along the canals, where a water quality of TDS = 500 to 1,000 mg/L can be secured. When considering groundwater as a source of water supply development, freshwater resources along the Branch Canals should be considered.



Source: Website, http://irrigation.punjab.gov.pk/sg/sg_intro.aspx: Amended by JICA Mission Team

Figure A2.2.10 Plan View Distribution Map of EC in Faisalabad Zone of Rechna Doab

A2.3 Socioeconomic Conditions

2.3.1 Population and Population Growth

(1) Punjab

Punjab is the most populous province of Pakistan. More than half of the total population of the country lives here, as presented in **Table A2.3.1**.

Table A2.3.1 Population of Punjab (Unit: 1,000 people)

Year	2005	2010	2015
Pakistan	156,043	173,509	184,349
Punjab	85,904	94,745	100,174
Proportion of Punjab/National	55.1%	54.6%	54.3%

Source: Compiled from the Pakistan Ministry of Finance Documents

(2) Faisalabad City

During the British colonial rule, Mandi Town was established for a population of about 20,000 to serve as an economic mediator. Initially it was established over an area of 3 square kilometers, but the town rapidly grew into a city due to its centralized location and better job opportunities. Many people shifted from rural areas to the city for better prospects. After partition, there was rapid increase in population owing to migration from India. The population grew by an average of almost 9% per annum for another decade and then started declining from 1970 onwards. The Industrial Revolution also set hold in the country around this period.

The population growth rate receded to 3.53% in the 1980s and further declined in the next decades to about 3%. By this time the overall population growth of Pakistan had also declined to 3%.

Table A2.3.2 Historical Population Growth of Faisalabad City

Item	1961	1972	1981	1998
Population	425,240	823,344	1,104,209	2,139,984
Growth Rate, %	9.10	5.82	3.32	3.97

Source: Population census conducted from 1961 to 1998. No adjustments in terms of Urban, Peri-urban, or UCs have been made in the above data from the Punjab Land Use Rules 2009

Prior to 2005, Faisalabad District consisted of Faisalabad City and Faisalabad Saddar with four tehsils (Chak Jhumra, Jaranwala, Sammundri and Tandlianwala). The following table summarizes the area of Faisalabad City and Faisalabad Saddar, together with the population recorded in the 1998 census:

Table A2.3.3 Population of Faisalabad City and Faisalabad Saddar

Name of Tehsil	Area (Sq. km)	Population in 1998
Faisalabad City	168	2,140,000
Faisalabad Saddar	1,186	924,000
Total	1,354	3,064,000

Source: Punjab Development Statistics 2015

Faisalabad City District (including City District Government) was formed in the year 2005. The four tehsils (Chak Jhumra, Jaranwala, Sammundri and Tandlianwala) were re-designated into towns. In parallel, Faisalabad City and Faisalabad Saddar were replaced by four towns (Iqbal Town, Jinnah

Town, Lyallpur Town and Madina Town). Faisalabad District is now made up of eight towns (Chak Jhumra Town, Jaranwala Town, Sammundri Town, Tandlianwala Town, Iqbal Town, Jinnah Town, Lyallpur Town and Madina Town). The newly designated towns mainly make up part of the Faisalabad Urban area and partly make up the mixed Urban-Rural area.

According to the Punjab Land Use Rules, a Peri-Urban area was marked around Faisalabad City in 2009. This area serves as a transitional zone between the city and its surrounding rural area. This will also act as an interface between urban, rural, and natural areas with relatively rapid growth in the future.

The Peri-urban area is already demarcated by the Government of Punjab (see **Figure A2.3.1**).

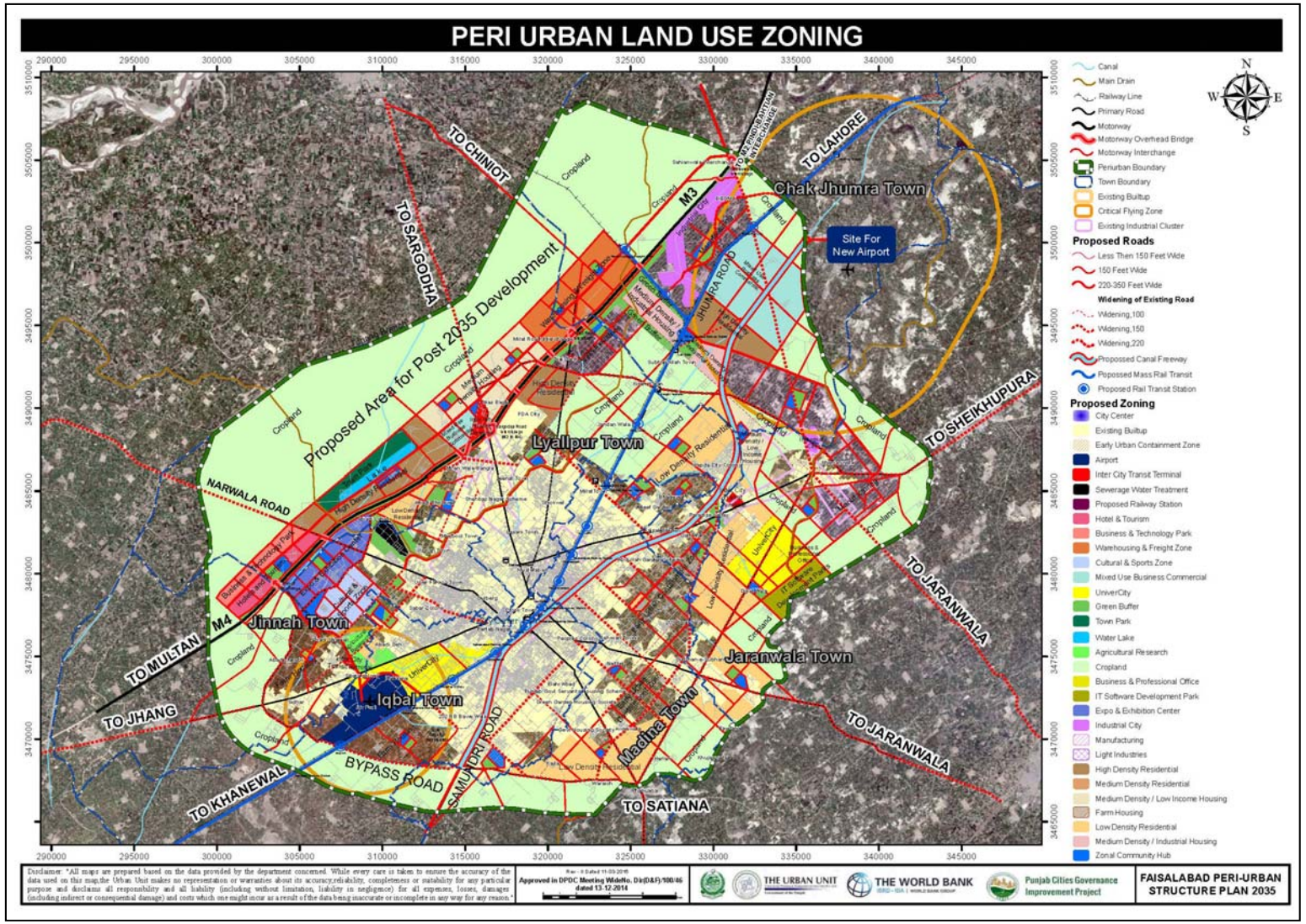


Figure A2.3.1 Peri-Urban Land Use Zoning

This Master Plan study has proposed to extend land use through the expansion of the current Faisalabad City up to the surrounding Peri-Urban area. The target is to cover the Faisalabad Peri-Urban Structure Plan (FPUSP) by the year 2035 under the Punjab Cities Governance Improvement Project implemented by the Government of Punjab with assistance from the World Bank.

Based on the Punjab Land Use Rules of 2009, the population of Faisalabad City recorded in the 1998 census has been adjusted into the Urban area, Peri-Urban area, and union councils of the city. Comparing the population of the urban UCs in 1998 with that of 1981, the growth is estimated to have been just over 3% (i.e., 3.06%).

Similarly, the 2015 population estimated in the Punjab Development Statistics in the same year has been adjusted according to the Punjab Land Use Rules of 2009 into urban UCs, the Peri-Urban area, and union councils.

Based on the growth rate determined in the population census of 1998 and the estimated population of 2015, projections for the Master Plan study have been worked out up to 2038 for the Urban area, Peri-Urban area & union councils of Faisalabad City. The projections are shown in **Table A2.3.4**.

The population of the Urban and Peri-Urban area estimated by the JMT (including population growth from 1998 to 2015) and number of union councils falling in the Urban and Peri-Urban area are reported in **Table A2.3.4** below.

Table A2.3.4 Population of the M/P Study Area (Faisalabad Urban and Peri-Urban Areas)

Survey area for Study	Number of Union Councils	Population		ACGR (1998-2015)
		1998	2015	
Faisalabad Urban Area	108	2,031,000*	2,702,000*	1.69 %
Faisalabad Peri-Urban Area	47	898,000**	1,324,000**	2.31 %
Total	155	2,929,000	4,026,000	1.89 %

ACGR: The Annual Compound Growth Rate (ACGR) is a useful measure of growth over multiple time periods. The ACGR shows an increasing trend in population growth compounded over a period of 18 years (1998-2015).
The ACGR formula for calculating the rate of population growth from 1998 to 2015 (18 years) is as follows:
$ACGR = (Xt/Xb)^{1/(n-1)}$ where:
Xt = Population Value in the Terminal Year (2015)
Xb = Population Base Year, 1998 Census
n = Number of Years, i.e., 1998 to 2015 = 18 years
Source: * Punjab Development Statistics, 2015; ** Estimated by the JICA Mission Team

Note that the population data compiled by the Bureau of Statistics, Government of Punjab up to 2015 showed a decline in the growth rate from 3% to just below 2% in all areas but the Peri-Urban area (which showed a growth rate above 2%). The population projections for UCs are made individually based on the growth rate at each UC level.

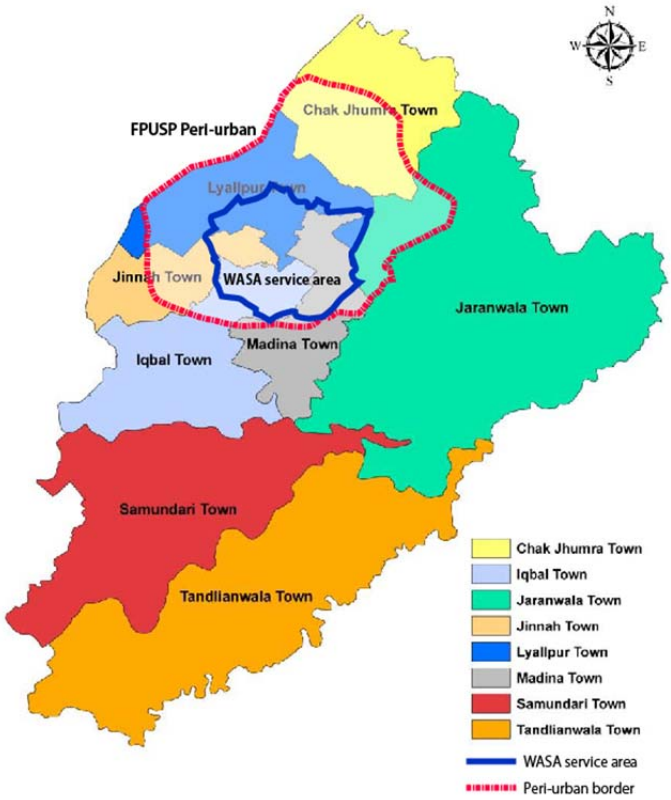
One of the reasons for the decline in population growth was a reduction of job opportunities linked to the closure of many industrial units due to power supply shortages. The lack of jobs caused a migration of population to rural areas, other cities, and abroad.

Assuming a linear trend in growth, the population projections for the Master Plan study period in different areas of Faisalabad City will be calculated at the UC level (basic administrative unit), whereas the World Bank projections are based on town levels with an ACGR of just over 2%.

It is pertinent to note that rapid urbanization and population growth are likely to occur in the country, especially in the Faisalabad region, due to infrastructure development projects such as the Karachi – Lahore motorway, CPEC, additional power generation, etc.

2.3.2 Land Use

Faisalabad District has a total area of 5,856 km^2, out of which Faisalabad City occupies an area of more than 200 km^2. There are eight towns in the District, namely, Lyallpur Town, Jinnah Town, Iqbal Town, Madina Town, Chak Jhumra Town, Sammundri Town, Jaranwala Town, and Tandlianwala Town, as shown in **Figure A2.3.2**. These towns have a mix of urban and rural areas.



Source: JICA Mission Team

Figure A2.3.2 Faisalabad Urban Areas

Land use in the Faisalabad City area is divided into three categories:

- Residential areas (including services and commercial applications)
- Public facilities
- Industrial areas

The land use patterns in the Urban and Peri-Urban areas are presented in **Table A2.3.5**. Though Faisalabad City is a planned city, the amount of industrialization and development was not foreseen. As a consequence, there are no delineated zones for industry, residence, agriculture, etc.

Due to unprecedented growth of the city and paucity of open spaces, the quality of the physical environment is quite detrimental to health, with contaminated groundwater and air quality. Worse, water for agriculture and household use is contaminated due to the lack of sufficient sewerage disposal facilities.

Different studies have been undertaken to quantify the current state of urban and rural Faisalabad. The major studies are conducted under the Faisalabad Peri-Urban Structure Plan (FPUSP) by Urban Unit. FPUSP reports outline the historical development of Faisalabad city and previous master plans, highlight the problems of the city, and discuss future urbanization and mechanisms for planned growth.

Table A2.3.5 Land Use Patterns in Faisalabad

Sr. No.	Land Use	Area (km^2)	%
Built-up Area			
1	Residential Area	56.08	46.49
2	Commercial	2.56	2.31
3	Industrial Area	6.09	5.05
4	Educational Area	4.41	3.65
5	Open Space	1.96	1.62
6	Public Buildings	4.76	3.94
7	Graveyards	1.04	0.86
8	Agriculture Area	41.54	34.44
9	Major Roads	2.19	1.81
	Total Area	120.65	100.00
Peri-Urban Area			
1	Agriculture	6.37	83.11
2	Commercial	4.14	0.54
3	Community Facility	2.50	0.33
4	Dairy and Livestock	1.83	0.24
5	Empty	53.48	6.97
6	Industry	20.42	2.66
7	Residential	42.85	5.59
8	Transportation	4.28	0.56
	Total	767.05	100.00

Source: FPUSP-2015

2.3.3 Socioeconomic Conditions

(1) Economy

Faisalabad City is the second largest city in Punjab and the third largest city in Pakistan. It is the fastest growing city in the country, with a strong export base in the textile industry. This section briefly summarizes the socioeconomic conditions of the city and presents data on the projected population of the city, land use patterns, and urban development trends.

a. Gross domestic product (GDP) in Punjab

Punjab's GDP accounted for 59% of the total GDP of Pakistan in 2010. **Table A2.3.6** presents the GDP/growth rate statistics for Punjab and all of Pakistan.

Table A2.3.6 Punjab GDP Growth

Item	GDP/Growth Rate	2010	2015
Pakistan	GDP (Billion USD)	177.41	246.88
	Annual Growth Rate	2.58%	4.14%
Punjab	GDP (Billion USD)	104.93	-
	Annual Growth Rate	-	-

Source: http://www.tradingeconomics.com/pakistan/gdp-growth

b. GDP in Faisalabad City

Faisalabad is a major industrial city, ranking 3rd in GDP contribution (contributing about 15% to the national economy), trailing only Karachi and Lahore. Details are shown in **Table A2.3.7**.

Table A2.3.7 GDP of Faisalabad City

Year	Karachi	Lahore	Faisalabad
2009 (Billion USD)	78	40	35
Estimated GDP Growth Rate for 2025	5.5%	5.6%	5.7%

Source: Faisalabad Peri-Urban Structure Plan (April 2015)

(2) Industry

Faisalabad City was developed as an industrial town in the late 1930s. After independence, the city entered a phase of remarkable industrialization. Year by year, it was gradually transformed into a major industrial center of Pakistan with highways, railways, railway repair yards, processing mills, and engineering works. The Faisalabad City of today is known as a strong industrial base with many factories engaged in the manufacture and dyeing of textiles and the production of fertilizers, industrial chemicals, pulp and paper, printing, industrial goods, agricultural equipment, and so on. According to the Faisalabad Chamber of Commerce & Industries in 2013, the export of textile products from the city totaled about 5 billion USD per year and exports from other sectors contributed about 1 billion USD. The various industrial firms located in Faisalabad are summarized below:

Table A2.3.8 Types of Industry in Faisalabad District

	Type of Factory		Number
1	Textile	Textile Spinning Mills	85
2		Power Looms (Standard & Auto)	200,000
3		Shuttles Looms/Air jet Looms	30,000
4		Textile Processing, Printing and Finishing Mills	250
5		Sizing Industries	125
6		Hosiery & Knitwear Units (Small, Medium & large)	1,000
7		Cotton Ginning/Processing	25
8		Embroidery Units	400
9	Foundries		250
10	Power Generation		8
11	Rice Mills		12
12	Soap (Sodium Silicate & Detergent)		59
13	Vegetable ghee & Cooking Oil		4
14	Flour Mills		45
15	Fiber Plant (largest in the Country)		1
16	Chemical Plants (one of the Largest in the Country)		3
		Total	232,267

Source: FPUSP 2015 (based on data from the Faisalabad Chamber of Commerce & Industries, 2013)

About 2,000 factories and public facilities such as hospitals operate in Faisalabad City. Among them, about 528 facilities contribute significant amounts of pollution to wastewater without any proper treatment. These facilities are under the supervision of the Environmental Protection Agency in Faisalabad (EPA-F). The numbers are summarized in **Table A2.3.9**.

Table A2.3.9 Numbers of Major Factories and Public Facilities

	Type of Factory	Number	Percentage (%)
1	Textile, Dyeing	350	66.3
2	Ice making, dairy product manufacturing	48	9.1
3	Milling	40	7.6
4	Hospital and medical facilities	37	7.0
5	Cotton cleaning and breaching	20	3.8
6	Soap	10	1.9
7	Meat processing	7	1.3
8	Sugar	5	0.9
9	Pulp and paper	5	0.9
10	Ghee & Cooking Oil	3	0.6
11	Fertilizer etc.	3	0.6
	Total	528	100%

Source: Detailed Planning Survey on the M/P Study 2016 (based on interview to EPA-F)

(3) Income distribution

The table below shows the distribution of household income according to quintiles in the Punjab Urban area (urban areas in Punjab province) and Pakistan in 2015 to 2016. The sample size of the survey

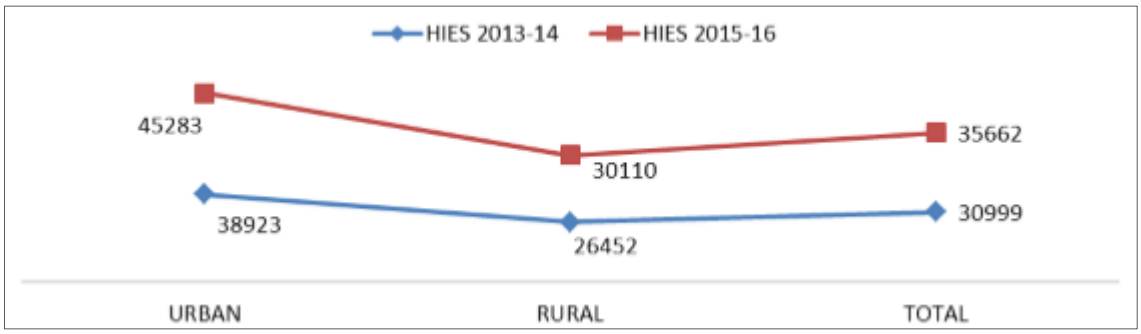
conducted under the Household Integrated Economic Survey (HIES) was 7,181 households in the Punjab Urban area and 24,238 households nationwide. The monthly income and consumption expenditure of the Punjab Urban area are both higher than the national averages. The average income of the richest quintile was 3.5 times that of the poorest quintile. Likewise, the average expenditure of the highest quintile was more than 3 times that of the lowest quintile.

According to *Poverty & Social Impact Analysis in Urban Punjab 2010,* a similar survey report published by the Urban Unit in Faisalabad, the average income and expenditure were PKR 18,312 and PKR 17,391, respectively. These figures reflect a 16-17% annual increase in the household income and expenditure in the Punjab Urban area. The HIES 2015-16 also reports a 15-20% increase in the household income and consumption expenditure in the urban area. Ongoing increases in income and expenditure are expected to be somehow achieved.

Table A2.3.10 Income Distribution of the Punjab Urban Area in 2015-16

Quintile	Punjab Urban Area			Pakistan	
	Average monthly income (PKR)	Average monthly expenditure (PKR)	Percentage of household	Average monthly income (PKR)	Average monthly expenditure (PKR)
1st	19,366	17,977	6.1 %	19,742	18,500
2nd	24,315	22,948	10.4 %	23,826	22,874
3rd	28,224	27,264	15.9 %	28,020	26,702
4th	34,558	32,841	23.9 %	33,668	31,337
5th	68,975	58,834	43.7 %	60,451	52,906
Total	46,616	41,385	100.0 %	35,662	32,578

Source: HIES 2015-16



*Urban: the urban area in Punjab. Rural: the rural area in Punjab. Total: the whole of Punjab.
Source: JICA Mission Team based on HIES

Figure A2.3.3 Average Household Income

The above income distribution shows the whole urban areas of Punjab Province such as Faisalabad, Gujranwala, Lahore, Multan, and Rawalpindi. The average household income of Faisalabad is lower than that of the Punjab Urban area on average. According to the results of a survey conducted by UU, "Poverty & Social Impact Analysis in Urban Punjab (PSIAUP) 2010," the average household income of Faisalabad is equivalent to approx.75% of that of the Punjab Urban area.

(4) Poverty

Based on purchasing power parity prices, poverty estimates in 2005 indicate that the proportion of population living below $1.25 per day declined from 17.2% in 2008 to 12.7% in 2011 (ADB CPS Poverty Analysis 2015-2019). The proportion of population living below purchasing power parity prices at $1.90 per day in 2014 is estimated at 12.4% (ADB Basic Statistics 2016).

The unemployment rate in Faisalabad District in 2011 was 2.7% (see **Table A2.3.11**). The percentage of the households in which a family member is working outside the village or town is 17%. Turning to the social safety net, 14% of households purchase from governmental utility stores where goods are sold at

discounted prices. The poorest members of society receiving cash donations make up 1.2% of the population.

Table A2.3.11 Socioeconomic and Health Indicators

Indicator	Unit	Punjab	Faisalabad
Socioeconomic			
Unemployment Rate (15+ years)	%	2.9	2.7
Family Member working outside village/town	%	15	17
Purchase from Govt. Utility Stores (Safety Net)	%	14	14
Receive Cash Donations	%	1.5	1.2
Health			
Infant Mortality Rate (IMR)	Per 1,000 births	82	82
Under 5 Mortality Rate (U5MR)	Per 1,000 births	104	103
Prevalence of Diarrhea of Child	%	16	11

Source: Punjab Development Statistics 2015 referred from Multiple Indicator Cluster Survey (MICS) 2011

(5) Health

When limited to Faisalabad District, the only health indicators available are the Infant Mortality Rate (IMR), Under 5 Mortality Rate (U5MR), and prevalence of diarrhea of children. According to the Multiple Indicator Cluster Survey (MICS) in 2011 (see **Table A2.3.11**), the IMR is 82 per 1,000 births, the U5MR is 103 per 1,000 births, and the prevalence of diarrhea of children is 11%.

The latest health conditions within the study area, such as morbidity of waterborne diseases, are included in the socioeconomic survey conducted under the M/P study. The results of the household survey completed in December 2016 are summarized in the following section **2.3.4 Socioeconomic Survey (sub-contract)**. Around 30% of the survey respondents indicate that their health has been affected by water. Since many households in the Study Area utilize the groundwater for domestic use, groundwater contamination is also considered a cause of water-borne diseases.

(6) Education

The Literacy rate of the population (10 years & above) in Faisalabad City in 2011 was higher than the overall ratio in Punjab: 66% versus 60%. The following tables present breakdowns of the Literacy Rates for different periods and different age groups.

Table A2.3.12 Literacy Rates Compared by Age, Sex, and Area, Punjab 2011

	Percentage (%)	
	Literacy Rate 10+ years	Adult Literacy rate 15–24 years
Punjab	60	74
Male	68	78
Female	51	70
Rural	53	69
Urban	75	85
Faisalabad City	66	80

Source: Punjab Development Statistics 2015

(7) Water and sanitation

The availability of safe drinking water on the premises, a condition associated with greater use of drinking water, is an indicator of family attitudes toward the maintenance of better household hygiene and healthcare. Eighty percent of the population of Faisalabad District has direct physical access to drinking water on their premises, while only 3% use properly treated water. Improved water source and sanitation facilities are available to 58% of the households. The indicators regarding water and sanitation facilities are shown in the table below:

Table A2.3.13 Environmental Indicators

Indicator	Unit	Punjab	Faisalabad
Environmental indicator			
Physical Access to Drinking Water (within dwelling)	%	89	74
Use of Improve Drinking Water Sources	%	94	80
Use of Properly Treated Water	%	6	3
Improved Sanitation	%	72	88
Use of Improved Water Sources and Sanitation	%	58	58

Source: Punjab Development Statistics 2015, based on a Multiple Indicator Cluster Survey (MICS) conducted in 2011

(8) Electric Power Supply

Faisalabad Electric Supply Company Limited (FESCO) distributes and supplies electricity to about 1.8 million customers. FESCO covers the Faisalabad, Sargodha, Chiniot, Mianwali, Khushab, Jhang, Bhakker, and T.T. Singh Districts. The FESCO coverage area is approximately 44,000 km^2.

- 72% of the villages and towns in Faisalabad District are powered. Another 3% will be covered through ongoing work.
- 25% use alternative sources such as kerosene oil, other sources, etc.

In the FESCO coverage area, 55% of the consumers are domestic, 30% are industrial, and 8%~10% are tubewells. Shortfalls in power in the range of 20% to 30% come in the peak season (summer). The shortfalls are compensated by load shedding: 6 hours of load shedding per day in urban areas and 8 hours per day in rural areas. Load shedding is scheduled so as not to interrupt WASA-F, hospitals, and rescue facilities, all of which are supplied continuous power through multiple power feeders. No load shedding takes place in the winter. Meanwhile, the Neelum-Jhelum Hydropower Project (NJHP – 969 MW) - Muzaffarabad, Tarbela-IV Extension Project, Tarbela - KPK (1410 MW) Project, and several other small hydropower projects are expected to be completed by 2018. The completion of these projects is expected to help stabilize power availability in the future.

(9) Solid Waste Management

The City District Government of Faisalabad (CDGF) is responsible for managing the municipal solid wastes. CDGF has suffered from increasing rates of solid wastes generation, low waste collection rates, unsafe waste disposal, and low customer satisfaction.

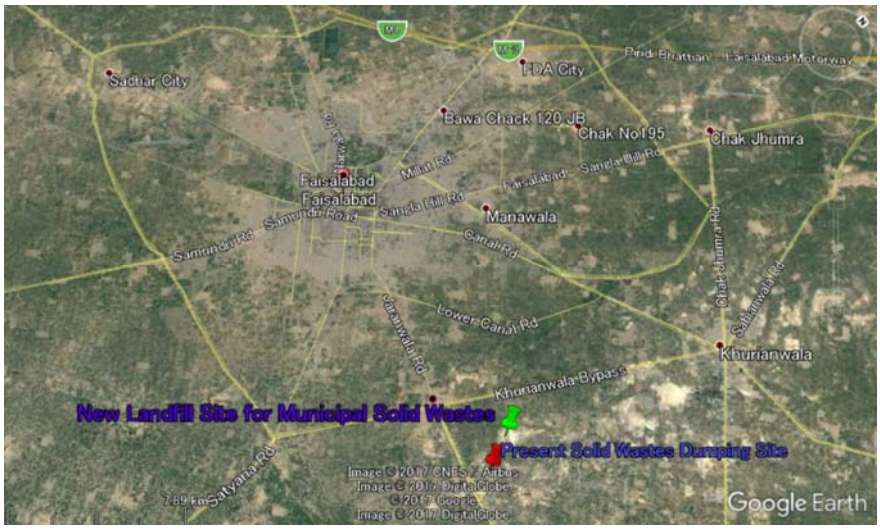
The Government of Punjab State (GOPb) announced a special package of PKR 600 million to improve the Solid Waste Management (SWM) system in the city. As the first phase, PKR 150 million was released to tackle the SWM issues of Faisalabad city. The Urban Unit was assigned as a special task by GOPb to devise a plan for the SWM system of Faisalabad City.

The phase 1 project has introduced a comprehensive solid waste management system encompassing the following: door-to-door and shop-to-shop waste collection as a pilot project, improved waste separation of valuable waste from non-valuable waste by constructing mini transfer stations (intermediate stations), efficient waste transportation by providing mechanical sweepers for main roads and tractor trolleys for waste transportation, improvements of the existing dumping site, recruitment and training of staff, and public awareness activities.

Faisalabad Waste Management Company (FWMC), a body fully funded by the provincial government, manages the collection and transportation of municipal solid wastes. According to a hearing survey, an estimated 1,600 tons solid wastes are produced each day, of which roughly 75% (1,200 ton/day) is disposed of at the dumping site. The dumping site occupies an area of about 20 ha (50 acres) at the location shown in **Figure 2.3.4**. A new site of about 61 ha (150 acres) is also planned. The planning and design work are entrusted to the Urban Unit in Lahore. Under the current plans, the new landfill site will

be a controlled (sanitary) landfill that will not receive any sludge produced from the WASA-F sewerage and drainage system.

The pictures below show the current conditions of the existing dumping site and new sanitary landfill site.



Source: JICA Mission Team

Figure A2.3.4 Locations of Existing Solid Wastes Dumping Site and New Sanitary Landfill Site

1) Existing Solid Wastes Dumping Site

2) A Truck transporting the municipal solid wastes

3) A Truck transporting the municipal solid wastes

New Sanitary Landfill Site

Source: JICA Mission Team

Figure A2.3.5 Current Conditions of Existing Solid Wastes Dumping Site and Sanitary Landfill Site

(10) Piped Gas Supply

Gas is piped in through the Sui Gas Northern Pipe Lines (SNGPL). Almost 40% of the area of Faisalabad City District has access to gas facility, while the remaining 60% uses other sources. The length of the existing distribution network is about 2,000 km.

Table A2.3.14 Piped Gas Consumer Data

Item	Domestic Consumer	Commercial Consumer	Industrial Consumer
Piped Gas	200,000	1900	450

Source: JICA Mission Team

Total daily gas consumption is about 250 Million Cubic Feet per Day (MMCFD). According to press reports, there is a 40% shortfall in supply versus the total demand *(by Federal Petroleum Minister)*. The government has already set up more Liquefied Natural Gas Terminals at Karachi port to overcome the shortfall. A gas import agreement now implemented between Pakistan and Qatar has reduced the shortfall. In the near future, the gap between the demand and supply of piped gas will be negligible.

2.3.4 Socioeconomic Survey (sub-contract)

(1) The Purpose of the Survey

The purpose of the socioeconomic survey was to collect basic information necessary for the pilot activities and the M/P of WASA Faisalabad from the perspective of customer needs and the criteria for judging the appropriateness of the planning. The collected interview data include information on housing conditions, household income, water supply and sewerage, sanitary conditions, and customer suggestions or feedback on the project. The findings were discussed with WASA-F and future improvements were considered.

1) Target of Investigation

Areas designated as pilot activity areas within the M/P Project area were selected for the survey. Care was taken, during the selection of these pilot activity areas, to include a representative sample of Faisalabad society and ensure that the areas would not overlap with other donor projects. Tabular and graphic summaries of the survey locations are presented below.

Table A2.3.15 Targets of the Investigation on Domestic Water Use

District Surveyed	Total Household	Household Surveyed	Consumer Type
Sarfraz Colony	676	200	Domestic
Sitara Sapna City	285	200	Domestic
Madina Town (X-Block)	1,868	200	Domestic
Total	2,829	600	

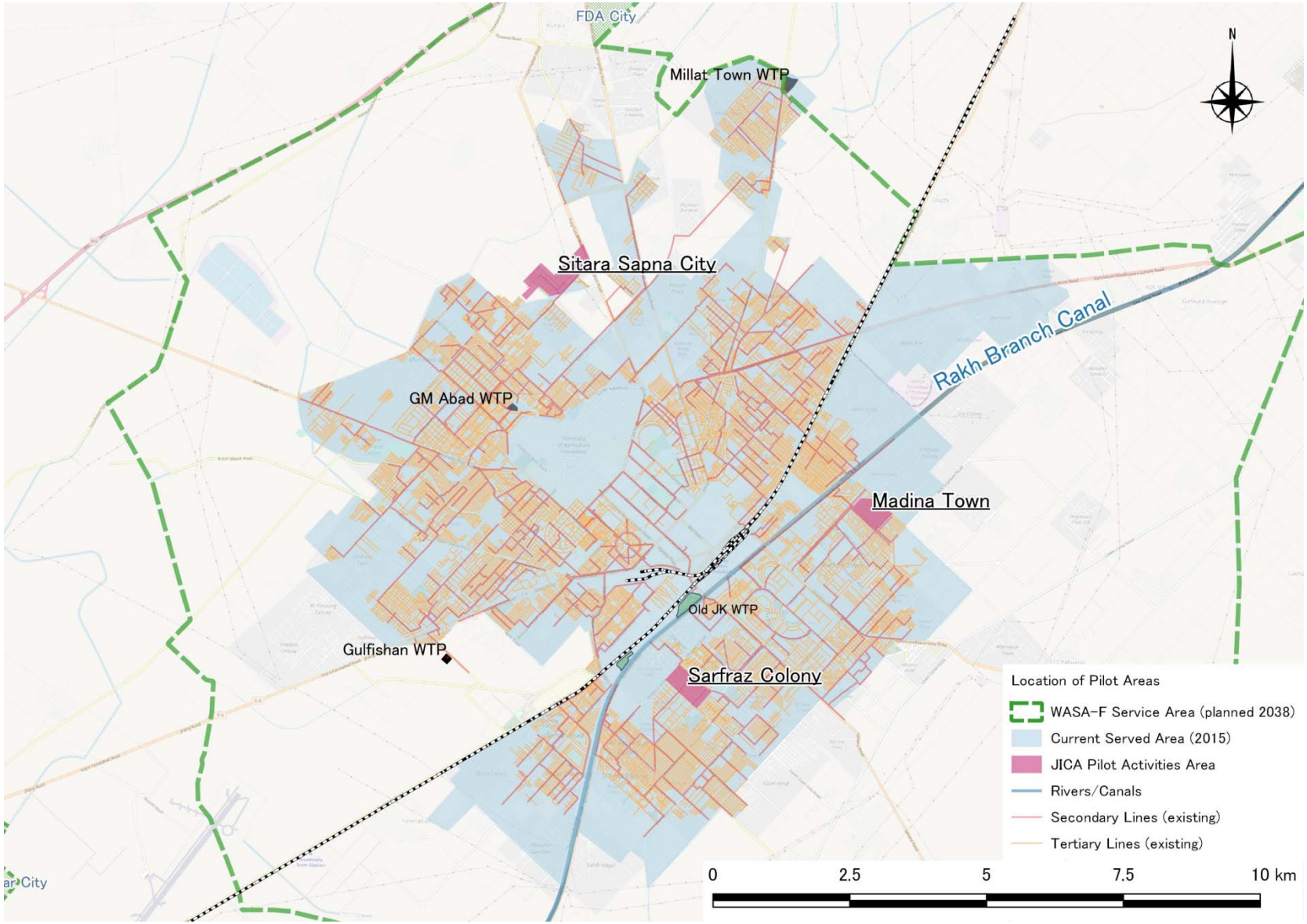
Source: JICA Mission Team

Table A2.3.16 Targets of the Investigation on Industrial & Commercial Water Use

Category	Surveyed	Consumer Type
Textile factory Manufacturing, etc.	30	Industries
Restaurant, Pharmacy, Hotel	70	Commercial
Total	100	

Source: JICA Mission Team

Questionnaire sheets for domestic and industry & commercial users are shown in **Appendix AA2.1, Questionnaire for Customer Survey (Interview Survey)**, in the **Supporting Report**, and the compiled results are also shown in **Appendix D3, Interview Survey Results**, in the **Data Book**.



Source: WASA-F

Figure A2.3.6 Location of the Pilot Activities

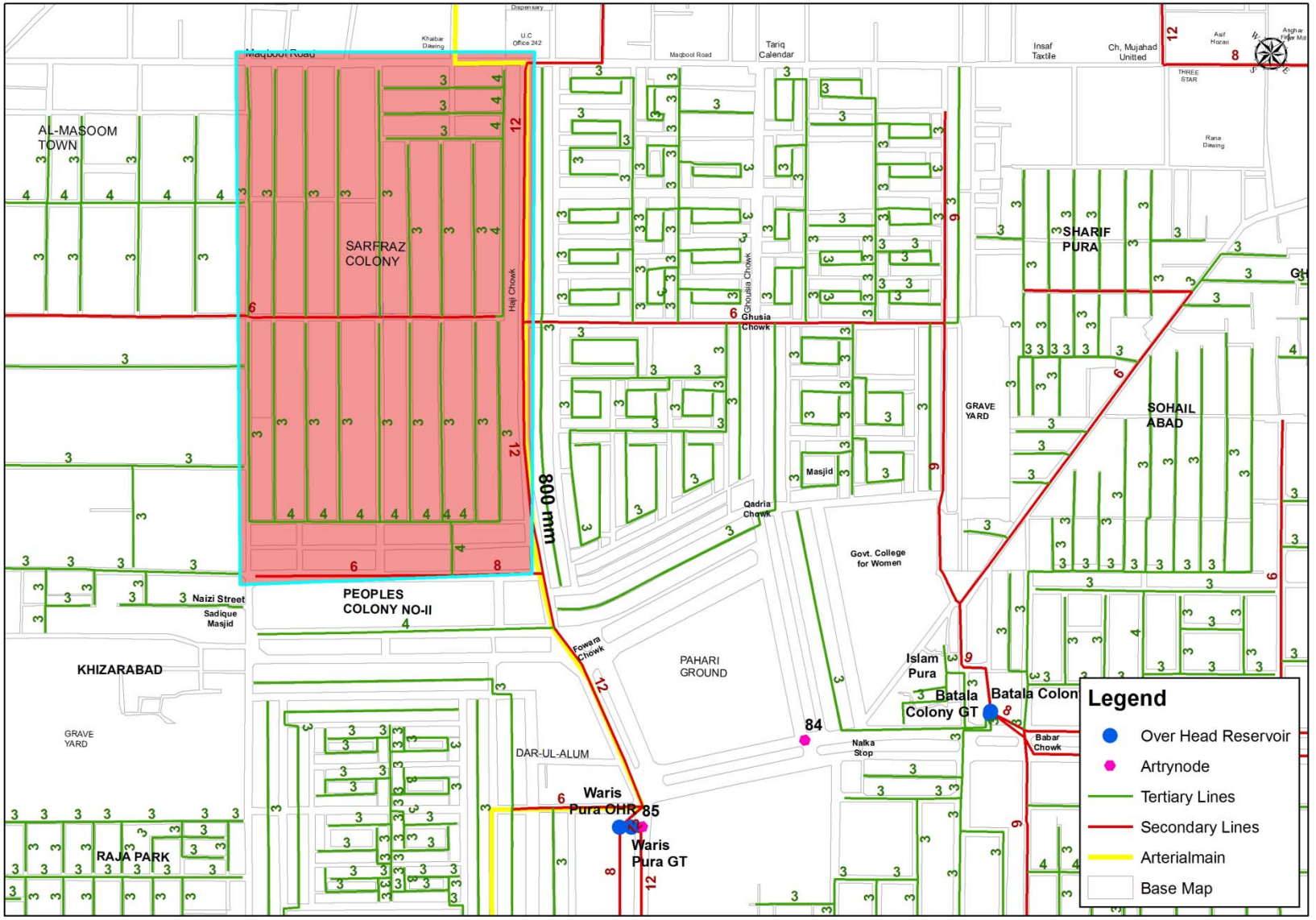


Figure A2.3.7 Sarfraz Colony Target Area

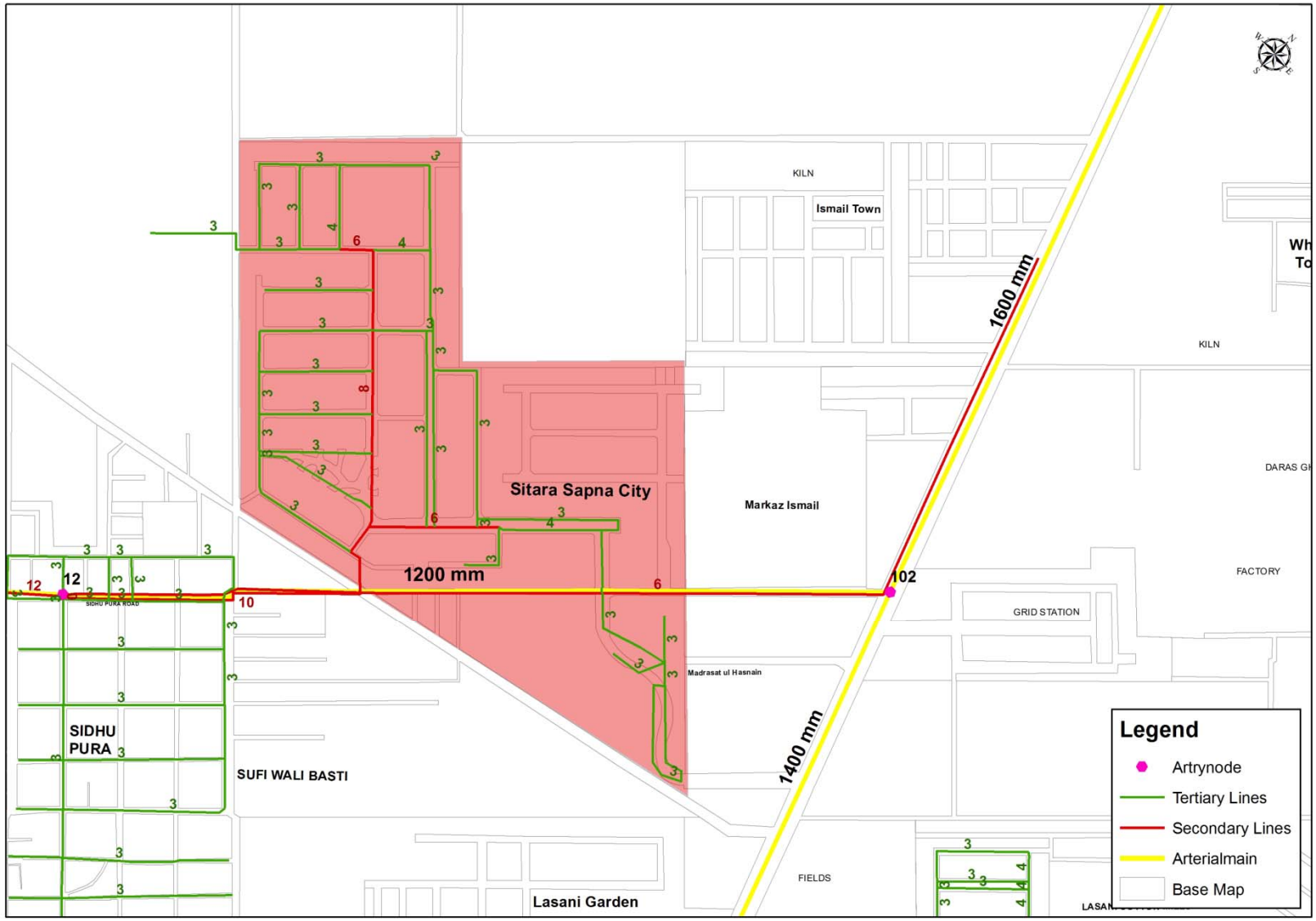


Figure A2.3.8 Sitara Sapna City Target Area

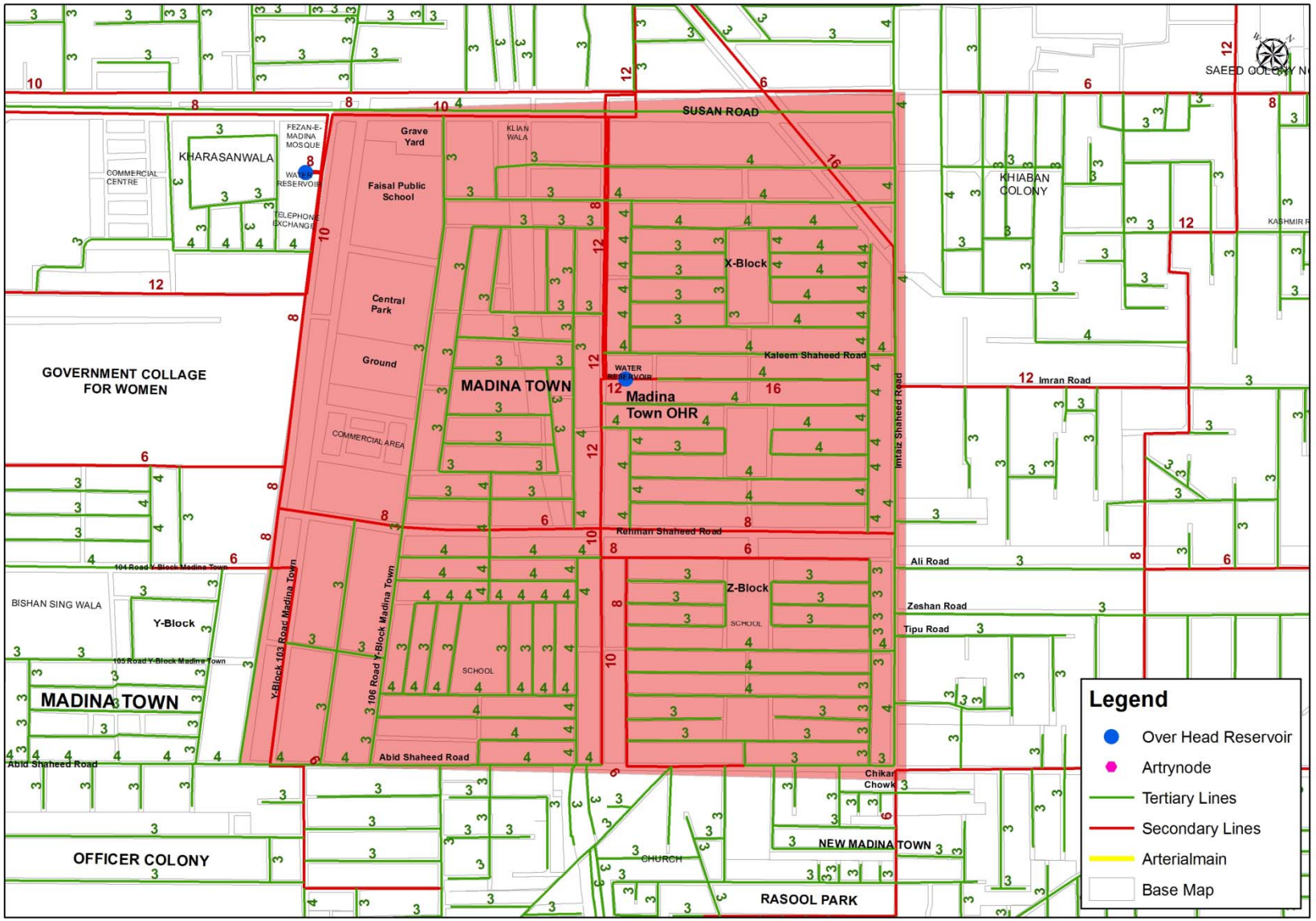


Figure A2.3.9 Madina Town X Block of Target Area

2) Period of Execution:

The survey was performed over 25 days (excluding holidays), starting on the 5th of November 2016 and ending on the 3rd of December 2016.

3) Methodology

Four researchers were employed, working fulltime without changing. In addition, rehearsal surveys were conducted several times with the researchers. The customer answers were compared with the objective of the JMT survey, and the questionnaire was adjusted for clarity and relevance. This improved the information-gathering capability of the researchers and helped to ensure the collection of highly reliable information.

Non-responders to the survey were not included in the results. Data sufficient for inclusion in the survey were acquired from about 200 respondents. Households that refused to pay WASA-F generally chose not to participate in the survey.

4) Questionnaire Sheets

See the Attachments in the Supporting Report.
Attachment 1: Domestic
Attachment 2: Commercial and Industry

5) Households Surveyed

Six hundred domestic households and 100 commercial & industry establishments were surveyed. Only 530 of the 600 households responded to the survey.

Table A2.3.17 Gender of the Respondents in the Domestic Water Survey

Gender	Number
Female	175
Male	425
Total	600

Source: JICA Mission Team

6) Customer Survey of Domestic Water Users

Basic information on households was surveyed. Respondent information and family structure were investigated in detail.

a) Basic Information

The family structure of an average single family was investigated. The survey found that the average single-family household was made up of 7 people. Households of more than 8 people were also common. Information on households of 8 - 12 people is important for the accurate measurement of general water use volumes.

Table A2.3.18 Typical Household Structure in the Survey Area

Area	Total No. of Family Members	Effective Answer/House	Average Number/Household	No Response
Sarfraz Colony	1,309	176	7.44	4
Sitara Sapna City	860	150	5.73	0
Madina Town	1,403	197	7.12	3
Total	3,572	523	6.83	7

Source: JICA Mission Team

b) Features of the Survey Area

The areas surveyed and relevant details were as follows:

- Salfraz Colony: Mostly Middle-class households. The number of people per household was highest in this area.
- Sitara Sapna City: Higher-class residential area, prominent in the city. Many households had foreign lifestyles not typical of Pakistan. There were large variances in household structures within this more affluent segment. House size, water usage, and incomes were quite different from other parts of the city.
- Madina Town: An area with various homes in the middle to lower-middle class, regarded as representative of the WASA-F service area as a whole.

c) Dwellings

Construction: Most buildings are made of concrete. A small percentage use brick construction.

Table A2.3.19 Types of Dwellings

Area	Concrete	Brick
Sarfraz Colony	177	3
Sitara Sapna	189	11
Madina Town	150	0
Total	97%	3%

Source: JICA Mission Team

The area of the general house: WASA-F calculates water supply charge based on the floor area of the household. Since a luxury residential area was included in this JMT survey, it was difficult to get the correct average area. Data disclosed through government announcements were used to determine the average household area in the WASA-F service area.

Table A2.3.20 Average Household Size (Unit: Marla)

Area	2013-14	2015-16
Urban	6.09	6.03
Rural	6.49	6.47
Total	6.35	6.31

Note: 1 Marla = 25.269 m^2
Source: HIES 2015

d) Household income (Unit: PKR)

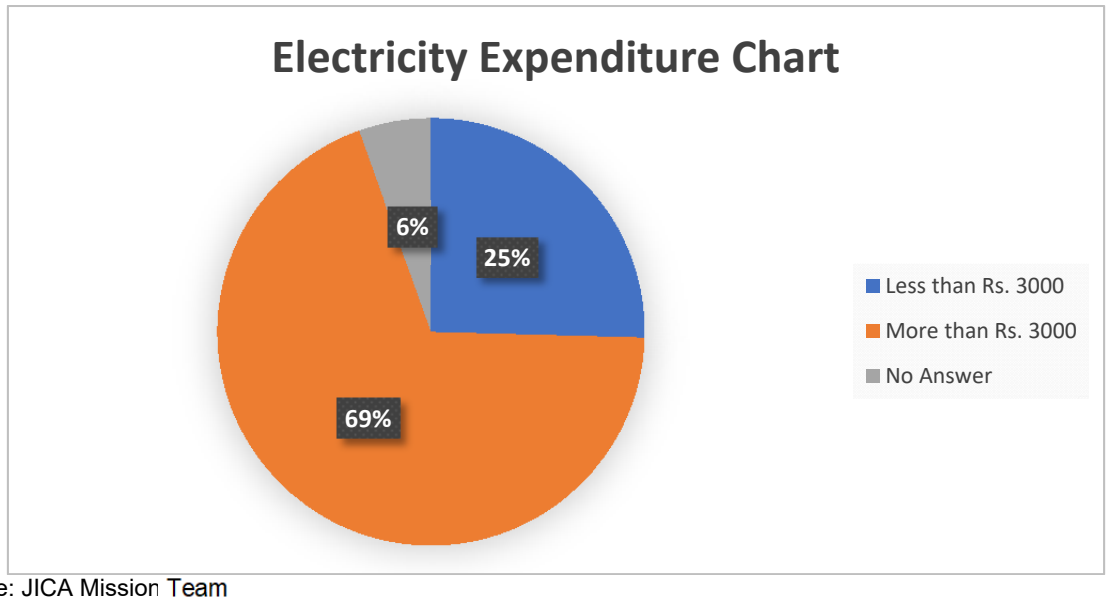
In the hearing conducted by JMT, no responses on income or expenditure were obtained. In an interview conducted previously by JMT, the average income was found to be PKR 70,000 to PKR 90,000. In the data released by the government, the average household income in urban areas in Pakistan is PKR 45,283.

e) Expenditures on Electricity, Gas, and Other Utilities

Table A2.3.21 Number of Respondents in each Electricity Expenditure Bracket

Area	Less than PKR 3000	More than PKR 3000	No Answer
Madina Town	99/200	100/200	1/200
Sitara Sapna	6/150	130/150	14/150
Sarfraz Colony	29/180	137/180	14/180
Total	134/530	367/530	29/530

600 people were surveyed, but only 530 responses were obtained.
Source: JICA Mission Team



Source: JICA Mission Team

Figure A2.3.10 Electricity Expenditures in the Survey Area

Electricity charges are important expenses for the customers in the WASA-F Service Area as the use of electric pumps for obtaining groundwater for domestic use is a common practice in the area. In order to identify the scale of electricity usage in pilot activity areas, the survey investigated the number of people who pay more than PKR 3000 per month for electricity.

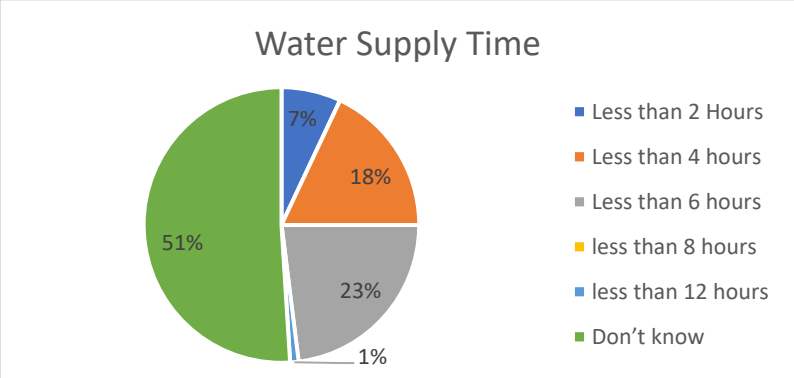
The percentage of electricity charges in the urban area is very high, as published in the survey report by the Government of Pakistan. According to this survey, 20.91% of total household income in urban areas is spent on utility bills (electricity, gas, and fuel). Of that, electricity accounts for 68.49% and gas 21.20%. Water tariffs are not included in the above percentages.

The pump specifications and status of pump installation were surveyed in five areas in an earlier investigation conducted by JMT (three pilot areas: GM ABATTO, and JINHA colony clock tower). The pumps installed in many homes were 30 years old and quite energy inefficient. After analysis of the pump specifications and water usage volume, the cost of operating a pump to draw water ranged from PKR 1,000 to PKR 1,500 monthly. The Faisalabad Electric Supply Company (FESCO) installs the pumps for PKR 5,000 to PKR 10,000.

f) Waterworks Information (water supply service)

For many citizens of Faisalabad City, WASA-F supply is not the only source of water. Historical waterworks policies dating back to before the independence in 1947 partly explain the situation. A low service level overall is also partly responsible. Since groundwater is available at most households, it is pumped up to supplement the WASA-F water. As can be seen from the survey, WASA-F water accounts for a small fraction of the total daily use, making estimation of water consumption difficult. Cases in which pumps were connected directly to WASA-F pipes were also found. Pumping from pipes upstream of the water supply areas (DMAs) causes many problems and is a major cause of falling service levels. In some cases, water never reaches the downstream users. In other cases, water pressure falls to very low levels, the water is contaminated with sewerage, etc. The following summarizes relevant details of the services:

g) Water Supply Time and Procedures of WASA-F



Source: JICA Mission Team

Figure A2.3.11 Water Supply Times

The daily water supply time of WASA-F is announced as 6 hours officially. According to the survey, the 6-hour water supply target is not reached for more than half of the households that responded. Moreover, many households responded that they were unaware that water was supplied on a fixed time basis. The large differences in the promised services and actual services are a factor responsible for declining customer trust. JMT measured a time difference between the start of operation of the distribution pumps at TR and the increase of water pressure at Peoples Colony on the east side of Faisalabad City. It took up to 50 minutes for water to reach customers from TR.

h) Current Supply situation by WASA-F

A situation of illegal suction pump installation by customers in the survey areas is shown in the following table.

Table A2.3.22 Situation of Illegal Pump Installation in the Survey Area

Area	Installed Electric Pumps	Household Visited	Percentage
Sarfraz Colony	172	200	86%
Sitara Sapna City	115	150	77%
Madina Town	152	180	84%
Total	439	530	83%

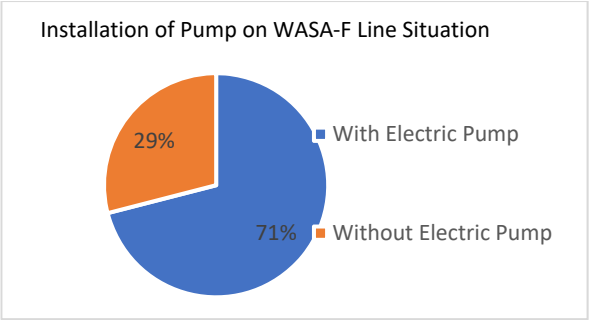
Source: JICA Mission Team

i) Suction Pump

As a corollary to the above, two methods of pump installation were identified. One was to connect to WASA-F pipe and pump/suction directly from the water supply lines. The other was to install a groundwater pump. Households using both methods were also observed.

WASA-F pipe line With Electric Pump	375 (71%)
WASA-F pipe line Without Electric Pump	155 (29%)

Unit: House number
Source: JICA Mission Team



Source: JICA Mission Team

Figure A2.3.12 Status of Pump Installation on the WASA Line

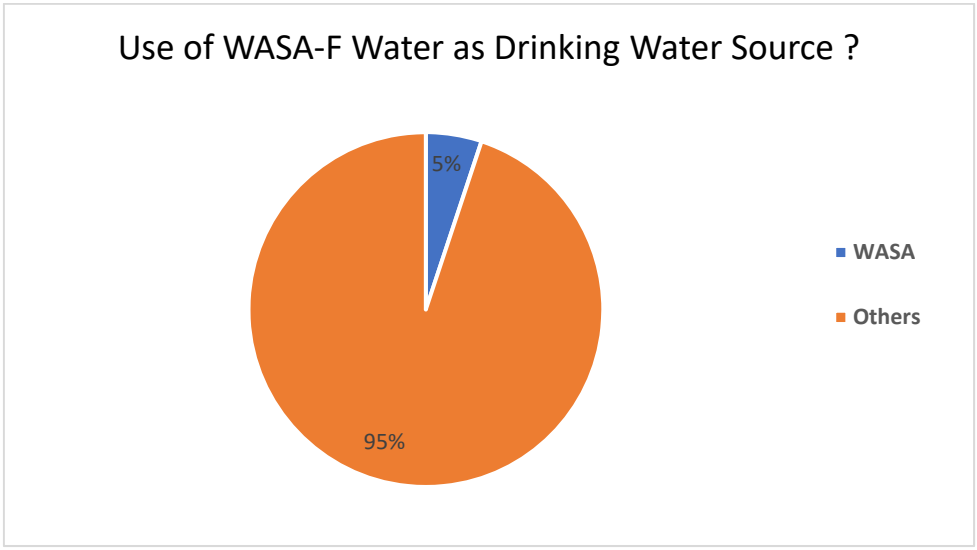
j) WASA-F Water for Drinking

Very few people drink directly from the WASA-F supply. Some drink it after boiling. Trust in the water quality is low.

Table A2.3.23 Survey Responses to the Question, "Which Water are You Drinking"?

Area	Drinking Water Source		Percentage	
	WASA	Others	WASA	Other
Sarfraz Colony	6	174	3.3%	96.7%
Sitara Sapna City	20	130	13.3%	86.7%
Madina Town	1	199	0.5%	99.5%
Total	27	503	5.1%	94.4%

Source: JICA Mission Team



Others: Private Gallon Bottle, Can Unit, Free Water Station
Source: JICA Mission Team

Figure A2.3.13 Use of WASA-F Water as Drinking Water

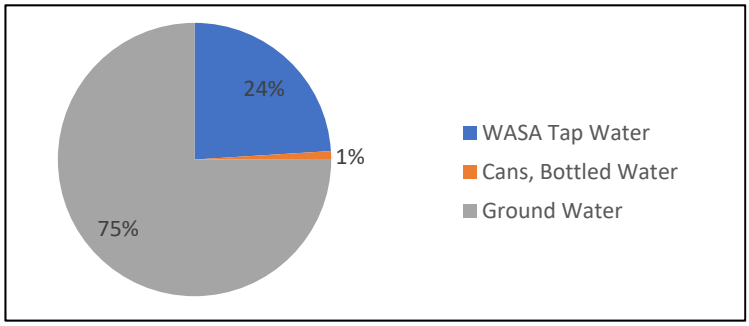
k) Consumption Volume by Person

The total water consumption from the various water sources is summarized below.

Type	lpcd	
WASA-F Tap Water	33.0	(24%)
Canned, Bottled Water	1.4	(1%)
Groundwater	103.0	(75%)
Total	137.4	(100%)

Source: JICA Mission Team Survey

Note:
These figures are sampled values obtained by the interview survey in the survey areas.



Source: JICA Mission Team

Figure A2.3.14 Daily Water Consumption by Households Sampled in the Survey Areas

l) Water Tariff System for WASA-F Users

The table below shows the fixed and metered water tariff structure of WASA-F.

Table A2.3.24 Current WASA-F Water Tariffs

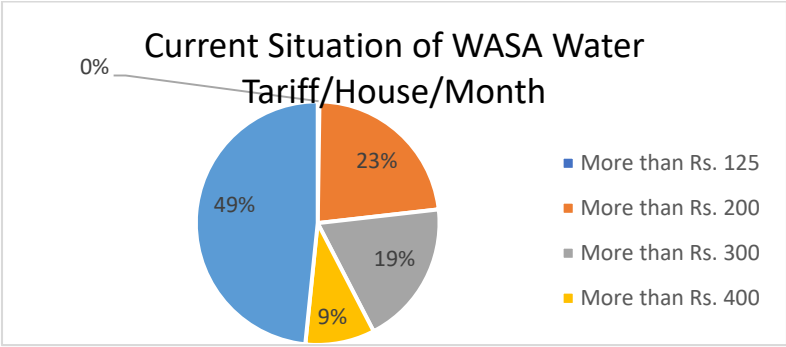
Non-metered domestic connection (1/4 inch ferrule)			
Plot Size			
Marla	m^2	PKR/connection	PKR/m^2
< 2.5	< 63	83	1.32
2.5 – 3.5	63 – 88	124	1.97 – 1.41
3.5 – 5.0	88 – 126	145	1.65 – 1.15
5.0 – 10.0	126 – 252	242	1.92 – 0.96
10.0 – 20.0	252 – 504	322	1.28 – 0.64
20.0 – 40.0	504 – 1,008	644	1.28 – 0.64
'> 40	'> 1,008	966	0.96
Metered domestic connection			
Monthly usage		PKR/1000 gal/connection	PKR/m^3
< 5,000 gal (22.7 m^3)		39	42.9
5,000 – 10,000 gal (22.7 m^3 – 45.5 m^3)		40	44.0
'> 10,000 gal (45.5 m^3)		49	52.8

Note a) Marla is a local unit of area, and 1 Marla = 25.29 m^2
Note b) 1/2 inch domestic connections are charged at twice the rate (for non-metered connections)
Note c) Rates based on an area of up to three stories. Additional levels are charged at 33.3% of the rate.
Source: JICA Mission Team

The table below shows a breakdown of the respondents according to water tariff amounts.

WASA-F Water Tariff (PKR/month)	Number of Respondents
More than PKR 125	1
More than PKR 200	92
More than PKR 300	77
More than PKR 400	37
More than PKR 500	194

Source: JICA Mission Team



Source: JICA Mission Team

Figure A2.3.15 Current WASA-F Water Tariffs in the Survey Area

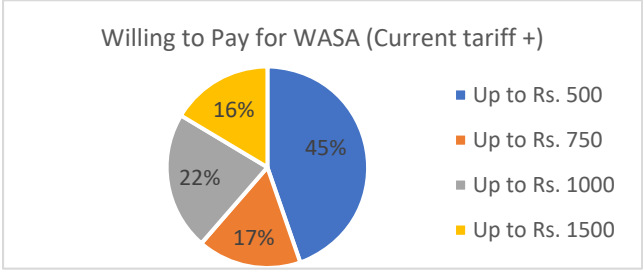
m) Willingness to Pay for WASA-F Supply

JMT conducted survey activities in the survey areas every day. Residents observing the activities recognized their potential utility in improving water services. This encouraged participation, and the rate of responses indicating a willingness to pay for future water services was higher than expected. The table below shows potential water bills and the number of respondents willing to pay in each price range.

Up to PKR 500	177/600
Up to PKR 750	66/600
Up to PKR 1000	88/600
Up to PKR 1500	65/600

Source: JICA Mission Team

Note:
These figures are a sampled value obtained by interview survey in the survey area.



Source: JICA Mission Team

Figure A2.3.16 Willingness to Pay for WASA-F Water Supply sampled in the Survey Area

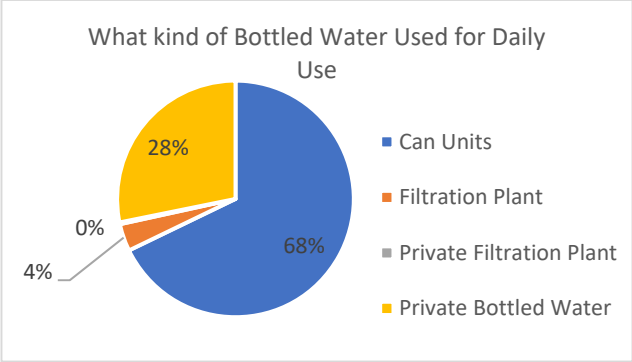
n) Bottled water

The following summarizes the status of expenditure on bottled water.

Can Units	272
Filtration Plant/WASA Free Water station	15
Private Filtration Plant	1
Private Bottled Water	113

Source: JICA Mission Team

Note:
These figures are sampled values obtained by the interview survey in the survey areas.



Source: JICA Mission Team

Figure A2.3.17 Types of Water Purchased for Daily Use

The following figures show the various sources and forms of "bottled water."

Can unit 19 L = PKR 15~30

Filtration plant 1 L = PKR 1~2

Public Pump: Free

Private Bottled Water 19 L = PKR 50 ~ 200

WASA-Water Station: Free

Source: JICA Mission Team

Figure A2.3.18 Types of Water Available for Purchase

o) Water and Sanitation

In previous inquiries conducted by JMT, customers considered water a factor in disease. In the water quality survey conducted directly by JMT within the survey area (with PAC Chlorine test), residual chlorine could not be confirmed in any of the pilot areas except Madina Town. Customer awareness and customer impressions of water were investigated. Customers tended to use only bottled water for drinking. Though very expensive compared with WASA-F tap water, bottled water is indispensable for avoiding illness and the inconvenience of the unstable water supply.

The same survey also confirmed that Madina Town has particularly poor service, as no residual chlorine could be detected. Overall, about 80% of customers consider bottled water reliable drinking water.

Table A2.3.25 Survey Responses to the Question, "Which Type of Water is Safer to Drink?

Area	Water Used for Drinking		Percentage	
	Private Bottles/Cans	WASA Tap Water	Private Bottles/Cans	WASA Tap Water
Sarfraz Colony	142	6	96%	4%
Sitara Sapna City	122	20	86%	14%
Madina Town	180	1	99%	1%

Source: JICA Mission Team

a) Waterborne Diseases

Illnesses caused by water are often remembered for many years. The questionnaire surveyed any illnesses thought to have been caused by water within the last year. On the whole, about 30% of respondents stated that their health had been affected by water. Some survey areas have serious problems. Given how the WASA-F water is used, however, groundwater contamination is another potential cause of illnesses.

Table A2.3.26 Survey Results to the Question: Has Anyone in Your Family Suffered from a Waterborne Disease in the Last Year?"

Area	Answer			Percentage		
	Yes	No	Don't Know	Yes	No	Don't Know
Sarfraz Colony	1	192	7	1%	96%	3%
Sitara Sapna City	7	137	6	5%	91%	4%
Madina Town	1	192	7	1%	96%	3%

Source: JICA Mission Team

b) Solid Waste

The processing method for garbage disposal is different in each area. The differences are thought to stem from differences in the functionality of the community organizations in the areas. Localities where the communities take measures against solid waste and unpleasant odors from drainage channels and sewers have relatively high revenue, even water and sewer / drainage tariff. Sharing information on garbage dumping process with local communities and local societies will be necessary and can be expected to have beneficial effects.

Table A2.3.27 Survey Responses to the Question, "Where Do You Dispose of Your Garbage?"

(Unit: house)

Area	Designated Garbage Collection Place	Street Nearby	Drainage Channels/Sewers	Local Dump Sites
Sarfraz Colony	180/200	0/200	0/200	0/200
Sitara Sapna City	46/200	0/200	1/200	103/200
Madina Town	197/200	3/200	0/200	0/200

Designated Place: Districts with established repositories under their administrative control
Source: JICA Mission Team

p) Sewerage

Customers expect much service improvement from WASA-F. There are many claims about sewage service from customers.

a) Connection to the WASA-F Sewer Line

The sewerage connection rate is 100%. Unlike water supply services, there are no other options available to sewerage service customers. Customers are aware of the sewerage services and use them, but have many complaints.

Table A2.3.28 Survey Responses to the Question, "What Kind of Sanitation Facilities Do You Use at Your House?" (Unit: house)

Area	Sewer Line	Septic Tank	Open Drain
Sarfraz Colony	180	0	0
Sitara Sapna City	150	0	0
Madina Town	200	0	0
Total	530	0	0

Source: JICA Mission Team

b) Issues Related to Sewerage

The survey also identified large differences between districts in wastewater overflow. The problem seems to be related to the garbage collection conditions.

Table A2.3.29 Survey Responses to the Question, "Do You Ever Experience Wastewater Overflow from the Sewer Pipeline or Rainwater Flooding due to Poor Drainage?"

Area	Answer	
	No	Yes
Sarfraz Colony	23	153
Sitara Sapna City	131	8
Madina Town	61	139
Total	215	300

Source: JICA Mission Team

q) Comments from Customers

The fundamental service of a water utility operator is to supply safe water 24/7. Since the birth of Faisalabad City, WASA-F has supplied water for only 6 hours a day, forcing citizens to live with intermittent water supply. Dependence on groundwater has become not only commonplace, but essential

for performing daily activities. A future where safe water is constantly available without pumps is difficult to imagine for most WASA-F customers. A great many WASA-F staff even have difficulty imagining such a situation. Therefore, there was a difference from customer requests and previous JICA reports. The following summarizes comments from customers during the survey.

Sarfraz Colony**:**

- Rehabilitate the existing line. More regular supply. Improve the sanitation system.
- Improve the water quality. Properly clean the sewerage lines.
- Supply water 24/7 a day. More consumption of soap for washing clothes. People should not use suction pumps. The government must take special action against people who do so.
- Consumers agree to have regular WASA connections if WASA provides them with clean water for drinking.
- Willing to pay more if the water quality and pressure are good. Major problems arise from industries.

Sitara Sapna City

- The smell in the water should be treated.
- Make the water drinkable.
- WASA should start marketing bottled water.
- The M/P should be advertised on the WASA-F Website.
- WASA should build a main tank and make it accessible to the public.

Madina Town

- Make the water drinkable. Install new pipelines for the project.
- Supply clean water with proper pressure.
- WASA should provide water for 24/7.
- WASA never responds to complaints. This must mean that WASA itself doesn't use WASA Water.
- WASA should take the steps necessary to send out fair invoices.

7) Customer Survey for Commercial & Industrial Sector

1) Revision of Commercial & Industrial Water Tariffs

Commercial and Industrial water tariffs were raised in the tariff revision of October 19th, 2016. The revisions were applied in November. The commercial and industrial tariffs differ from the domestic tariffs, with revenue recovery rates of 80% ~ 90% according to WASA-F. A significant increase in revenue is expected since a 25% hike in the tariff has been put into effect. Many large factories, however, still rely on sources other than WASA-F supplied water. Many also chose not to cooperate with this survey.

Table A2.3.30 Comparison of Industrial & Commercial Revenue Before and After Tariff Revision

Date	Monthly Revenue (PKR)	Collection Ratio (%)	Remarks
Aug, 2016	1,000,000	80~90	Collection Ratio is good
Dec, 2016	1,250,000	75~80	Income is good

Source: JICA Mission Team

2) Water Supply District in WASA

Connection to WASA-F was possible at the locations of 93 commercial and industrial customers investigated in the survey. Water services were also lacking or absent in some areas of the industrial belt.

Table A2.3.31 Water Supply Conditions for Commercial & Industrial Customers (Unit: No. of Customers)

Category	Existing Water Supply Area	Non-Distribution Area
Commercial	69	1
Industrial	24	6
Total	93	7

Source: JICA Mission Team

3) Category of Company

Textile factories operate in many areas of the Faisalabad Urban area.

Table A2.3.32 Types of Industry on the WASA-F Connection (Unit: No. of Customers)

Category	Restaurant	Textile Factory	Manufacturing	Hotel	Retail Shop	Other
Commercial	37	0	0	1	6	26
Industry	0	18	4	0	1	7

Source: JICA Mission Team

4) Main Types of Consumption in Daily Use

As with domestic users, most WASA-F water is used for washing and direct drinking.

Table A2.3.33 Daily Consumption by Usage (Unit: No. of Customers)

Category	Washing/Dish Washing	Bleaching/Printing	Processing	Dying	Other
Commercial	38	0	0	0	0
Industry	3	2	5	4	4

Source: JICA Mission Team

5) Water Sources

More than half of the facilities rely completely on groundwater. Many others use groundwater in addition to WASA-F water. While abundant amounts of drainage are suspected, inaccurate records on intake volumes make the actual drainage levels difficult to estimate. The influence on sewage is expected to be very high impact.

Table A2.3.34 Various Water Sources (Unit: No. of Customers)

Category	WASA	WASA & Groundwater	Neighbor Sharing	Groundwater	WASA Bottled Water	Other
Commercial	7	7	6	41	4	5
Industry	1	11	0	18	0	0
Total	8	18	6	59	4	5

Source: JICA Mission Team

6) Water Reservoir Condition

Many facilities are equipped with reservoirs to get water. Most are also increasing groundwater usage by using tanks with capacities of greater than 10 tons to obtain water for industrial activities.

Table A2.3.35 Water Reservoir Installation (Unit: No. of Customers)

Category	Ground Reservoir/OHR present?				
	Don't Know	No	Yes	Capacity <1000 L	Capacity >1000 L
Commercial	13	20	50	30	7
Industry	0	0	30	7	23

Source: JICA Mission Team

CHAPTER A3 LAWS, REGULATIONS, AND POLICIES

The water supply in Pakistan is maintained and regulated in provincial level with no national laws in place. The Punjab Municipal Water Act (Draft) 2014 was created to regulate the water supply in Punjab province but has not been enacted.

Regarding sewerage and drainage works, the Sewerage and Drainage Faisalabad Regulations enacted in 2015 clarify the relationship between users and business operators in particular.

This Chapter introduces the laws, regulations, and policies for water sources both in groundwater and surface water, water supply, sewerage and drainage, environmental and social considerations, and water quality relevant to the Project.

A3.1 Laws and Regulations on Groundwater

As a matter of customary law that is consistent with the principles of Islamic law, groundwater is owned by the person or entity that owns the land above it. In practice, the groundwater is owned by the person who operates the pump.

Water in the Indus Basin canal irrigation system is considered state property until it enters a watercourse managed by a group of farmers, from which point the farmers own the water as common property. Water entering a private farmer's land becomes the property of the farmer.

Water resources indispensable for water supply, however, are regarded as public property. Related laws, collectively known as the Punjab Municipal Water Act 2014, have been devised and are in the draft stage. According to these laws, water resources required for urban water supply is principally public property and subject to protection by the government, even in the cases described in the previous paragraph.

Groundwater yield increased significantly in the 1980s due to the rapid installation of private tubewells. The government introduced various regulations in the 1990s including "a licensing system" to restrict the installation of private tubewells in areas where groundwater tables were rapidly falling and groundwater quality was deteriorating.[7] The licensing system against tubewell installation derived from the "Punjab Soil Reclamation Act, 1952." A license can be received after notification and registration to the board of directors organized under this law.

Yet even with enforcement, these systems have proven to be ineffective. In Punjab Province, the groundwater level has gradually risen through seepage from the canal-bed after the construction of the LCC network in the late 1800s. Agricultural lands have been waterlogged and salinized to hazardous levels as a result. To prevent these problems, the government sought to decrease groundwater levels by encouraging the installation of tubewells through tax incentives and subsidies.

Noticeable declines in the groundwater level from the mid-1990s (especially in the freshwater zone) prompted the government to study the following items with the assistance of the World Bank, in order to prepare a groundwater regulatory framework for Punjab for sustainable groundwater development and capacity-building of the official staff.[8]

[7] Drivers of groundwater use and technical efficiency of groundwater, canal water, and conjunctive use in Pakistan's Indus Basin Irrigation System: Dawit Mekonnen, Afreen Siddiqi & Claudia Ringler; International Journal of Water Resources Development, ISSN: 0790-0627 (Print) 1360-0648 (Online) Journal homepage: http://www.tandfonline.com/loi/cijw20.

[8] Document of The World Bank: Report No. 15207-PAK, STAFF APPRAISAL REPORT PAKISTAN PUNJAB PRIVATE SECTOR GROUNDWATER DEVELOPMENT REJECT JUNE 13, 1996.

- Enhanced institutional capacity in groundwater monitoring
- A more refined set of regulatory requirements
- Assessments of safe exploitation levels and the allocation of rights
- Staff training,
- Technical competence,
- Organizational arrangements for the implementation of regulatory functions

The following is a description of the effective use of groundwater from the ADB Report[9] of August 2006 for the Punjab Irrigated Agriculture Development Sector Project.

The lining of canal prisms in areas underlain by fresh groundwater is not justified; only canals in saline groundwater areas will be lined. The conjunctive use of groundwater with surface water has been fundamental in the expansion of the agricultural economy. Without THE introduction of a sound, sustainable, and well-founded groundwater management framework, these benefits may be lost as groundwater levels continue to fall (the water table is falling at a rate of about 0.3 m or 1 ft/year) due to over pumping or as the water quality condition of the aquifer continues to decline. The necessary responses are to establish a groundwater management system with data management and resource assessment mechanisms and to use groundwater and surface water in an integrated fashion.

According to the ADB report, water use for agriculture is to be carried out under the direction of committees for water use and irrigation called Warabundi, and fixed-turn, 7-day rotations are practiced at the watercourse level. The farmers currently allowed to use the canal supply only on a reduced basis must therefore use groundwater under this system. Farmers in fresh groundwater areas may use canal water and pumped water for different parts of their landholdings. In saline groundwater areas, farmers either mix canal water with pumped water or irrigate alternately.

The following sections summarize the laws and regulations related to the groundwater at present.

(1) Canal and Drainage Act

This Act was issued in 1873 and amended in 2006 and 2016.

The Canal and Drainage Act, a major legislation governing water, provides the legal framework for water management in the agricultural sector. The Act allocates considerable administrative and judicial authority to irrigation department officials while providing almost no terms for public accountability. The Act mandates a fixed-time rotational irrigation schedule. The Act provides for collective punishment for possible individual acts of sabotage of irrigation infrastructure, giving absolute administrative and judicial authority to irrigation department functionaries to adjudicate disputes. The Act legally mandates sufficient water delivery to sustain a 64% cropping intensity. With regard to the coexisting use of groundwater and canal flowing water for irrigation, the Act overlooks engineering matters such as mechanisms for the integrated use of surface water and groundwater, the water quality, and so on.

(2) Punjab Development of Cities Act, 1976

This law gives the Development Authority of each city strong rights regarding the use of groundwater resources. It prohibits the construction of tubewells for commercial purposes without the authorization of the board of directors. When tubewell construction is permitted, the users are charged for groundwater uses. Aquifer charges in units of cusecs are imposed on the tubewells of industries, textile processing plants, and government-related agencies. Penalties are imposed to increase compliance with the law.

[9] ADB Technical Assistance Consultant's Report: Project Number: 37231, August 2006; Islamic Republic of Pakistan: Preparing the Punjab Irrigated Agriculture Development Sector Project (Cofinanced by the Japan Special Fund, the Government of the Netherlands, and the Cooperation Fund for the Water Sector).

(3) PIDA (Punjab Irrigation and Drainage Authority) Act

PIDA is an Authority founded by a provincial Act issued in June 1997. The Authority is provided for the purpose of carrying out institutional reform of the irrigation sector focused on the supply of sustainable irrigation water to farmers (physically and financially), the encouragement of farmer participation in the establishment of funds and governance, and irrigation system management through private partnerships. The contents of the PIDA Act is to exercise all the powers under the Canal and Drainage Act described above, and the Soil Reclamation Act 1952 and any other law for the time being in force relating to the subject matter of these Acts.

With respect to groundwater-related matters, the rights vested in the Authority can be likened to the following.

- Adjustment and institutionalization with respect to the water level and water quality monitoring, data compilation on the same, etc., together with the measurement and recording of the surface water flow-rate, monitoring of water table and quality of the groundwater, and appropriate cooperation with other provinces regarding similar tasks.
- General water resources control in the Province: preparing efficient schemes for public purposes regarding the use of all rivers, canals, drainage canals, small rivers, hill torrents, fountains, lakes, reservoirs (excluding WAPDA supervising facilities), and groundwater resources under the Indus Water Treaty (1960)[10] and the Water Apportionment Accord (1991)[11].

(4) Punjab Private Housing Schemes and Land Subdivision Rules 2010

When the installation of tubewells is planned in Housing Schemes and/or Farm Housing Schemes, etc., or when WASA or other agencies so request, the owner of tubewells is supposed to inform those agencies of details of the plan, such as the quantity, capacity, design, connection/distribution method, drilling record, installation of machinery, etc.

(5) Punjab Municipal Water Act (Draft), 2014

An Act was formed to recognize, regulate, and manage present and future municipal water in Punjab. As of this writing, the Punjab Municipal Water Act has not yet come into force.

“Whereas, water is a natural resource essential for the sustenance and enjoyment of life and an economic commodity, and also in recognition of the Government’s overall responsibility and authority for water resources and their use, including the equitable allocation of safe drinking water, the promotion of sustainable management of municipal water for public benefit, the protection of the quality of water resources, it is expedient to provide an integrated and comprehensive regulatory framework for the municipal water supply and sanitation services and to establish rights of access to basic water supply and basic sanitation, and to ensure conservation of water resources in the Province.”

Groundwater: Notwithstanding anything to the contrary contained in the Punjab Irrigation and Drainage Authority Act 1997 or any other law in force for the time being, all groundwater used or to be used for municipal purposes in the urban areas shall be vested in the Government and regulated by the Punjab

[10] Indus Water Treaty：The Indus Waters Treaty is a water-distribution treaty between India and Pakistan, brokered by the World Bank (then the International Bank for Reconstruction and Development).

[11] Water Apportionment Accord: APPORTIONMENT OF THE WATERS OF THE INDUS RIVER SYSTEM BETWEEN THE PROVINCES OF PAKISTAN; the 21st of March, 1991 will go down in the history of Pakistan as the day of a pivotal breakthrough in Pakistan’s leap towards the 21st century and as a turning point in Pakistan’s march towards national consolidation. A dispute that had been festering on this part of the subcontinent for seventy years was unraveled on that day. As a follow-up to the meeting of the Chief Ministers at Lahore on March 3, 1991, a meeting of the representatives of the four provinces was held at Lahore on March 4, 1991. Another meeting was held at Karachi on March 16, 1991. The list of participants is attached.

Municipal Water Commission. Further, the following items are assumed to be targets of protection in relation to groundwater.

1) Any watershed or any area of land adjacent to any surface water or overlying any groundwater may be declared by the Government as a protected area. Groundwater extraction will be prohibited in these protected areas and in other areas already designated by the Environment Department as Environmentally Sensitive Areas. All watershed or any area or land adjacent to any surface water or overlying any groundwater may be declared as protected area by the Government.

2) Regulations may be promulgated by the Commission to prohibit or control any activities by the owners or occupants within the protected area that may damage or degrade the surface water or groundwater or interfere with the investigation, use, control, protection, management, or administration of such water.

A3.2 Laws and Regulations on Surface Water

The following laws and regulations deemed to be related to surface water development have been collected and carefully reviewed. The main points of each law/regulation with regard to surface water development are cited below.

(1) The Canal and Drainage Act, 1873

Regulations are provided regarding the use and control, for public purposes, of the water of all rivers and streams flowing in natural channels and lakes, sub-soil water, and other natural collections of still water. The Provincial Government is entitled to use and control the water for public purposes. Regarding the transfer of rights to use canal water use, the Act requires that permission be obtained from the superintending canal officer. The superintending canal officer is defined as an officer exercising general control over a canal or portion of a canal.

(2) The Indus Water Treaty, 1960

Regulations for the management of rivers flowing through Pakistan and India are stipulated between the Government of Pakistan and the Government of India. Two matters are noteworthy in this regard: 1) all the water of the Eastern Rivers (The Sutlej, The Beas, and The Ravi) shall be available for unrestricted use by India, barring exceptions provided in the Article of the Treaty, and 2) Pakistan shall receive for unrestricted use all waters of the Western Rivers (The Indus, The Jhelum, and The Chenab), and India shall be under the obligation to let all such waters flow, unless such water is subject to certain objectives of use.

(3) The Water Accord, 1991

The Water Accord of 1991 establishes terms for the apportionment of the waters of the Indus river system, as agreed between the provinces of Pakistan. Concrete distributional water figures are described for each province in the periods (cropping seasons) known as Kharif (April to September) and Rabi (October to March). In Punjab Province, the apportionments are set at 37.07 MAF (million feet per acre) of water in Kharif and 18.87 MAF of water in Rabi, the equivalents of about 48% and 51% of total the accepted water of the Indus River System in each period, respectively. The Accord also mentions that 1) there are to be no restrictions preventing the Provinces from undertaking new projects within their agreed shares, and 2) the provinces are to have the freedom within their allocations to modify system-wise and period-wise uses.

(4) The Punjab Irrigation and Drainage Authority Act, 1997

This act is expedient to the following purposes: to establish the Punjab Irrigation and Drainage Authority as a body to implement the Government of Punjab's strategy focused on streamlining the Irrigation and

Drainage System; to replace the existing administrative setup and procedures with more responsive, efficient and transparent arrangements; to achieve economical and effective operation and maintenance of the irrigation, drainage, and flood control system in the Province; to make the irrigation and drainage network sustainable on a long-term basis and invite the participation of beneficiaries in operation and management. To effectuate the schemes to be prepared under this Act in relation to public purposes, the Act stipulates that the Authority is to have control over all the rivers, canals, drains, streams, hill torrents, public springs, natural lakes, reservoirs and underground water resources within the Province.

A3.3 Laws and Regulations on Water Supply

The water supply in Pakistan is maintained and regulated in provincial units with no national laws in place. The Punjab Municipal Water Act (Draft) 2014 was created to regulate the water supply in Punjab province but has not been enacted. This law prescribes the establishment of a commission independent from the state government and measures to strengthen the operation of water supply projects. In parallel with works to strengthen the operation of the water supply business, the province needs to establish and promptly activate the law. Meanwhile, a set of Water Supply Faisalabad Regulations clarifying relationships with customers was enacted in 2015. The content of these regulations must be strictly applied.

(1) Punjab Municipal Water Act (Draft) 2014

There are no laws or acts governing water supply at the national or provincial level in Pakistan. As for groundwater control, only a customary law and principles of Islamic law are available.

The Punjab Municipal Water Act was drafted in 2014 to recognize, regulate, and manage present and future municipal water in Punjab, that is, to supply safe water to 90 million inhabitants in Punjab. In defining municipal water, this Act declares that the use of water for drinking purposes shall take precedence over other water uses. The Act proposes the establishment of Punjab Municipal Water Commission by the Punjab Government, a body which is to have the responsibility for regulating the conservation, protection, utilization, exploitation, and development of municipal water resources and the regulation of all municipal water services. The Commission shall consist of the following members:

- Secretary to the Government, Local Government, and Community Development & Community Development Department;
- Secretary to the Government, Housing and Urban Development Protection Department;
- Secretary to the Government, Environment Protection Department;
- Secretary to the Government, Irrigation Department;
- At least four professional members in the field of water resource management, water supply, and sanitation or environmental and public health engineering;
- Two members of the Provincial Assembly (one from a rural area and one from an urban area);
- Executive Director of the Commission

As of this writing, the Water Act remains in draft form. The Punjab Government seems to have little interest in legislating it.

(2) Water Supply Faisalabad Regulations – 2015

The Faisalabad Development Authority (Water and Sanitation Agency) established the Water Supply Faisalabad Regulations – 2015, a legislation that provides the necessary rules in the space between the Agency and the users. The contents of this Regulation are as follows:

Part 1 Definitions
Part 2 Application and general Provisions

Application for Installation, Main Stop Valve Required, Average Consumption for Users with Damaged/No Meters, Payment of Bills, Responsibility for Water Service Installation, etc.

Part 3 Installation and Maintenance of Service
Water Supply and Pressure, Service in Good Order, Restriction on Work and Water Usage, Pump Directly Connected (prohibited), etc.

Part 4 Specification for the Laying of Water Supply Pipes and Fittings
Part 5 Specification of Material
Part 6 Protective Measures
Part 7 Tests
Part 8 Additional Instructions

A3.4 Laws and Regulations on Sewerage and Drainage

With the exception of the environmental laws described later, most aspects of the legal system in the field of sewerage works were originally prescribed by the Canal and Drainage Act enacted in 1873. This law applies not only to canals, but also to water use and environmental conservation in public waters. Violations of the law incur penalties in some instances. Regarding rainwater drainage in particular, the law remains the basis for laws in effect today. Regarding sewerage works, the Sewerage and Drainage Faisalabad Regulations enacted in 2015 clarify the relationship between users and business operators in particular. Some provisions, however, are not strictly applied in practice. For example, in case of industrial wastewater control as an example, relevant provision is not applied because of the lack of the organizational structure and the creation of guideline/manual to control them, and so it is required to establish them for strict application of the regulations.

(1) The Canal and Drainage Act, 1873

The Canal and Drainage Act 1873 granted entitlements to use and control for public purposes the water of all rivers and streams flowing in natural channels and all lakes, sub-soil water, and other natural collections of still water. It has been expedient, however, to amend the law in relation to irrigation, navigation, and drainage. This Act prescribes the following: the use of water for public purposes such as water supply and construction and maintenance works, water rates, canal navigation, drainage, prohibitions and controls regarding the discharge of effluent into canals and drainage works, the management of subsoil water, the obtainment of labor for canals and drainage works, jurisdiction, offences and penalties, and subsidiary rules.

(2) Sewerage and Drainage Faisalabad Regulations – 2015

The Faisalabad Development Authority (FDA) established the Sewerage and Drainage Faisalabad Regulations – 2015, a set of regulations that provide the necessary rules between the Agency and users. The contents of this Regulation are as follows:

Part 1 Definitions
Part 2 Application and General Provisions
To apply for installation, an entity needs to obtain the written permission of the Agency and the approval of the property owner, and so on.

Part 3 Installation and Maintenance of Waterborne Sanitary Services
The owner or occupier of any premises is obliged to maintain the sanitary installation and drainage installations in a proper state of repair, in good working order, and in good overall conditions.
No waterborne sanitary installation should connect into any surface drain, stormwater channel, or irrigation water channel.

Part 4 Specification for the Construction of Waterborne Sanitary Installations
Part 5 Specification of Material
Part 6 Stormwater Drainage and Sewage

The connection of sewage water with any storm drain and the discharge of sewerage water on open land are prohibited.

The use of sewage for irrigation without paying revenue to the Agency shall be theft of public property. Moreover, sewage cannot be used for growing vegetables. The Agency reserves the right to sell sewage for irrigation use.

Part 7 Protective Measures

All materials, pipes, fittings and apparatus shall be approved by the Engineer.

Part 8 Industrial Wastes

Part 9 Additional Instructions

A3.5 Laws and Regulations on Environmental and Social Considerations

3.5.1 Legal Framework for Environmental and Social Considerations

After the 18th Amendment of the Constitution was resolved, the responsibility for environmental protection shifted from the Federal Ministry of Environment to the Provincial Governments. Federal and provincial policies and legislation related to environmental and social considerations are listed in **Table A3.5.1**.

Table A3.5.1 Laws and Regulations on Environmental and Social Considerations

Category	Title
Environmental Protection (Federal)	Pakistan Environmental Protection Ordinance, 1983
	National Conservation Strategy, 1992
	Pakistan Environmental Protection Act (PEPA), 1997
	National Environmental Quality Standards (NEQUS), 2000
Environmental Protection (Punjab)	Punjab Environmental Protection (Amendment) Act, 2012
	Punjab Environmental Quality Standards (PEQS), 2016
IEE/EIA	Pakistan Environmental Assessment Procedure, 1997
	Guidelines for the Preparation and Review of Environmental Reports, Government of Pakistan, 1997
	Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations, 2000
Land Acquisition and Resettlement	Land Acquisition Act (LAA), 1894
	Punjab Land Acquisition Rules, 1983
	Project Implementation and Resettlement of Affected Persons Ordinance, 2001

3.5.2 Laws and Regulations on Environmental Protection

Legal developments and policy decisions for environmental protection have been promoted in Pakistan from the late 1970's. A summary of the major laws and policies follows.

1) Pakistan Environmental Protection Ordinance, 1983

The Pakistan Environmental Protection Ordinance is the first ordinance with a specialized focus on environmental protection in Pakistan. The Federal Environmental Protection Agency was founded in 1984 after the issuance of this ordinance. According to the ordinance, deliberations on Pakistan's environmental policy in the latter half of the 1980s led to the drafting of the National Conservation Strategy in 1992. In addition, the county environmental protection offices were established in accordance with this ordinance at this time.

2) National Conservation Strategy, 1992

The National Environmental Conservation Strategy, 1992 is a fundamental policy document for environmental problems in Pakistan approved by the Pakistan government. This Strategy consists of 14 key subsidiary strategies to be carried out over a 10-year period of planning and implementation. Some of the key strategies focus on:

- Maintaining the soil environment in upland fields
- Protecting the catchment environment
- Maintaining biodiversity
- Managing municipal waste
- Protecting cultural heritage

Rather than stating individual mitigation measures, the National Environmental Conservation Strategy enumerates the principles of protection, management, and conservation of the environment. The Biodiversity Action Plan was formulated based on the principles of this Strategy in 1992.

3) Pakistan Environmental Protection Act, 1997, PEPA 1997

Pakistan Environmental Protection Act, 1997 (PEPA 1997) is a comprehensive environmental protection law enacted in place of the earlier Pakistan Environment Protection Ordinance 1983. The Act provides a framework for the implementation of the upcoming National Environmental Conservation Strategy, 1992. The objectives of the Act include the following: protection and conservation of species, habitats of wildlife and biodiversity; conservation of renewable resources; establishment of air quality, water quality, and soil quality standards; establishment of environmental courts and appointment of environmental judges; the provision of implementation of the IEE and EIA; promotion of residents' education and awareness through mass media on environmental issues.

PEPA 1997 authorizes the government to compose laws and regulations for environmental protection and deals with a wide range of environmental problems such as air, water, soil, sea area, noise, hazardous waste. It also stipulates penalties for violations of its own articles.

4) National Environmental Quality Standards, 2000, NEQS

The National Environmental Quality Standards, 2000 (NEQS) are standards established to control environmental pollution and have been enacted for domestic wastewater, factory wastewater, factory exhaust gas, noise and gas emissions from automobiles, and drinking water. The NEQS were issued in 1993 and revised in 1995 and 2000.

5) Punjab Environmental Protection (Amended) Act, 2012

The Punjab Environmental Protection Act, 1997 (Amended 2012) is comprehensive legislation that provides the legislative framework for the protection, conservation, rehabilitation and improvement of the environment. The Act defines the environment as follows: (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities, and works; (f) all social and economic conditions affecting community life; and (g) the interrelationships between any of the factors specified in sub-clauses (a) to (f).

The notable points of the law are:

- No proponent of a Project shall commence construction or operation unless the proponent has filed an EIA with the Provincial Agency designated by the Provincial EPAs and has obtained approval;
- Establishment and formation of the Punjab Environmental Protection Council;
- Prohibition of certain discharges and emissions;
- Punjab Environmental Quality Standards (PEQS) for wastewater, air emissions and noise; and
- The Provincial Government can issue notices and enforce them to protect the environment.

In the recent amendment of 2012, the federal government grants legislatives powers related to the environment and ecology to the provincial governments. The provinces are required to enact their own legislation for environmental protection. The Government of Punjab is in the process of drafting new provincial rules and regulations for the environment. Other amendments include increases in the penalties for violations. The amended amounts of penalties are described in the Punjab Environmental Protection (Administrative Penalty) Rules 2013. The penalty for excessive emission of pollutants or importation of hazardous wastes, for example, was increased from a minimum of PKR 1,000 to PKR 10,000 for every day the contravention continues.

The Environmental Protection Department (EPD) / Environmental Protection Agency (EPA) and Government of Punjab (GOPb) are the concerned authorities of the Project. It is an important task that this Act functions properly for improvement of environmental administration.

6) Punjab Environmental Quality Standards (PEQS), 2016

The PEQS, 2016 specify the following standards:

- Maximum allowable concentrations of pollutants in municipal and liquid industrial effluents discharged into inland waters, sewage treatment facilities, and the sea.
- Maximum allowable concentrations of pollutants (16 parameters) in gaseous emissions from industrial sources.
- Maximum allowable concentrations of pollutants (two parameters) in gaseous emissions from vehicle exhaust and noise emission from vehicles.

PEQS have also been issued for drinking water, ambient air, exhaust and noise from motor vehicles, municipal and liquid industrial effluents, and treatment of liquids, and disposal of biomedical waste.

3.5.3 Laws and Regulations on Environmental Impact Assessment

1) Pakistan Environmental Assessment Procedure (1997)

The Federal Environmental Protection Agency published the following guidelines on the implementation of environmental assessment and environmental management of different development projects.

- Policies and procedures for document preparation, reviews, and approvals for environmental assessment, 1997
- Guidelines for preparing and reviewing reports on the environment, 1997
- Guidelines on consultations with inhabitants, 1997

(1) Guidelines for Preparation and Review of Environmental Reports, Government of Pakistan (1997)

The guidelines on the preparation and review of environmental reports specify the following for project proponents:

- The nature of the information to be included in environmental reports
- The minimum qualifications of the EIA conductors appointed
- The need to incorporate suitable mitigation measures at every stage of project implementation
- The need to specify monitoring procedures

TORs for the reports are to be prepared by the project proponents themselves. A report must contain baseline data on the project area, a detailed assessment thereof the project area, and mitigation measures.

(2) Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations (2000)

The Pakistan Environmental Protection Agency (Review of IEE/EIA) Regulations, 2000, a legislation developed by the Pak-EPA under the powers conferred upon it by the Act, provides the necessary details on the preparation, submission, and review of an IEE and EIA. One of the main components of the Regulations is categorization of the projects/schemes for an IEE and EIA. Projects/schemes have been classified on the basis of the expected degree of adverse environmental impacts. Project types listed in Schedule I are designated as potentially less damaging to the environment, while those listed in Schedule II are designated as having potentially serious adverse effects. Schedule I projects/schemes require an IEE to be conducted, provided they are not located in environmentally sensitive areas. For the Schedule II projects/schemes, conducting an EIA is necessary. In the case of a water supply facility and water purification plant construction project, for example, a project with a total cost of less than PKR 25 million is categorized as Schedule I of the Regulation, requiring an IEE, and a project costing more is categorized as Schedule II, requiring an EIA.

3.5.4 Laws and Regulations on Land Acquisition and Resettlement

(1) Land Acquisition Act (LAA), 1894

The concept of land acquisition was introduced by the British before independence. The Land Acquisition Act (LAA) 1894 was promulgated to govern the acquisition of private land for public purposes. The Act and successive amendments remain the primary laws of land acquisition in Pakistan through the exercise of the right of eminent domain. Land acquisition is the responsibility of the province, and the province may only transfer land to another entity after the province itself has acquired it. The rights of titled landowners are fully safeguarded under the Act. Land and crops are compensated in cash at the current market rate to the landowners. Specified formalities and notifications are required for entering private land or carrying out surveys and investigations. If affected persons are unsatisfied, they can contest the compensation in a Court of Law.

(2) Punjab Land Acquisition Rules, 1983

For the purposes of acquisition of land in the Province of Punjab, the government of Punjab has also framed the Punjab Land Acquisition Rules, 1983. In addition to the LAA, the 1983 Rules were published in the *Gazette of the Punjab Extraordinary*, setting out the procedure for land acquisition in accordance with provincial-specific conditions. These rules apply in Punjab Province.

(3) Project Implementation and Resettlement of Affected Persons Ordinance, 2001

Referred to as the “Resettlement Ordinance," this ordinance was promulgated in 2001 by the federal government for enactment by provincial and local governments after incorporating local requirements. The ordinance was developed as a document to supplement the LAA and other laws of Pakistan, and to conform with the resettlement policy wherever applicable. The ordinance establishes that the rehabilitation and resettlement of disrupted populations and the restoration of their livelihoods shall be done as a matter of right and not by way of charity or any such sentiment. Also, the Affected Persons (APs) shall be accepted as special groups who in the supreme interest of the country have accepted/undergone involuntary displacement.

A3.6 Water Quality Standards

3.6.1 Drinking Water Quality Standards

In 2008, the Ministry of Environment published National Standards for Drinking Water Quality (NSDWQ) in collaboration with Ministry of Health, World Health Organization (WHO), and UNICEF. Standard values for each parameter are shown in **Table A3.6.1**. As reference, guideline values of the WHO are also presented in **Table A3.6.1**. Regarding the standard for arsenic (As), note that the WHO provisional guideline of 0.01 mg/L has been adopted by many (more than 98) countries[12], whereas the value in Pakistan has been kept 0.05 mg/L.

Table A3.6.1a National Standards for Drinking Water Quality (NSDWQ)

	Parameter	Standard Values for Pakistan	WHO Guidelines (2011)	Remarks
	Bacterial			
1	E. Coli (Drinking water)	ND/100 ml sample	ND/100 ml sample	Most Asian countries also follow WHO Guidelines
	E. Coli (Treated water entering the distribution system)	ND/100 ml sample	ND/100 ml sample	
	E. Coli (Distribution system)	ND/100 ml sample	ND/100 ml sample	
	Physical			
2	Color	≤15 TCU	≤15 TCU	
3	Taste	Non objectionable/ Acceptable	Non objectionable/ Acceptable	
4	Odor	Non objectionable/ Acceptable	Non objectionable/ Acceptable	
5	Turbidity	<5 NTU	<5 NTU	
6	Total hardness as $CaCO_3$	<500 mg/L	---	
7	Total Dissolved Solids (TDS)	<1,000 mg/L	---	<1,000 mg/L (WHO guideline value in the year 1984)
8	pH	6.5-8.5	---	6.5-8.5 (the range recommended by WHO for the purpose of corrosion control in pipelines)

1) Indicates priority health-related inorganic constituents that require regular monitoring.
2) PSQCA: Pakistan Standards Quality Control Authority.
3) ND: Not Detected
4) Source: Pakistan Environmental Protection Agency (EPA)

[12] Report on regulations and standards for drinking water quality, compiled by David Drury, United Kingdom, Nov. 2013

Table A3.6.1b National Standards for Drinking Water Quality (NSDWQ)

	Parameter	Standard Values for Pakistan	WHO Guidelines (2011)	Remarks
	Chemical			
	Essential Inorganic	**mg/L**	**mg/L**	
9	Aluminum (Al)	≤0.2	0.2	
10	Antimony (Sb)	≤0.005(P)	0.02	
11	Arsenic (As)	≤0.05(P)	0.01	
12	Barium (Ba)	0.7	0.7	
13	Boron (B)	0.3	2.4	0.5 mg/L (WHO guideline value in the year 2004)
14	Cadmium (Cd)	0.01	0.003	Standard for Pakistan; similar to most Asian developing countries
15	Chloride (Cl)	<250	---	250 mg/L (the value recommended by WHO for the purpose of taste)
16	Chromium (Cr)	≤0.05	0.05	
17	Copper (Cu)	2	2	
	Toxic Inorganic	**mg/L**	**mg/L**	
18	Cyanide (CN)	≤0.05	--- (0.07, 2004)	Standard for Pakistan; similar to most Asian developing countries
19	Fluoride (F)[1)]	≤1.5	1.5	
20	Lead (Pb)	≤0.05	0.01	Standard for Pakistan; similar to most Asian developing countries
21	Manganese (Mn)	≤0.5	--- (0.4, 2004)	
22	Mercury (Hg)	≤0.001	0.006	0.001 mg/L (WHO guideline value in the year 2004)
23	Nickel (Ni)	≤0.02	0.07	0.02 mg/L (WHO guideline value in the year 2004)
24	Nitrate (NO_3) [1)]	≤50	50	
25	Nitrite (NO_2) [1)]	≤3(P)	3	
26	Selenium (Se)	0.01(P)	0.01	
27	Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	--	
28	Zinc (Zn)	5.0	---(levels above 3 mg/L may not be acceptable to consumers)	Standard for Pakistan; similar to most Asian developing countries
	Organic			
29	Pesticides mg/L	PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20- 58 may be consulted. [2)]		Pakistan Standard Specification for Bottled Drinking Water
30	Phenolic compounds (as Phenols) mg/L		≤0.002	
31	Poly-nuclear aromatic hydrocarbons (as PAH) g/L		0.01 (by the GC/MS method)	
	Radioactive			
32	Alpha emitters, Bq/L	0.1	0.5	
33	Beta emitters, Bq/L	1	1	

1) Indicates priority health-related inorganic constituents that require regular monitoring.
2) PSQCA: Pakistan Standards Quality Control Authority.
3) ND: Not Detected
4) Source: Pakistan Environmental Protection Agency (EPA)

3.6.2 Effluent Quality Standards

The National Environmental Quality Standards (NEQS) for Municipal and Liquid Industrial Effluents were published by the Ministry of Environment in 1993 and revised in 2000. **Table A3.6.2** shows the details of the updated NEQS for Municipal and Liquid Industrial Effluents.

Table A3.6.2 National Environmental Quality Standards (NEQS) for Municipal and Liquid Industrial Effluents[1,2] (2000)

No.	Parameter	Standards		
		Into Inland Waters	Into Sewage Treatment[3]	Into Sea[4]
1	Temperature increase[5]	=<3˚C	=<3˚C	=<3˚C
2	pH	6-9	6-9	6-9
3	Biochemical-Oxygen Demand (BOD)[6], mg/L	80	250	80[7]
4	Chemical oxygen demand (COD) , mg/L	150	400	400
5	Total suspended solids (TSS) , mg/L	200	400	200
6	Total dissolved solids (TDS) , mg/L	3,500	3,500	3,500
7	Grease and oil, mg/L	10	10	10
8	Phenolic compounds (as phenol) , mg/L	0.1	0.3	0.3
9	Chlorides (as Cl^-), mg/L	1,000	1,000	SC[8]
10	Fluorides (as F^-), mg/L	10	10	10
11	Cyanide total (as CN^-), mg/L	1.0	1.0	1.0
12	Anionic detergents (as MBAS)[9], mg/L	20	20	20
13	Sulfates (SO_4) , mg/L	600	1,000	SC[8]
14	Sulfides (S^-), mg/L	1.0	1.0	1.0
15	Ammonia (NH_3), mg/L	40	40	40
16	Pesticides[10], mg/L	0.15	0.15	0.15
17	Cadmium (Cd)[11], mg/L	0.1	0.1	0.1
18	Chromium (trivalent and hexavalent, Cr), mg/L	1.0	1.0	1.0
19	Copper (Cu)[4], mg/L	1.0	1.0	1.0
20	Lead (Pb)[4], mg/L	0.5	0.5	0.5
21	Mercury (Hg)[4], mg/L	0.01	0.01	0.01
22	Selenium (Se)[4], mg/L	0.5	0.5	0.5
23	Nickel (Ni)[4], mg/L	1.0	1.0	1.0
24	Silver (Ag)[4], mg/L	1.0	1.0	1.0
25	Total toxic metals, mg/L	2.0	2.0	2.0
26	Zinc (Zn) , mg/L	5.0	5.0	5.0
27	Arsenic (As)[4], mg/L	1.0	1.0	1.0
28	Barium (Ba)[4], mg/L	1.5	1.5	1.5
29	Iron (Fe) , mg/L	8.0	8.0	8.0
30	Manganese (Mn) , mg/L	1.5	1.5	1.5
31	Boron (B)[4], mg/L	6.0	6.0	6.0
32	Chlorine, mg/L	1.0	1.0	1.0

1. The dilution of liquid effluents with fresh water to adjust them to within the NEQS limits is not permissible before discharge into the environment.
2. The concentrations of pollutants in water used will be subtracted from the effluent in the calculations of the NEQS limits.
3. Applicable only when and where sewage treatment is operational and BOD = 80 mg/L is achieved by the sewage treatment system.
4. Provided the discharge is not at shore and not within 10 miles of mangrove or other important estuaries.
5. The effluent should not result in a temperature increase of more than 3˚C at the edge of the zone where the initial mixing and dilution take place in the receiving body. If no zone is defined, use 100 m from the point of discharge.
6. Assuming a minimum discharge dilution of 1:10, a lower ratio would invite the determination of progressively more stringent standards by the Federal Environmental Protection Agency. A 1:10 dilution means, for example, that a water body receiving 1 cubic meter of treated effluent would have to contain at least 10 cubic meter of water for dilution of the effluent.
7. The value for industry is 200 mg/L.
8. Discharge concentration at or below sea concentration (SC).
9. Methylene Blue Active Substances: assuming the surfactant is biodegradable.
10. Pesticides include herbicides, fungicides, and insecticides.
11. Provided that the total toxic metals discharge does not exceed the level given at No. 25.
12. Source: National Environmental Quality Standards

A3.7 Policies on Water Supply and Sewerage

3.7.1 Policies on Water Supply

(1) National Drinking Water Policy, 2009

The Ministry of Environment formulated a National Drinking Water Policy in 2009 to provide adequate quantities of safe drinking water to the entire population at an affordable cost in an equitable, efficient, and sustainable manner. The Policy aims to improve the quality of life of the people of Pakistan by reducing the incidence of death and illness caused by waterborne diseases. Toward this end, the Policy provides specific guidelines for increased access to safe drinking water, the protection and conservation of surface and groundwater resources, water treatment and safety, the standardization of appropriate technologies, community participation, public awareness, capacity development, public-private partnership, research and development, emergency preparedness and response, and coordinated planning and implementation. One of the objectives of the Policy is to provide access to a safe and sustainable drinking water supply to the entire population of Pakistan by 2025. The other objectives are related to the protection and conservation of water resources, the treatment and safety of drinking water, community participation, appropriate and cost-effective technological options, the capacity of related organizations at all levels, public-private-partnership, research and development, and inter-sectoral collaboration.

(2) Punjab Urban Water Supply and Sanitation Policy, 2007

The Punjab Urban Water Supply and Sanitation Policy was established by the Government of Punjab in 2007 with the intention to guide and support provincial institutions, District Governments, Tehsil Municipal Administrations, Water Utilities, and communities for improving water and sanitation services. This Policy is consistent with the National Sanitation Policy 2006 and National Environment Policy 2005. The vision of the policy is “Sustainable water and sanitation for all.” The goal of the policy is to provide sanitation services and water of optimal quality, in optimal quantities, on a sustainable basis. The objectives of the policy are to provide a legal, regulatory framework and efficient institutional arrangements for sustainable water supply, sanitation and wastewater treatment services, and to provide sustainable financing arrangements including Community Participation and Public Private Partnerships. The following key policy principles would be employed for achieving the objectives and policy measures; Sustainable Development, Community Participation, Social and Environmental Considerations, Capacity Building and Public Private Partnerships. The implementation of this policy is the joint responsibility of the Government of Punjab and the respective water utilities. To ensure effective coordination of policy implementation and oversee the progress in this regard, a “Punjab Urban Water & Sanitation Policy Implementation Committee” is to be established by the Government of Punjab at the provincial level. The following context is pointed out in this policy:

- Punjab’s total population is 86 million, out of which 27 million people are living in the cities.
- Groundwater is the main source of supply for most cities. The situation in Faisalabad City is less favorable.
- Varying levels of wastewater collection and drainage systems exist in each the cities. None of the cities, however, have complete provisions in place to cater to the total wastewater generated on their premises.
- Raw sewage in the cities is either used for irrigation purposes or discharged into fresh water bodies through drainage networks that ultimately feed into the rivers.

(3) Punjab Drinking Water Policy, 2011

The Punjab Drinking Water Policy was established in 2011 by the Government of Punjab to provide guiding principles under which the efforts of provincial and local authorities are to be planned and coordinated. This policy adopted the key principals outlined in the National Drinking Water Policy of 2009. The key policy principles to be highlighted are as follows:

- Water is a finite and essential resource, the use of which needs to be regulated and measured in order to avoid wastage and misuse.
- Drinking water allocation for domestic purpose will have priority over all other usages.
- Saving underground aquifers and surface water from contamination of all kinds will be given top priority through legislation/regulation as well as measures to increase public awareness.
- Public service provision institutions (WASAs, TMAs, and others) will follow a reform program based on tariff rationalization, reduced cost inefficiency, and improved service delivery.

Under this policy, the Government of Punjab is to enact the Punjab Municipal Water Act to provide a statutory, independent, institutional setup that will regulate the policy principles, standards, and performance of service delivery agencies in the light of this policy. This Act was to have been enacted and enforced by 2013. A draft of the Act was established in 2014, but little headway toward enactment has followed since.

3.7.2 Policies on Sewerage

(1) National Sanitation Policy, 2006

The National Sanitation Policy established by the Ministry of Environment in 2006 provides a broad framework and policy guidelines to the Federal, Provincial, and Local Governments for the enhancement and support of sanitation coverage in the country through the formulation of sanitation strategies, plans, and programs focused on improving the quality of life of the people of Pakistan and the realization of a physical environment necessary for a healthy life. This Policy seeks to reduce the proportion of people without sustainable access to improved sanitation by half by the year 2015 and to provide improved sanitation to 100% of the population by 2025. The specific objectives of the Policy are:

- To ensure an open, defecation-free environment; the safe disposal of liquid, solid, municipal, industrial, and agricultural wastes; and the promotion of health and hygiene practices.
- To link and integrate sanitation programs with city and regional planning policies, the health, environment, housing, and education.
- To facilitate access of all citizens to a basic level of services in sanitation, including the installation of sanitary latrines in every household and in important public places, as well as the installation of community latrines in densely populated areas.
- To promote Community-Led Total Sanitation (CLTS)
- To develop guidelines for the evolution of an effective institutional and financial framework.
- To enhance the capacity building of government agencies and other stakeholders at all levels for better sanitation, particularly sanitation effective in reducing the incidence of waterborne diseases.
- To develop and implement strategies for the integrated management of municipal, industrial, hazardous, and hospital and clinical wastes at the national, provincial, and local levels.

This Policy defines the Policy Measures as follows:

- Financing by the Government
- The Component Sharing Model will be adopted as a Sanitation model for all government schemes in the urban areas and villages of over 1,000 population. Developers will provide sewage and wastewater treatment facilities for large schemes where local-government-developed disposal is unavailable.
- For settlements with populations of less than 1,000, the government will mobilize communities, raise awareness, provide incentives to encourage the communities to build sanitary latrines and wastewater disposal systems, and promote hygiene and preventive health practices overall.
- Effluent Quality Monitoring
- Provincial Environmental Protection Agencies (EPA) will be responsible for monitoring the industrial and municipal effluent in accordance with the NEQS.

- Capacity Building

(2) Punjab Urban Water Supply and Sanitation Policy 2007

This topic is already covered in 3.7.1 (2).

A3.8 Policies on Environmental and Social Considerations

(1) National Environmental Policy, 2005

The National Environmental Policy, 2005 was formulated as a long-term framework for solving environmental problems Pakistan faces such as land water and seawater pollution, air pollution, inadequate waste management, deforestation, loss of biodiversity, progressive desertification, natural disasters, and climate change.

The National Environmental Policy 2005 shows the direction towards solving environmental issues in order to fulfil international obligations while clarifying the potential causes of environmental degradation and maintaining a focus on cross-sectoral environmental issues.

The goal and objectives of the National Environmental Policy, 2005 are as follows:

Goal: Protect, preserve, and restore Pakistan's environment to improve the quality of life of the people through sustainable development

Objectives:
- Conservation and recovery of environmental resources and proper management
- Integrate environmental considerations at the policy planning and planning stages
- Capacity Building of government agencies and stakeholders at all levels
- Efficient implementation of international obligations in line with international trends
- Raise the residents' awareness of environmental improvement through public relations and community mobilization

(2) Punjab Environmental Policy, 2015 (Draft)

Following the Pakistan Environmental Policy 2015, the Government of Punjab formulated the draft Punjab Environmental Policy, 2015. The latter policy provides guidelines to Provincial and Local Government in Punjab for addressing environmental concerns related at the provincial and local levels while ensuring the effective management, restoration, and enhancement of environmental resources and their sustainable use. The policy has been approved by the Punjab Environmental Protection Council headed by the Chief Minister Punjab under Section 4(b) of the Punjab Environmental Protection Act 1997 (Amended 2012) and is enforced with immediate effect.

(3) National Resettlement Policy (NRP), 2002

An important aspect of an environmental impact assessment is the relocation and resettlement of persons affected by the relevant development project. The resettlement policy has been drafted by the Ministry of Environment, Local Government and Rural Department with technical assistance from the ADB. At present the policy is in further draft stages at Pak-EPA and has yet to be approved. The policy will apply to all development projects involving adverse social impacts, including land acquisition, loss of income, loss of business, etc. The policy also aims to compensate for the loss of income to those who suffer loss of communal property such as common assets, productive assets, structures, other fixed assets, and income and employment, as well as loss of community networks and services, pasture, water rights, and public infrastructures such as mosques, shrines, schools, hospitals and graveyards.

(4) National Climate Change Policy, 2012

The National Climate Change Policy was launched by the Ministry of Climate Change in 2012, focusing on vulnerabilities of various sectors such as water, agriculture, forestry, coastal areas, biodiversity and other ecosystems. The policy provides a comprehensive framework for coping with the threats of climate change through appropriate adaptation and mitigation measures. Appropriate measures include flood forecasting warning systems, local rainwater harvesting, developing new resilient crops, health impact assessment of changing weather patterns, promotion of renewable energy and efficient transport systems. Also some measures relating to disaster preparedness; introduction of the climate change issue in higher education curricula; ensuring environmental compliance through IEE and EIA in the development process; addressing the issue of deforestation and illegal trade in timber; promoting Clean Development Mechanisms (CDM); and raising Pakistan's stance regarding climate change at various international forums, have also been incorporated as important components of the policy.

(5) National Disaster Risk Reduction Policy, 2013

The National Disaster Risk Reduction (DRR) Policy provides an overall guiding framework with the aim of creating a resilient nation. The policy lays special emphasis on risk assessment, prevention, mitigation and preparedness, covering both natural and man-made hazards. It seeks to promote priority measures to improve already existing vulnerability to hazards, and equally important measures to ensure future development processes and programs strengthening resilience. The policy comprises of four chapters: (1) Chapter 1 assesses risk awareness and preparedness in Pakistan, (2) Chapter 2 outlines the vision and principles of the National Disaster Management Authority (NDMA) for capacity development in Pakistan with a focus on vulnerable populations, (3) Chapter 3 explains the policy interventions of NDMA particularly for development in risk knowledge, mitigation and preparedness, (4) Chapter 4 explains the implementation framework of NDMA to mainstream DRR in Pakistan including plans for financing, monitoring and educating students on disaster preparedness.

(6) United Nations Sustainable Development Goals (UN-SDGs)

In 2015, the United Nations (UN) member states adopted the 2030 Agenda for Sustainable Development (the 2030 Agenda), setting universal goals and targets to ensure that no one is left behind. The 2030 Agenda established 17 Sustainable Development Goals (SDGs) and 169 global targets, relating to development outcomes and means of implementation (MOI), for the period 2015 to 2030. In the water and sewerage sector, the most relevant goal is SDG 6: Ensuring availability and sustainable management of water and sanitation for all. It reflects the increasing attention on water and sanitation issues in the global political agenda. The 2030 Agenda emphasizes rising inequalities, natural resource depletion, environmental degradation, and climate change. The sustainable and integrated management of freshwater resources and ecosystems is highlighted as prerequisite of social development and economic prosperity. SDG 6 includes 8 global targets which the government need to incorporate into national planning processes, policies and strategies based on the national realities, capacities, levels of development and priorities. They cover the entire water cycle including: provision of drinking water (target 6.1) and sanitation and hygiene services (6.2); treatment and reuse of wastewater and ambient water quality (6.3); water-use efficiency and scarcity (6.4); IWRM including through transboundary cooperation (6.5); protecting and restoring water-related ecosystems (6.6); international cooperation and capacity building (6.a) and participation in water and sanitation management (6.b).

List for these laws, regulations and policies relevant to the M/P is provided in **Appendix AA3.1, Lists for List for Laws and Regulations,** in the **Supporting Report**.

CHAPTER A4 DEVELOPMENT PLANS AND PROJECTS OF WASA-F

Since the initial M/P (1976) prepared by the Asian Development Bank, many donors have supported to WASA-F for development of the water supply, sewerage, and drainage facilities in Faisalabad City.

At present, many projects are being proposed and scheduled; however, some of them have been suspended on the way, or were withdrawn.

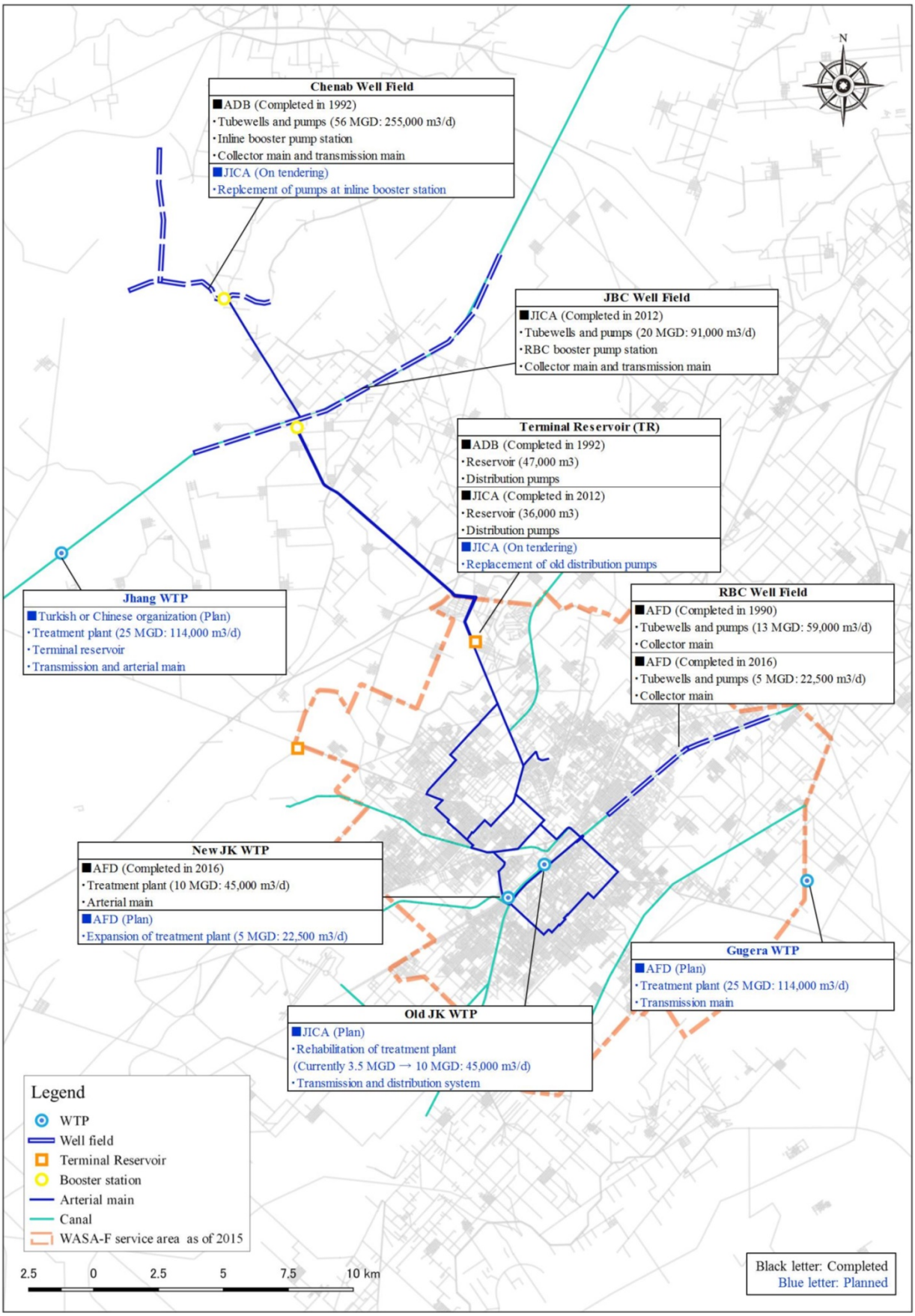
This Chapter introduces and consolidates the projects, which were implemented or under planning, by donors such as the Asian Development Bank, the World Bank, the French Development Agency, and Japan International Cooperation Agency, as of 2016.

A4.1 Plans and Projects Supported by the Asian Development Bank (ADB)

4.1.1 Faisalabad's Water Supply and Sewerage Master Plan (1976)

In 1975-76, the Asian Development Bank (ADB) prepared a master plan (M/P) to be completed over a 25-year period up to the year 2000. The plan was to be implemented in phases. The implementation of Phase-I was scheduled to be completed in 1980 but was delayed due to technical reasons. The water supply facilities based on Phase-I were finally completed in 1992 with the ADB's financial support. Under Phase-I, 25 tubewells were constructed for water supply for the city of Faisalabad from the Chenab Well-field running about 30 km northwest of the city. The result was a comprehensive water supply system encompassing a terminal reservoir and city water distribution trunk network (i.e., arterial mains) running a total length of approximately 45 km.

Figure A4.1.1 illustrates the locations of the water supply facilities developed or planned by the donors, namely, the ADB, French Development Agency, and JICA, after the preparation of the initial M/P (1976).



Source: JICA Mission Team

Figure A4.1.1 Locations of Water Supply Facilities Developed or Planned as of 2016

4.1.2 Pre-Feasibility Study for Urban Transport and Industrial Wastewater Management Faisalabad (2010-2011)

(1) Background

The vast majority of industrial effluent is discharged "raw" without any treatment into two main drains, namely, the Paharang Drain to the northwest and Madhuana Drain to the southeast. The Paharang Drain eventually discharges to the Chenab River and Madhuana Drain to the Ravi River. Both drains are managed by the Irrigation Department.

Wastewater produced by industries is conveyed by the public sewerage system and drains operated by WASA-F in its operation area and discharged to the drains operated by the provincial Irrigation Department. The only wastewater treatment plant in operation is designed for the treatment of domestic wastewater but treats both domestic and industrial wastewater by necessity. In total, this plant treats less than 10% of the domestic and industrial wastewater generated in the city.

The factories in the area produce very little solid industrial waste, and most that they produce is reused or recycled. The wastes generated from the hospitals, however, are hazardous and need improved systems and practices for treatment and disposal.

In order to improve the above situations, the City District Government Faisalabad (CDGF) requested Cities Development Initiative for Asia (CDIA) to provide technical assistance on projects in integrated urban environmental infrastructure covering urban transport and industrial waste management. A Pre-Feasibility Study (PFS) was implemented as a part of the technical assistance.

(2) Pre-Feasibility Study (PFS)

The PFS proposed two packages respectively consisting of the following sub-projects:

Package 1 (May 2010) consists of the following five sub-projects:

- Enhanced public awareness and training;
- Strengthened hospital waste management;
- Extension of the existing Chokera wastewater treatment plant;
- Establishment of an industrial wastewater management cell; and
- Construction of a combined wastewater treatment plant near Madhuana Drain.

Package 2 (May 2011) consists of the following two sub-projects:

- Construction of a treatment plant for Maqbool road and Sammadari road in the southern part of the City; and
- Construction of aeration weirs on both the Paharang and Madhuana drains.

The sub-projects on wastewater in packages 1 and 2 are outlined as follows in the report.

1) Enhanced public awareness and training:

The Project for the enhancement of public awareness and training would establish a center for environmental management and train textile engineers in cleaner design and production. The center would run training courses for staff from all of the relevant departments. A mass awareness campaign would also be introduced as another element of the project.

2) Extension of the existing Chokera wastewater treatment plant and Construction of a combined wastewater treatment plant near Madhuana Drain:

A project has been proposed to double capacity of the existing Chokera WWTP and establish a new WWTP of oxidation ponds system at the southern part of the City near Madhuana Drain. Through these proposed WWTPs development, an estimated 95 out of 183 MGD of wastewater would be treated by package 1. A further 20 MGD would be treated through the WWTP proposed in package 2.

(3) Establishment of an industrial wastewater management cell:

A project has been proposed to establish an industrial waste cell to ensure the implementation of regulation for the treatment of the waste produced by industries. Such a cell would help to improve law enforcement and would emphasize the “polluters pay” principle.

(4) Construction of Treatment Plant for Maqbool Road and Summadari Road:

The construction of a wastewater treatment plant with an oxidation pond system near WASA-F pumping station No. 31 (PS-31) at Maqbool road was proposed for the treatment of wastewater before discharge to the Madhuana drain. The planned capacity of the WWTP would total 20 MGD. This project would involve the construction of new treatment facilities to treat industrial wastewater from PS-31 to avoid untreated discharge into the open drain to Satiana Road. This would isolate the industrial area by connecting it through realignment of the future-based proposed sewer. This arrangement would segregate industrial wastewater from domestic wastewater and improve the quality of industrial wastewater before discharge.

(5) Construction of Aeration Weirs on both the Paharang and Madhuana drains:

Under this proposal, aeration weirs with rough spillways would be constructed in both the Paharang and Madhuana drains with canalized upstream section. This would increase aeration and reduce deoxygenating of the wastewater for downstream users. This would also enable progressive treatment along the drain using mechanical treatment methods with low maintenance and nil energy requirement.

The sub-projects are proposed based on the findings through a series of technical, environmental, and socioeconomic surveys.

Under the plans formed, the WWTPs proposed in package 1 would treat both domestic and industrial wastewater, the WWTP proposed in package 2 would treat industrial wastewater, and aeration weirs in the Paharang and Madhuana drains proposed in package would treat both domestic and industrial wastewater.

The PFS examined the following options for the WWTP in package 1 to treat industrial wastewaters by the industrial sector or by WASA-F service. Options 5 and 6 were concluded to be the most practicable and affordable in the current situation: the capacity of Chokera WWTP would be doubled and a new 40 MGD WWTP would be constructed to treat the domestic and industrial wastewater.

Option 1: Industries treat their own effluent before discharging
Option 2: Industries with similar effluent cooperate to treat their own effluent before discharging
Option 3: Industrial estates separate effluent from surface water and treat their own effluent before discharging
Option 4: WASA-F provides treatment to industries that pay
Option 5: WASA-F provides treatment to all industries without payment
Option 6: WASA-F provides treatment to a defined industrial area using the existing sewage network with fees paid by the industries in those areas.

To identify the most appropriate technology to treat both domestic and industrial wastewater, three options (not mentioned in the PFS report) are compared according to the following selection criteria: i) land availability; ii) institutional capability; iii) technological propriety; iv) maintainability; v) appropriate design for achieving NEQs; and vi) minimized adverse impacts. The oxidation ponds process has been selected as the most appropriate wastewater treatment process. WASA-F has operated the same process at Chokera WWTP for many years and has proven its capabilities in doing so.

Regarding the construction site for the two WWTPs in package 1, the following points are mentioned in the PFS. WASA-F has about 413 acres of land at the site of the Chokera WWTP. Of this land, 100 acres is still used only temporarily for agricultural purposes. WASA-F is of the view that no additional land will be required for the extension of the WWTP in the foreseeable future. At least 1200 acres of land will be acquired for the construction of the new WWTP near the Madhuana drain.

(6) Issues on the proposals for the industrial wastewater treatment and WWTPs plan

The PFS report states that the design conditions of the 1993 M/P are used for the WWTP plans, but no engineering designs for wastewater treatment plants are presented.

The following emerged as important issues in a review of the PFS report:

- It remains undetermined whether industrial wastewater is to be treated together with the domestic wastewater
- Selected oxidation ponds are inappropriate for the industrial wastewater treatment
- The capacity of Chokera WWTP could be doubled within the current acquired land space of 413 acres.
- The combined domestic and industrial wastewater discharged to the drains is being used for irrigation purposes and the vegetables grown in this wastewater are consumed by citizens of the city.

These issues will be studied and discussed in the course of master plan formulation.

A4.2 Plans and Projects Supported by the World Bank (WB)

4.2.1 Faisalabad Environmental Infrastructure Master Plan (1993)

The Government of Pakistan reviewed the ADB Master Plan in 1993 with support from the World Bank as part of a facility expansion plan to cope with the rapid growth of the city. The water supply and sewerage system established under the original Master plan (1975-76) were upgraded and incorporated in the Master Plan of 1993. The proposals under Phase-II to Phase-IV of the master plan (1975-76) were revised for 25 years from 1993 to 2018. The salient features of this revised plan are shown in the table below.

Table A4.2.1a Proposed Water Sources Development Plan in the Existing M/P

Phases	Development Sources	Development Years
Phase I	- Development of a new Chenab well-field	Completed in 1992 according to the initial M/P (1975)
Phase II	- Surface water from Rakh Branch Canal	Scheduled in 1993 – 2000 in the reviewed M/P (1993)
Phase III	- Tubewells along Rakh Branch Canal - Extension of the existing Chenab well-field - Development of a new well-field at Chenab River	Scheduled in 2001 – 2010 in the reviewed M/P (1993)
Phase IV	- Development of a new well-field at Chenab River	Scheduled in 2011 - 2018 in the reviewed M/P (1993)

Source: JICA Mission Team

The water supply target of the World Bank Master Plan (1993) is summarized in **Table A4.2.1b** below:

Table A4.2.1b World Bank Master Plan Water Supply Plan Outline

Phase	Period	Final Population Estimated (Million Persons)	Water Supply Target (%)
I	1976 - 1992	1.6	60
II	1993 - 2000	2.5	70
III	2001 - 2010	3.2	75
IV	2011-2018	3.7	80

Source: JICA Mission Team

Although facility plans were proposed for each phase (i.e., Phase-II to Phase-IV), no funds were available. However, the project component of the water supply system requiring urgent implementation was met through allocations of funds provided in the Punjab Province budget under JICA Grant Aid and French loans.

In accordance with the master plan above, the Government of Pakistan called upon the Government of Japan to support a project to either construct a new water treatment plant that takes water from the RBC (planned as Phase-II in the master plan) or expand the existing Chenab Well-field. The Government of Japan selected the latter proposal based on reasonable grounds and dispatched a team for the basic study. During the survey at the Chenab Well-field, farmers on the site organized a protest against new well construction. These new wells (90,900 m^3/day, 20 MGD) were relocated and constructed along the Jhang Branch Canal (JBC) in 2012 by JICA Grant Aid.

On the other hand, the French Development Agency (AFD) conducted a study for a new water treatment plant (45,500 m^3/day, 10 MGD) and new wells (22,500 m^3/day, 5 MGD) taking water from the Rakh Branch Canal (RBC). The construction of the new plant and wells was thereupon completed in 2016 with French loans. Meanwhile, an F/S report for expansion of the water treatment plant (22,500 m^3/day, 5 MGD) was prepared in 2016 by a local company (to be filled to the required amount in Phase-II). AFD plans to dispatch a mission for the further study.

In addition to the above, improvements to the distribution network, namely, the arterial main, were conducted with funds from the Government of Punjab Province. An expansion of the arterial main has also been proposed.

4.2.2 Water and Sanitation Program (WSP) (2006-2017)

The World Bank has implemented the Punjab Cities Governance Improvement Project (PCGIP) to support the development of urban planning in the main cities of Punjab Province and has supported preparations for the Faisalabad Peri-Urban Structure Plan (FPUSP), WASA-F water supply and sewerage facilities, GIS-based asset management (Water Supply and Sewerage Asset Mapping), and a water supply and sewerage facilities expansion plan.

The Water and Sanitation Program (WSP) prepared by Urban Unit (UU) also introduced a set of Performance Indicators (PIs) in the Water Facilities Data Book/Punjab Water Utility Data Book. Technical guidance on monitoring will be provided by the Punjab Government with the UU serving as secretariat.

In addition, the World Bank supported the establishment of the Citizen Liaison Cell (CLC), a full-time department thought to be important to WASA-F's capacity to accurately grasp the needs of ultimate user/customers (citizens of Faisalabad City). The CLC has the following purposes:

- To eliminate the communication gap between WASA-F and users/communities
- To expand water supply services to poor urban areas
- To improve the MIS (Management Information System) in order to increase fee collection

4.2.3 Punjab Cities Governance Improvement Project (2012-2016)

With support from the World Bank, PCGIP aimed to improve the planning capacity, asset management, and accountability system in the five major cities of Lahore, Faisalabad, Multan, Gujranwala and Rawalpindi with a view to strengthening the institutional capacity development and city management/governance systems within those cities. PCGIP also provides integrated widely disseminated information, along with improved services, for each agency included in the World Bank Support Programme. The project was implemented from October 2012 to June 2016.

FPUSP has been implemented as a subcomponent DLI-5 of the PCGIP described, with the same financial assistance from The World Bank. The April 2015 update of the report aims to create and support a systematic city plan for the planned growth and development of Faisalabad for the next 20 years (until 2035).

The Urban Sector Planning & Management Services Unit, Punjab (USPMSU) is the primary agency responsible for initiating, managing, supervising, and facilitating the project, mainly with the help of a team of highly competent and experienced team of Urban Planners and GIS analysts. The City District Government Faisalabad (CDGF), however, can be considered the ultimate beneficiary of the project.

The FPUSP aims to assist the CDGF in future planned growth and systematic development for the next twenty years. The plan is prepared in accordance with the procedure prescribed in the Punjab Land Use (Classification, Reclassification and Redevelopment) Rules 2009, and thus provides the CDGF with an agreed Peri-Urban zoning and future road network plan ensuring that urban planning and development only occur in an integrated manner within the specified limits.

The FPUSP's general objective is to prepare for the comprehensive farsighted development of the city. The specific objectives of the FPUSP include:

- Suggest measures for preserving productive agriculture land and precious environmental resources in the Peri-Urban area
- Propose a pertinent mix of land uses in the Peri-Urban area
- Identify incompatible land uses such as industries located within residential areas and propose measures to mitigate the impacts on Peri-Urban development
- Recommend an efficient circulation network in the Peri-Urban area

4.2.4 Faisalabad Peri-Urban Structure Plan, 2015

In 2015, the Punjab Government established the Peri-Urban Structure Plan for Faisalabad (FPUSP) for the future growth and systematic development over the next twenty years. The Peri-Urban Structure Plan (FPUSP) is being prepared according to the prescribed procedure in the Punjab Land Use (Classification, Reclassification and Redevelopment) Rules 2009. As such, it provides the CDG Faisalabad with an agreed "City Boundary, Peri-Urban zoning, and future road network plan" by ensuring that the urban planning and development only occur in an integrated manner within specified limits.

A4.3 Plans and Projects Supported by the French Development Agency (AFD)

In 2007, a team of French experts visited Faisalabad to assess the Water Supply, Sewerage, and Drainage of the city. In August 2008, the Government of Pakistan approved the "Faisalabad City Water Resources Expansion Project" and agreed to accept French financial assistance. PC-I was approved by ECNEC on the 21st of January 2010. The financial protocol was signed on the 13th of December 2010 and the implementation agreement was signed on the 10th of November 2011. French Consultants were hired to prepare tender documents on the 9th of May 2011. In 2012, RFP for Consultants and Tender Documents for Contractors were floated. The project is now being implemented.

Objectives of the Faisalabad City Water Resources Expansion Project:

- Provision of additional water to 0.35 million people
- Improved water pressure in service
- Identification and repair of pipeline leakages (1,056 km)
- Reduction of non-revenue water from 32% to 20%
- Segregation of the eastern and western water supply networks
- Zoning of the water supply and drainage network
- Performance optimization
- Development of credible hydraulic models
- Training of WASA-F staff
- Metering of water supply

The project was divided in two phases. The plan for Phase-I (2010-2016) was to bring 67,500 m^3/day (15 MGD) water from the surface water treatment plant and tubewells along the RBC. The scope of work under Phase-I included the following:

- New Jhal Khanuana water treatment plant (45,000 m^3/day, 10 MGD)
- New Arterial Main of 1200 mm (6.5 km)
- Rakh Branch Canal Upstream Well-field (22,500 m^3/day, 5 MGD) (10 tubewells)
- Replacement of pumps (12 pumps)
- Bulk flow meters (51 connections)
- Industrial meters (585 connections)
- Domestic meters (20,000 connections)

With support from the Government of France, a plan for the "Extension of Water Resources for Faisalabad City Phase-II" has been established for implementation after the "Extension of Water Resources for Faisalabad City Phase-I." A feasibility study (F/S) for Phase-II was conducted (2015-2016) and a final report was submitted in March 2016.

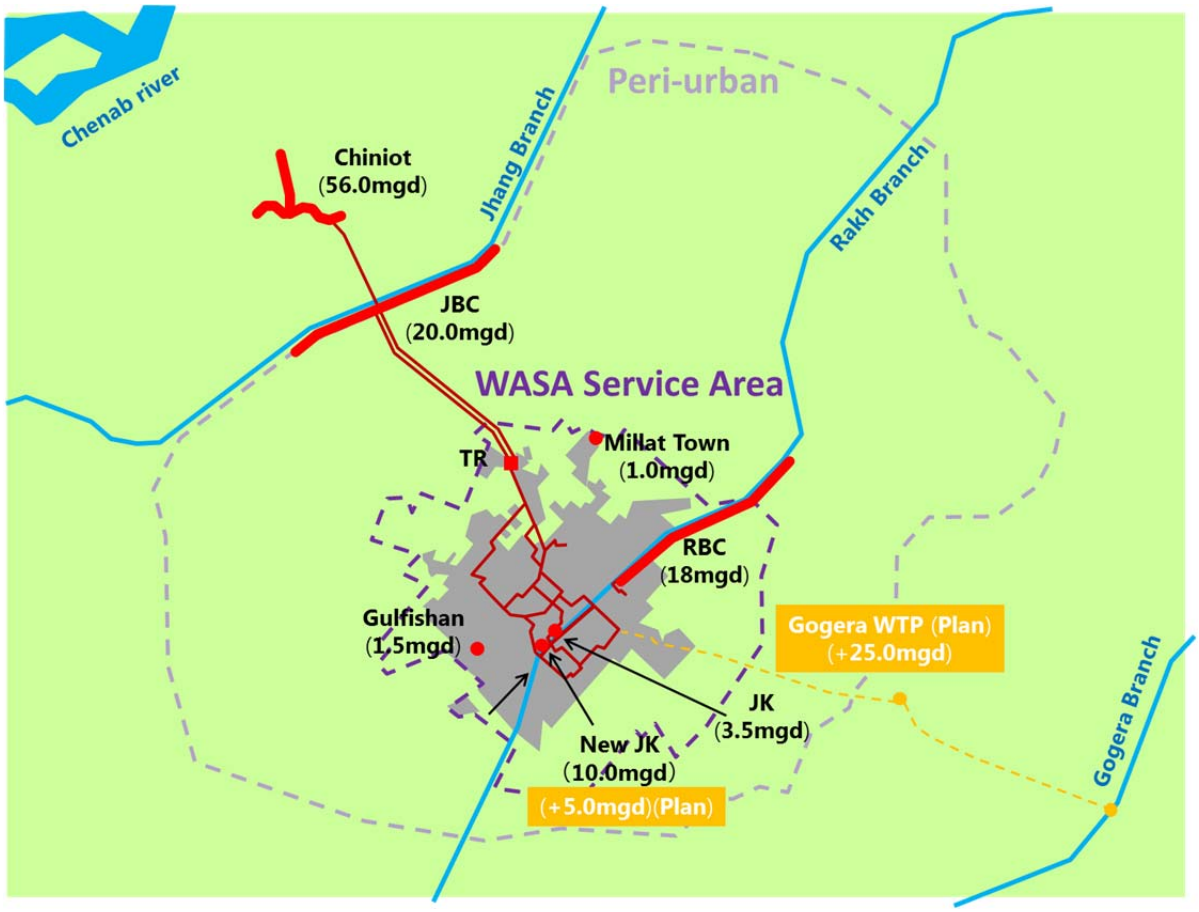
The expansion of the New Jhal Khanuana water treatment plant (22,500 m^3/day, 5 MGD) and construction of a new Gugera water treatment plant (112,500 m^3/day, 25 MGD) are scheduled in Phase II. Meanwhile, no well construction is included in the plan. This project is outlined in the following table.

Table A4.3.1 Outline of the Plan for the Extension of Water Resources for Faisalabad City Phase-II

1. Expected Development Partner	The Government of France
2. Component of Water Sources Development in Phase-II	
- Additional development from Rach Branch Canal (RBC)	22,500 m^3/day (5 MGD)
- New development from Gugera Branch Canal (GBC)	112,500 m^3/day (25 MGD)
Total	135,000 m^3/day (30 MGD)
3. Current status of the project implementation	PC - 1 has already been submitted to HUD & PHED, on May 12, 2015. The F/S report was submitted in March 2016.

Source: JICA Mission Team

The additional development from the RBC is to increase the water intake from 45,000 m^3/day (10 MGD) to 67,500 m^3/day (15 MGD) for the future expansion of New Jhal Khanuana water treatment plant completed in 2016. The new development from GBC takes in 112,500 m^3/day (25 MGD) from GBC flowing near Jaranwala town located approximately 30 km east-southeast of Faisalabad City, as shown in **Figure A4.3.1**.



Source: JICA Mission Team

Figure A4.3.1 Plan for the Extension of Water Resources for Faisalabad City Phase-II

Under Phase-I and Phase-II of the project, a total of 202,500 m^3/day (45 MGD) fresh water is to be supplied to the city. **Table A4.3.2** shows the expected improvements in the water supply after completion of the project.

Table A4.3.2 Water Scenario after Implementation of the AFD Project

Indicators	Progress	After French Assistance in Phase I & II beneficiaries	Strategy
Water Coverage	50%	76%	Source augmentation, rehabilitation and network extension
Non-Revenue Water	32%	20%	Leakage detection, extension in the tertiary network and replacement of house connections
Metered Consumption	1.74%	10%	Installation of bulk and consumer water meters
Continuity of water supply service	6.25 hrs.	10 hrs.	Source augmentation, storage enhancement, rehabilitation of OHRs (overhead reservoir) and network zoning.

Source: JICA Mission Team

A4.4 Plans and Projects Supported by the Japan International Cooperation Agency (JICA)

4.4.1 JICA Water Supply Projects

In 1995, the Government of Pakistan requested the Government of Japan to provide grant aid for the implementation of Phase-II proposed under World Bank Master Plan. The objective was to increase the water supply volume by constructing a new water treatment plant taking water from RBC flowing through the city, in order to meet the immediate future water requirement formulated in part of the World Bank Master Plan Phase-II. The request by the Government of Pakistan also included an alternative

proposal, namely, a plan to expand the existing Chenab Well-field originally planned in the further development as Phase-III of the Master Plan.

Under an agreement between the Governments of Pakistan and Japan, the Japan International Cooperation Agency (JICA) dispatched a preliminary study team in November 1997. Reviewing the context of the World Bank Master Plan, the Study team investigated the feasibility of constructing a water treatment plant and developing groundwater on a priority basis. The findings of the study team were as follows:

- The irrigation canal scheduled to take in water for the water treatment plant flowed through the central part of the city. Since the surrounding urban area was densely populated, it would be difficult to acquire land for the construction of water treatment plant.
- The Canal was closed for 1 month per year for maintenance. The operations of any plant, therefore, would also have to be halted for 1 month per year.
- The operation and maintenance of the water treatment plant required adjustments of the filtration rate and amounts of chemicals to be injected according to not only the conditions of the water treatment plant, but also the water quality of the water source, which changed day by day according to climatic and canal flow conditions. In addition to the high processing cost, advanced technology and skill would also be required for the operation of the water treatment plant, imposing burdens difficult for WASA-F's staff to shoulder at that time.
- Besides the quality of the water at the source/drainage basins, ongoing changes in the weather conditions were another important factor. The continuous maintenance of water quality/drainage basin required technical and skilled staff and high costs, which WASA-F lacked at the time and was unable to afford because of budgetary constraints.
- WASA-F had gained sufficient experience in developing groundwater at the initial stage of the ADB Plan Phase-I, as well as experience in the operation and maintenance of the groundwater source under the World Bank Master Plan.
- New groundwater development, one of the measures to boost the water supply volume, was proposed under Phase-III of the World Bank Master Plan. The same was already developed at the initial stage in the ADB Phase-I and was being operated and maintained. As such, WASA-F was deemed to have the capability and technical experience to maintain the quality of the groundwater. Relying on WASA-F, therefore, was deemed to be more economical than constructing a new treatment plant with a drain/canal as a water source.
- The appropriate water source was found to be nearby the existing source site at that time, as proposed in ADB Phase-I and the World Bank Master Plan.
- The target water volume was 90,900 m^3/day (20 MGD), a level that could have been met on an urgent basis through the development of groundwater supply at the time.

Based on the above preliminary survey results, a JICA basic design study team visited Pakistan in 1998. At the beginning, the study team conducted an overall survey and revised the prevailing conditions in terms of the demand and supply of water in the city. In a second field survey, the design study team prepared plans to excavate test wells with a view to developing the water source in the Chenab River Basin and confirming the well capacities by pumping tests. Ultimately, however, a protest campaign launched against the project by neighboring villagers prevented the team from mobilizing well-drilling machines to the site.

Meanwhile, political turmoil stemming from nuclear tests conducted in Pakistan in May 1998 prompted the Government of Japan to freeze economic cooperation with Pakistan. As a result, the next scheduled visit by the basic design study team was cancelled and the work on the project was abandoned.

Subsequently, WASA-F reviewed the water supply projects in accordance with the World Bank Master Plan based on fund provisions arranged under the provincial government’s annual development budget. WASA-F envisaged the following projects:

- Renewal of the exiting tubewells along the RBC.
- Addition of four wells on the existing Chenab Well-field to increase the water supply volume.

Despite these efforts, the increased water supply fell far short of demand. Afterwards, in 2001, the economic sanctions were lifted and the Government of Japan was requested to resume the preceding plans/projects.

(1) The Project for the Improvement of the Water Supply System in Faisalabad, Phase I (2005 - 2006) and Phase II (2009 - 2012)

JICA reviewed the project under the Faisalabad water supply improvement plan in the year 2004. The water works projects initiated in ADP had been completed shortly before, in 2002-03. In March 2004, the plan prepared by the JICA design team divided the project into two phases. Under Phase 1, the agreed-upon plan was to enhance the arterial mains for the city. In Phase 2, the design team proposed a plan to construct a new water supply facility for Faisalabad city. The bidding process for the two phases started in 2005 and 2006, respectively. In a review later conducted in 2006, however, three consecutive bids for Phase 2 relating to the construction of new water sources and water transmission and distribution facilities were found to be unsuccessful for the following reasons:

- A rise in the global steel price ongoing from 2003.
- A sharp rise in crude oil prices from 2004.
- Tremendously higher project costs stemming from high material and personnel expenses for construction work (i.e., rising prices and personnel/labor expenses in Pakistan) and high costs for reconstruction and rehabilitation after the 2005 Kashmir Earthquake.

As a result, it was difficult to complete the construction work within the period stipulated in the Exchange Notes pertaining to Phase 2 of the agreement between the two countries. The consultancy contract was terminated and the project work was suspended once again.

Nevertheless, Phase 1 of the project for the enhancement of the water supply for Faisalabad City was completed. Faisalabad, as Pakistan’s third major industrial city, requires quality water supply on a perpetual and sustainable basis. In this regard, the Government of Pakistan again requested the Japan International Cooperation Agency (JICA) to undertake Phase 2 of the project. JICA dispatched another study team for Phase 2 of the study in July 2007.

In July 2008, JICA resumed work on Phase 2 of the project and initiated the bidding process. The first bidding, however, was unsuccessful because of the global financial crisis and significant fluctuations in currency exchange rates before the bidding commenced. These developments prompted a review of the scope of Phase 2 and ultimately the separation of the water source facility component of the Phase 2 plan.

Bidding for Phase 2 of "The Project for the Improvement of the Water Supply System in Faisalabad” was resumed in November of 2009 and the project was completed in 2012.

(2) The Project for the Expansion of the Water Supply System in Faisalabad (2010 - 2012)

In order to respond to the request for early completion of the separated water source facility component, the JICA Mission Team carried out a review of the project cost in 2010. The main objective of the survey was to assess the current situation of the water source and to determine the construction cost. Consequently, the construction of the water source facility component started in 2010 and was completed in 2012.

An outline of the above-mentioned JICA grant aid projects is shown in **Table A4.4.1**.

Table A4.4.1 Outline of the Projects for Water Supply System in Faisalabad (Past JICA Grant Aid Project)

Name of the Project	Classification of facilities	Facility name	Specification
Project for the Expansion of the Water Supply System in Faisalabad (Completed in 2012)	Water source facility	Tubewells: 25 Nos. (standby 2 wells)	Basic design depth 160 m
		Tubewell pump stations: 25 Nos.	Size 45.4 m^2/each
		Tubewell pumps: 25 Nos.	Vertical hollow-shaft-turbine type Capacity 200 m^3/hr/each
Project for the Improvement of the Water Supply System in Faisalabad Phase 2 (Completed in 2012)	Collecting facility	Collector main, Dia. 400 - 900 mm	Steel/ductile cast iron pipe Total length about 14.6 km
	Transmission facility	Reservoir 1 No.	capacity 4,000 m^3
		Booster pumping station w/booster pumps 5 Nos.	Q=25.3 m^3/min, 190 kW/unit
		Chlorination equipment 1 set	Chlorinator w/Cl gas scrubber
		Transmission main, Dia. 1,000 mm	Steel pipe Total length about 11.3 km
	Distribution facility	Terminal reservoir	Capacity 36,000 m^3
		Terminal pumping station w/distribution pumps 5 Nos.	31.6 m^3/min 330 kW 2 Nos. 63.2 m^3/min 660 kW 3 Nos
Project for the Improvement of the Water Supply System in Faisalabad Phase 1 (Completed in 2006)	Reinforcement of the distribution network	Distribution pipeline Dia. 600 - 700 mm	Ductile cast iron pipe, Total length 6 km
	Procurement of operation & maintenance equipment	▪ Tubewell level meter 12 Nos. ▪ Water analysis equipment 1 No. ▪ pH/EC meter 2 Nos. ▪ TDS meter 2 Nos. ▪ Voice communication system ▪ Ultra-sonic water meter 1 No. ▪ Leakage sound detector 2 Nos. ▪ Voice communication system 1 set w/ main unit 4 Nos. & VHF handheld transceiver 15 Nos.	

Source: Implementation Review Study Report on the Project for the Expansion of the Water Supply System in Faisalabad in the Islamic Republic of Pakistan (March 2010)

The series of projects above have helped to increase the water supply capacity to 90,900 m^3/day (20 MGD) and to reinforce the distribution network in Faisalabad City. The quantitative effects of the project implementation are summarized in **Table A4.4.2**.

Table A4.4.2 Quantitative Effects of the Projects

Current status	Reference Value (2009)	Target Value (2012)
(1) Water coverage in the city	55%	60%
(2) Average per capita daily supply rate	89 liters	130 liters
(3) Water head (pressure) inside of the arterial mains in the east side of the city (1/3 of the whole city)	Water pressure of 0.5 kg/cm^2 in the arterial mains at the time of pumped distribution	Water pressure of 1.0 kg/cm^2 in the arterial mains at the time of pumped distribution
(4) Water supply service hours	6 hours at maximum (3 times a day, each lasting 1 to 2 hours)	12 hours at maximum (3 times a day, each lasting 4 hours)

Source: Implementation Review Study Report on the Project for the Expansion of the Water Supply System in Faisalabad in the Islamic Republic of Pakistan (March 2010)

(1) The Project for Replacement of Pumping Machinery at the Inlet Booster Pumping Station & Terminal Reservoir in Faisalabad (2018 – under implementation)

An on-going JICA Grant Aid project, the "Project for Replacement of the Pumping Machinery at the Inlet Booster Pumping Station & Terminal Reservoir in Faisalabad," has been executed since 2014. In the Preparatory Survey, it was judged that it would be necessary to renew the booster pumps at the Inline

Booster Pump Station used to transmit the water from the Chenab Well-field to the terminal reservoir (T/R), as well as to renew the distribution pumps at the T/R and take countermeasures against water leakages at that facility. The Survey team also recommended that a new distribution pump station be constructed for renewal of the distribution pumps at the T/R, in light of the construction process, safety, the need to turn off existing distribution pumps during construction, and other considerations. The final scope of this Project, based on the above, is as follows:

Table A4.4.3 Contents of the Project for Replacement of Pumping Machinery at the Inlet Booster Pumping Station & Terminal Reservoir in Faisalabad (Ongoing JICA Grant Aid Project)

Items	Contents
1) Facilities	- Renewal of the booster pumps at the inline booster pump station - Construction of the pump station at T/R - Renewal of the distribution pumps at T/R - Leakage control of T/R
2) Soft components (Technical assistance)	Technical support and capacity building (Water pressure reduction technique by valve operation)

Source: Preparatory Survey Report on the Project for Replacement of the Pumping Machinery at the Inline Booster Pumping Station & Terminal Reservoir in Faisalabad in the Islamic Republic of Pakistan (June 2015)

Regarding the Project's soft components, technical instructions will also be given on valve operation at the T/R for pressure reduction after distribution by the distribution pumps.

Tenders related to this project were conducted twice in April and December 2016, but both biddings were unsuccessful. A re-tendering carried out in March 2018 finally succeeded; project implementation is expected to be completed in March 2020.

Note that this project proposes a design flow of 204,780 m^3/day (45 MGD) at the inline booster pump station with replacement of pump machinery. In other words, the design capacity of Chenab Well-field will be changed from the current 255,000 m^3/day (56 MGD) to 204,780 m^3/day (45 MGD) after the Project is implemented.

The quantitative effects expected from the Project are as follows:

Table A4.4.4 Quantitative Effects of the Project

Index	Reference Value (2013)	Target Value (2023: 3 years after project completion)
Power Consumption of Booster, Distribution Pump (kW/m^3)	0.259	0.232
Hourly Maximum Water Supply (m^3/h)	8,418	13,230
Daily Maximum Water Supply (m^3/d)	149,508	161,880

Source: Preparatory Survey Report on the Project for Replacement of the Pumping Machinery at the Inline Booster Pumping Station & Terminal Reservoir in Faisalabad in the Islamic Republic of Pakistan (June 2015)

(4) The Project for Improving the Capacity of WASAs in Punjab Province (2015 - 2018)

The Project for Improving the Capacity of WASAs in Punjab Province has been in operation since July 2015 as a technical cooperation project for 5 WASAs in Punjab Province. The project will continue until July 2018. The main activities are to establish training courses for the WASAs staff focused on the following topics: i) Operation and Maintenance, O&M, of Tubewell and Pump Facilities; ii) Leakage Detection, iii) Asset Management for Water Supply; and iv) Business Management Plan. The project aims at improving the capacity of the 5 WASAs through the Al-Jazari Academy (previously WATSAN Academy established in 2014), a training institute for the capacity development of personnel from the WASAs and public water sector (e.g., PHED, TMAs).

(5) Dispatch of Institutional Reform Adviser (2013 - 2016)

JICA also dispatched an Institutional Reform Advisor for WASA Lahore and Faisalabad City. Over a 3-year period beginning from January 2013, the Advisor provided advice and support on the preparation of a mid-term business plan, performance monitoring indicators, long-term financial analysis, and the establishment of customer relation centers (CRCs) in the WASAs. Thereafter, more advisors came in a second dispatch and third dispatch up to July 2016. The advisors carrying out the programs addressed issues entailed in the promotion of the business plan and improvements in the tariff efficiency rate by monitoring and reviewing the action plans in the business plan, convening roundtable meetings, and holding tableau competitions by students on the themes of water resources, sanitary environment, and WASA jobs. Through these efforts, capacity development was carried out in areas such as staff motivation, responding to customer complaints, and the execution of training for WASA-F.

4.4.2 JICA Sewerage and Drainage Projects

(1) The Project for Upgrading the Mechanical System for Sewerage and Drainage Services in Faisalabad (2012 - 2014)

1) Background

WASA-F developed sewerage and drainage facilities based on the phase-1 project proposed in the revised water supply and sewerage master plan in 1993. The pumps and cleaning equipment for sewers and drainage channels have been used since the 1980s. According to reports, about 30% of the pumps are malfunctioning and the cleaning equipment has not been replaced since the 1980s.

The low-lying areas in the urban center of Faisalabad City are often flooded in the rainy season. To reduce the traffic congestion caused by the inundation, the aging pumps and cleaning equipment need to replaced or upgraded. The Government of Pakistan requested a grant aid project for "improvement in the operation of sewerage and drainage in Faisalabad" from the Government of Japan.

2) Outline of Survey Results and Project Implementation

The survey identified the following procurement plans for equipment based on the field surveys results, necessary preliminary design work, and discussions held between Pakistan's government agencies and the JICA Study team. The procurement and installation of pumps and equipment were completed as a Japanese grant aid project.

Table A4.4.5 Procurement Plan for Pumps and Generators

Name of Pump Station	Pump	Generator			
	25 cfs*	150 kVA	300 kVA	350 kVA	650 kVA
1) PS-3 Chokera	2	-	-	-	1
2) PS-31 Satiana Road	4	-	1	-	-
3) PS-36 Ahmed Nagar	2	1	-	-	-
4) PS-30 Bawa Chak	1	-	-	1	-
Sub-Total	9	1	1	1	1
Total	9	4			

Source: JICA Mission Team
Note: 1cfs = 0.0283 m^3/s

Table A4.4.6 Procurement Plan for Cleaning Equipment

Equipment	Major Specifications	Required Number	Existing Number		Procurement Number
			Total	Operating	
1) Jet Machine	Tank capacity: more than 3,500 liters, Pump capacity: about 200 L/min	15	7	7	8
2) Suction Machine	Capacity: more than 3,500 liters	4	3	2	2
3) Wheel Backhoe	0.2 m^3 class with option of hydraulic clamshell and skeleton bucket	3	1	1	2
4) Mini-Backhoe	0.08 m^3 class, weight less than 2.5 tons, with option of skeleton bucket	2	0	0	2
5) Bucket Crane	Crane lifting capacity of 25 ton	4	2	2	0
6) Dump Truck	Carrying capacity more than 3,500 kg	7	0	0	7
7) Crane Truck	Carrying capacity more than 2,500 kg, Crane lifting capacity of 2.9 tons	2	0	0	2
8) Pick-up Truck	4x4 Diesel, Double Cabin type	6	7	0	0
9) Dewatering Pump set	1 cfs (Diesel driven)	70	70	53	17

Source: JICA Mission Team

(2) Project for Capacity Improvement of the WASAs in Punjab Province (2016 - 2018)

A JICA technical cooperation project, the "Project for Capacity Improvement of the WASAs in Punjab Province," described in the previous section, 4.4.1 JICA Water Supply Projects, also included activates for capacity building in 5 WASAs related to sewerage and drainage managements. The project seeks to establish training courses for WASAs staff focused on the following topics related to sewerage and drainage: i) O&M of sewer and storm-water drainage, including safety response; ii) O&M of disposal stations, iii) Asset Management for Sewerage Systems; and iv) Business Management Plans.

A4.5 Other Development Plans and PPP Projects

4.5.1 Drinking Water, Sanitation and Hygiene, Punjab Sector Development Plan 2014 – 2024

According to Punjab's new Growth Strategy 2018, this Punjab Sector Development Plan advances an integrated strategy that groups the various water supply and sewerage strategies into the following categories: water quality, sewerage, sewage treatment, waste management, hygiene, education, etc.

4.5.2 Strategic Development Plan 2006

This plan was prepared by the City District Government Faisalabad. It focuses on reducing poverty and improving the standard of living by providing basic necessities for life such as housing, health, education, and water.

In this development plan, WASA-F proposed additional production facilities sufficient to deliver an additional 20 MGD of water to the city and serve a population of 264,000. New trunk and collector sewers were proposed in the north, west, and southeast of the city for sewerage and drainage. These sewers were intended to serve an additional 250,000 people.

Ultimately this plan could not be adopted, for the following reasons:

- Financial constraints
- Piecemeal plan implementation
- Frequent change of the government officials responsible for plan implementation

4.5.3 Other Water Supply Development Plans

WASA-F entered an MOU with private companies on November 2015 for the projects presented in **Table A4.5.1**.

Table A4.5.1 Water Supply Projects based on PPP considered by WASA-F

No	Project Name	Estimated Project Cost (Million USD)	Private enterprise	Contract form
1	JBC water treatment plant construction project	160.00	1) STFA İNŞAAT A.Ş, Turkey 2) AOJ Consortium, China	1) BOO 2) EPC + Finance
2	Arterial main expansion project	80.00	AOJ Consortium, China	EPC + Finance

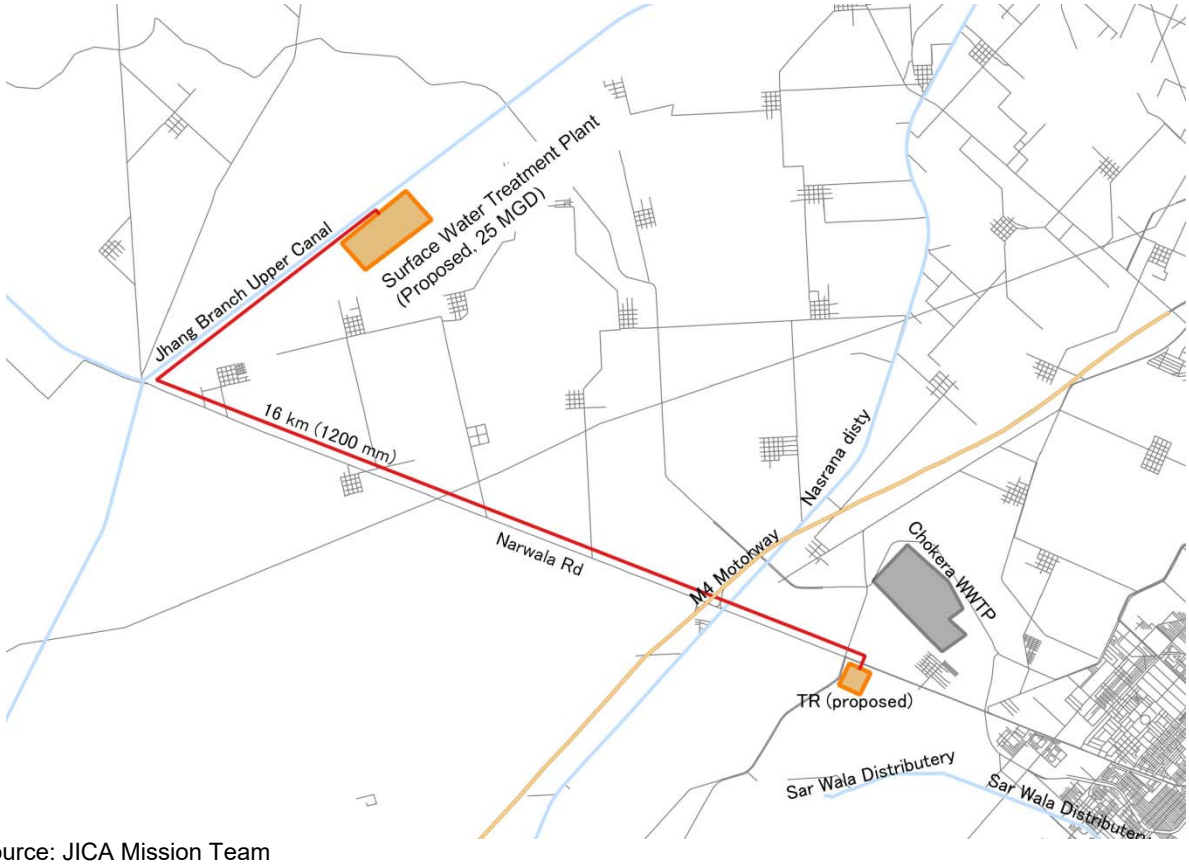
Source: WASA-F

A private Turkish company, STFA, is currently proposing a project on a PPP basis. Specifically, STFA proposes the establishment of a surface water treatment plant at the Jhang Branch Canal (JBC), running 35 km Northwest of Faisalabad City, as shown in **Table A4.5.2** and **Figure A4.5.1**.

Table A4.5.2 Outline of Surface Water Treatment Plant at Jhang Branch Canal

1) Expected Development Partner	STFA İNŞAAT A.Ş, Turkey
2) Contents of water source development in the project	New intake from JBC, 112,500 m^3/day (25 MGD)
3) Current status of project implementation	A summary for permission of application is to be submitted to the Government of Punjab.

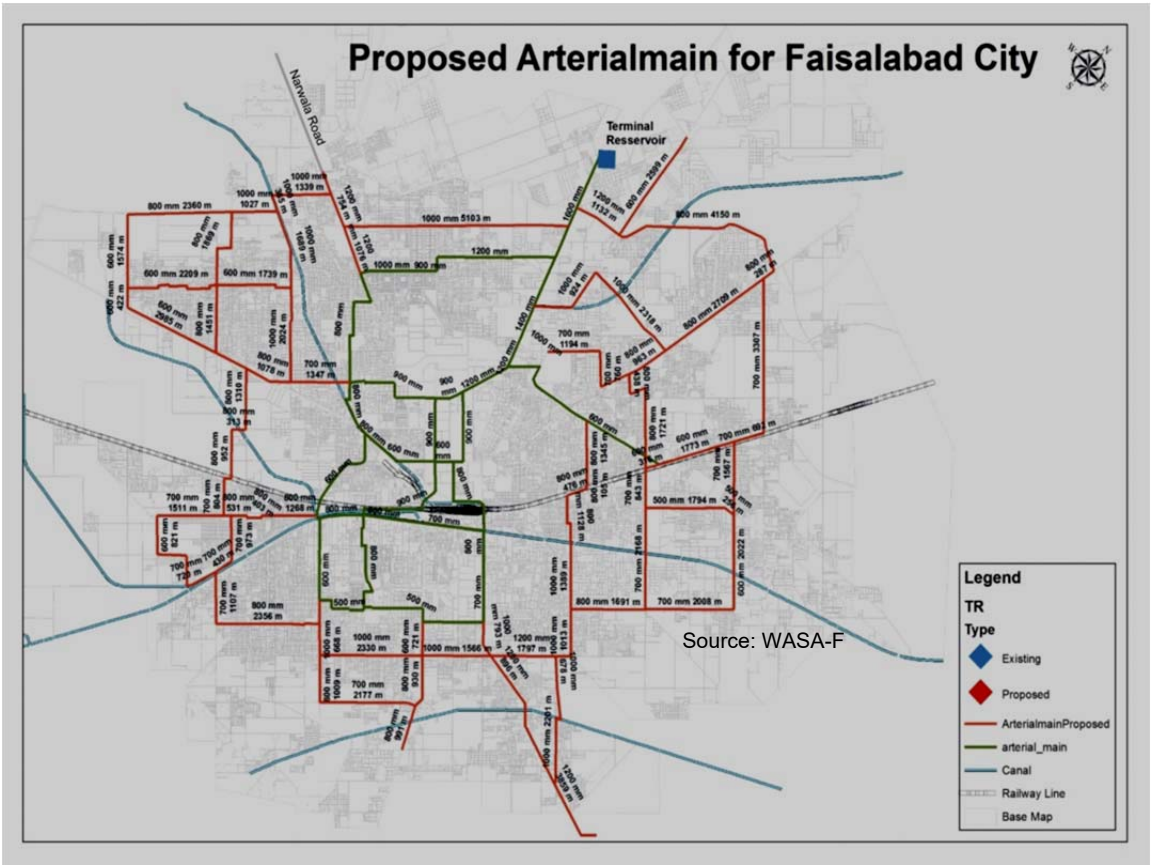
Source: WASA-F



Source: JICA Mission Team

Figure A4.5.1 Plan for a New Water Treatment Plant along JBC

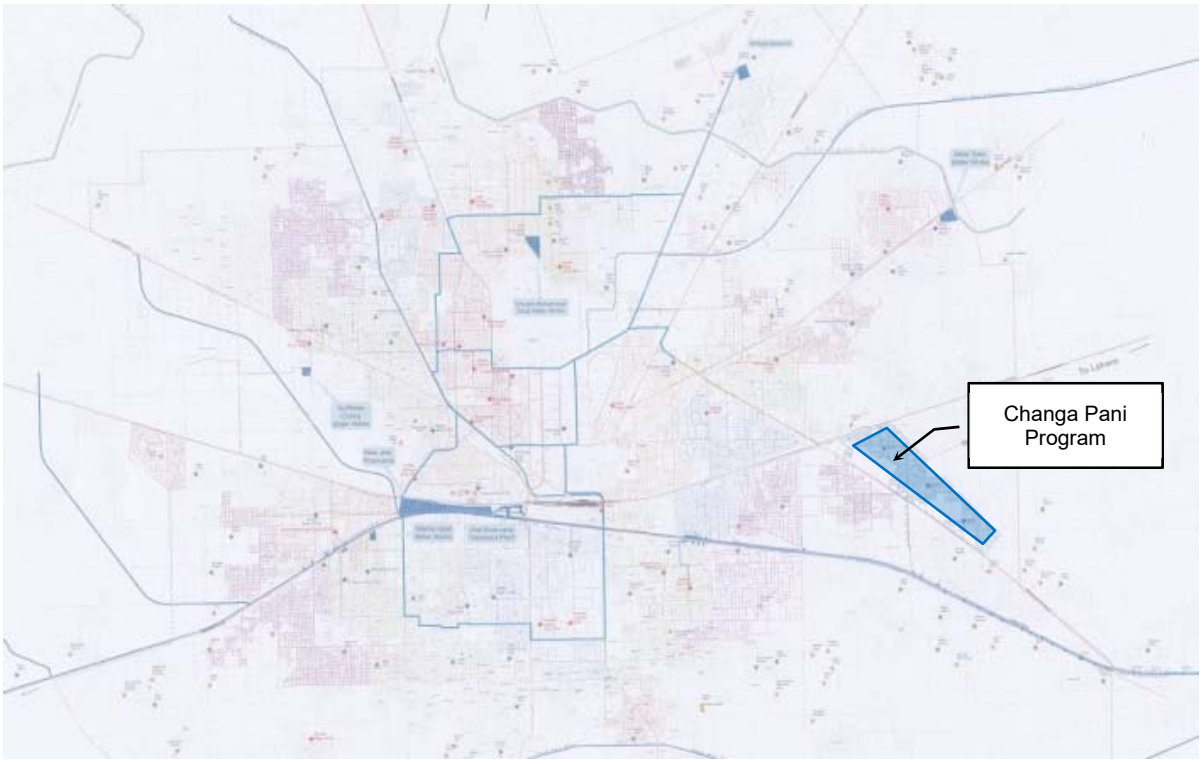
As a project to reinforce the distribution network, WASA-F proposes an expansion of the arterial mains as shown in **Figure A4.5.2**. The AOJ Consortium of China is currently showing interest in the expansion as an EPC project, but the future prospects and feasibility of fund and budget allocations are unclear.



Source: WASA-F

Figure A4.5.2 Proposed Expansion of the Arterial Main in Faisalabad City

As another ongoing project funded by private organizations, WASA-F has presently transferred the Changa Pani ("Good Water" in English) Program Phase-I to the NGO ASB (Anjuman Samaji Behbood). The program aims for infrastructure improvement as well as socioeconomic development in areas where water has not been supplied. There are many areas not reached by WASA's water supply, even inside of the WASA service boundaries. The Changa Pani Program is designed to activate the policy principle of community participation as programs in the cities of Punjab as a Public Sector Model to ensure water for all.



Source: JICA Mission Team

Figure A4.5.3 Location of the Changa Pani Program

The facility components to be constructed include two water intake wells (tubewells), a drain tank (ground tank), a water pump, a water supply pipe, a water distribution trunk line, and a water distribution pipe network (3.5 inch or more). It was scheduled to be completed in mid-December 2015. The initial investment is PKR 100 million was provided as a PHED grant from the Punjab Government. Ownership is transferred to Water & Sanitation Community Organization (WASCO) after construction. WASCO is responsible for installing water supply pipes (pipes of 3 inch or less), water meters, and operation and maintenance of minor repairs after construction of the facility. WASCO collects fees from the residents to meet Operation & Maintenance expenses and minor repair costs. WASA-F collects sewerage fees from WASCO because household wastewater/drainage is connected to WASA-F's sewer system. As the water facilities are owned by the community, no water fees are charged. WASA-F is responsible for the repair of major failures and therefore charges WASCO for the costs.

Under Phase-I of Changa Pani Project, 2,000 to 3,000 house connections are planned to be provided. In the subsequent Phases-II and III, the plans call for an increase to a total of 7,829 connections.

4.5.4 Other Sewerage Development Plans

In 2017, WASA-F signed an MoU with the Danish Government (DANIDA) for sewerage infrastructure development. The MoU covers a Feasibility Study for sewerage infrastructure in Faisalabad and financing of the works up to 100 million EUR, with priority on the Eastern Zone for implementation.

CHAPTER A5 INSTITUTIONAL FRAMEWORK AND ORGANIZATION

Policy-wise, the Federal Government has authority only over the water supply, sewerage, and drainage sectors, while the provincial governments implement projects by planning, allocating budgets, and providing funds. Day-to-day operations are undertaken by the local authority of each district.

This Chapter summarizes the institutional and organizational arrangements related to water supply, sewerage, and drainage works.

A5.1 Institutional Arrangements for Water Supply and Sewerage, and Drainage Sector

5.1.1 Provincial Government

(1) Planning and Development Department (P&D)

The Planning and Development Department (P&D), Government of Punjab, is the principal planning organization at the provincial level. This department coordinates and monitors the development programs and activities of various departments of the provincial government. It also prepares an overall Medium-Term Development Framework (MTDF) for the developmental activities within the province. The Medium-Term Development Framework lays down the developmental activities to be carried out in the province in various sectors of the provincial economy. In this manner, the Planning & Development Department is one of the main actors overseeing the growth of the economic potential of the province.

The mandate of the Planning & Development Department includes the provision of technical support and coordination among various government departments in their planning activities. The department is also the main government agency working with international development partners

The main objectives of the department are as follows:

- Assessment of the material and human resources of the province
- Formulation of long- and short-term plans
- Recommendations concerning prevailing economic conditions, economic policies, and measures on major development projects
- Examination of economic problems on which it may be expected to provide guidance and advice for the respective sectors of the economy
- Coordination of all economic activities in the provincial government

(2) Housing, Urban Development and Public Health Engineering Department (HUD&PHED)

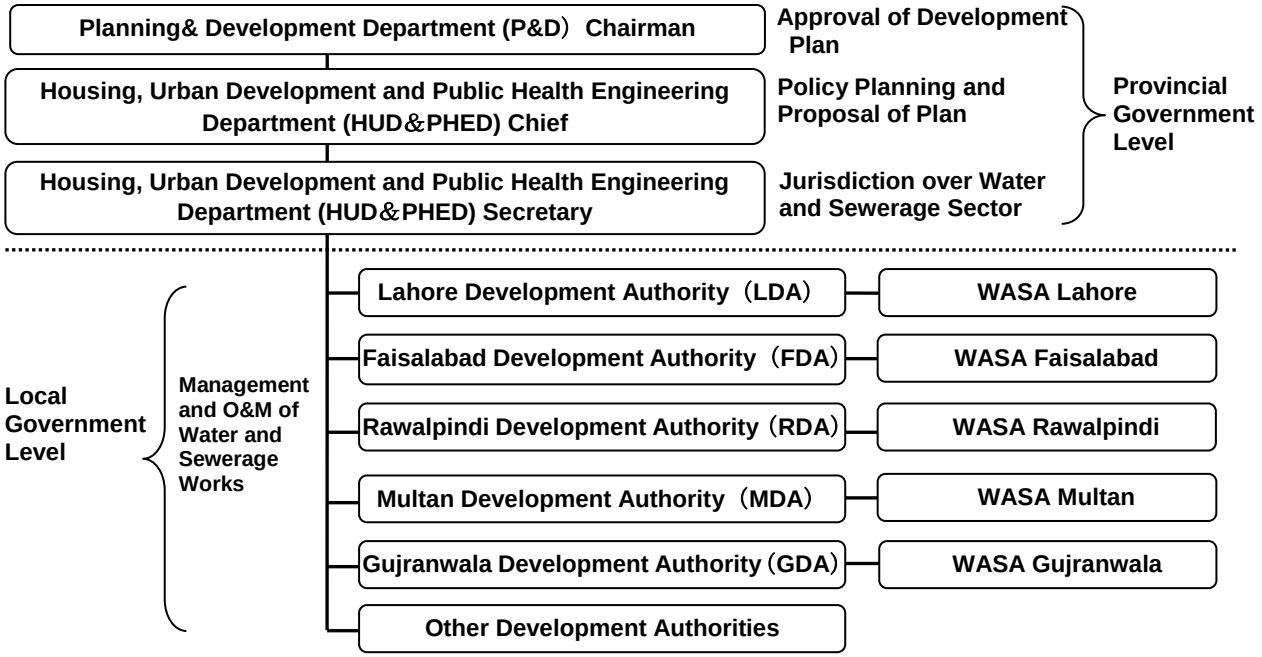
The Housing, Urban Development and Public Health Engineering Department (HUD&PHED) in the provincial government of Punjab is responsible for the following:

- Provision of housing facilities to the population of Punjab
- Promotion of development in big cities and
- Supply of potable water and provision of sanitation

The vision of the department is to harness the inherent potential of cities in order to make them the engines of economic growth in line with the vision of the Government of the Punjab and the provision of low-cost housing, water supply, and sanitation coverage across the province, particularly in brackish and barani (farming) areas.

The Faisalabad Development Authority (FDA) is the statutory body under the HUD&PHED and the WASA is a wing of the FDA for water supply, sewerage and drainage. The organization of the water and sewerage sector in Punjab District is shown in **Figure A5.1.1**.

Small community-based rural water supply and sanitation schemes have been planned and constructed by the PHED under an institutional framework with community participation. After construction and pilot testing, the water supply is handed over to the Village Development Association (VDA) for operation.



Source: JICA Mission Team

Figure A5.1.1 Organization of the Water and Sewerage Sector in Punjab District

(3) Medium-Term Development Framework (MTDF)

The P&D prepares an overall Medium-Term Development Framework (MTDF) for developmental activities in the province. The MTDF embodies the policy of the provincial government in the developmental activities to be carried out in various sectors of the provincial economy.

The P&D also established Saaf Pani (Clean Water) Company in 2014 for the provision of water supply facilities in the rural and Peri-Urban areas of Punjab Province. Operations have started since in 2015.

Investment for water supply and sanitation is budgeted in the social sector, the sector in charge of education, health, social welfare, etc. separately from the water sector. In total, 168,872 million PKR was allocated to the social sector in the year 2016-2017. (See **Table A5.1.1**)

Table A5.1.1 Medium Term Development Framework

Sector	Allocation for Each Year (Million PKR)		
	2016-17	2017-18	2018-19
Social Sector *1	168,872	164,012	173,171
Infrastructure Sector	158,200	167,506	167,830
Production Sector	49,270	60,720	55,403
Service sector	109,023	123,857	140,266
Others	12,635	13,905	15,330
Special Initiative	52,000	180,000	58,000
Grand Total	550,000	710,000	610,000

*1: Budget for water sector is included in Social Sector
Source: WASA-F P&D

Water supply and sanitation received an allocation of nearly 10,000 Million PKR before 2013-14 and increased allocations after 2014-15. The allocation for 2016-17 reached 45,000 Million PKR, marking a more than 90% increase from the allocation of 2015-16. The allocation for water supply in the current

year is 4,748 Million PKR, while that for sanitation is 10,043 million PKR. Note that a total of 30,000 Million PKR was allocated for the Saaf Pani Company, an entity that began full-scale construction projects in 2016-17.

Table A5.1.2 Trends in Allocations for the Water Supply and Sanitation Vision

Year	Allocation for Each year (Million PKR)
2010-11	9,500
2011-12	10,000
2012-13	9,886
2013-14	10,868
2014-15	17,118
2015-16	24,000
2016-17	45,000

Source: WASA-F P&D

5.1.2 Local Authority

(1) Faisalabad Development Authority (FDA)

The FDA is responsible for the planning, design, and implementation of various urban development projects. It oversees the following functions:

- Development of new housing colonies
- Building Control
- Water Supply, Sewerage & Drainage
- Environmental Improvement Schemes
- Regulation of Industrial Development
- Reports on Traffic/Transportation

The FDA pursues the vision of turning Faisalabad City into a "livable city" with combined support of people, the private sector, other local institutions, and the Government. The FDA mission is to establish an integrated environmental and regional development approach and accounting process vis-à-vis the FDA's planning and development functions. The main three wings of the FDA are the Urban Development Wing, the Water and Sanitation Agency (WASA), and the Traffic Engineering Planning Agency (TEPA).

(2) Role of Local Authorities in the Water and Sewerage Sector

Thirty-four districts in Punjab Province are handling the actual management and O&M of water and sewerage works. A WASA is established under each Development Authority in the five districts (big cities) of Lahore, Faisalabad, Rawalpindi, Multan, and Gujranwala as the entity implementing water and sewerage works. In districts other than the foregoing five, the water and sewerage works are implemented by lower district organizations known as, Tehsils. An Infrastructure Division under a Municipal Officer in each Tehsil is actually in charge of the O&M of these works.

A5.2 WASA-F Organization

5.2.1 Major Duties of WASA-F

WASA-F was created in 1978 as an Agency of FDA under the Punjab Development of Cities Act 1976. WASA-F has the following functions:

(1) Planning, design, and construction of water supply, sewerage, and drainage facilities for:
   A) New construction works

B) Rehabilitation and augmentation of the existing system
(2) Operation and maintenance of the water supply, sewerage, and drainage system
(3) Billing and collection of revenue for the services provided to consumers.

WASA-F envisions becoming a high-class service provider for the people of Faisalabad City and thereafter becoming the center of excellence in the water sector of the country. The WASA-F Mission Statement breaks down this vision into the following objectives:

- To make our customers feel welcome, appreciated, and worthy of our best efforts in everything we do as a provider of water supply, sewerage and drainage services.
- To achieve sustainable financial self-sufficiency.
- To train and motivate employees to adopt a professional approach for quality services.

The project and business of the WASA-F are operated as components of the FDA. so the annual investment plan of the FDA encompasses the annual investment plan of WASA-F. The WASA budget is approved by the Governing Body of the FDA. Each WASA in the province reports its annual achievements to the Punjab Government (Secretary of HUD&PHED, P&D, and Finance). The Governing Body of the FDA authority has also taken over the authority over tariffs, an authority previously held by the Punjab Government/Chief Secretary. Further, the FDA appoints the executive personnel to serve in WASA-F. In short, WASA-F is not an independent institution that makes decisions by itself but an organization under the FDA.

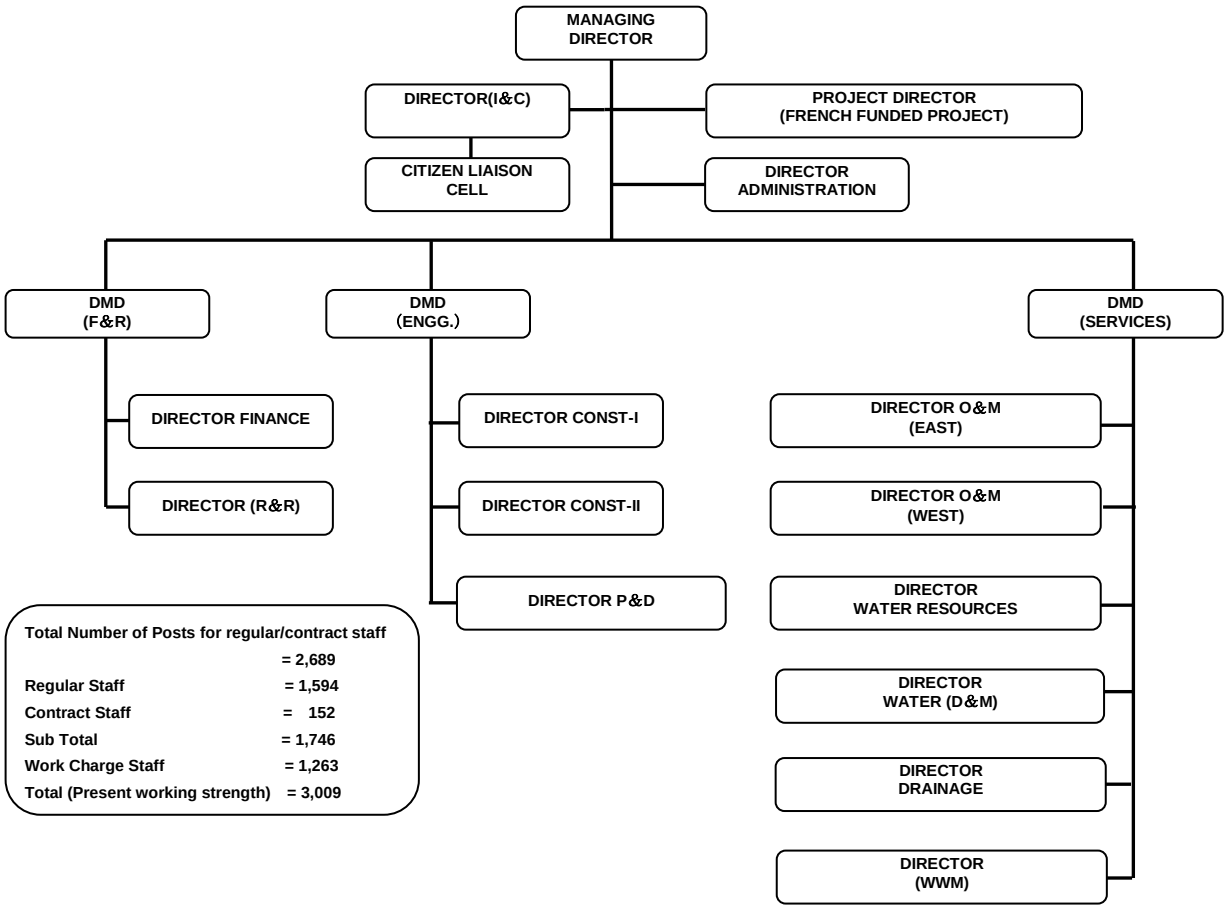
5.2.2 Organization Structure

Figure A5.2.1 shows an organogram of WASA-F, an organization of about 1,750 personnel made up of both regular and contract staff employed in the budget of the provincial government. WASA-F also engages work-charged staff to perform simple tasks in numbers that vary over time, covering the expense within its own budget. The number of work-charged staff engaged as of September 2016 totaled 1,263, making up just less than half of the total staff of 3,009 in that month. This report focuses mainly on regular and contract staff in its discussions on personnel management.

The organization of WASA-F is formulated under a Managing Director (MD) appointed by the Secretary HUD&PHED. The Chief Secretary/Chief Minister can direct the Secretary HUD&PHED to appoint the MD. The appointment procedure currently adopted is carried out in the following steps: advertisement in newspapers, interviews by a selection board, approval of the selection board's recommendation by the Chief Secretary/Chief Minister, and appointment by the Secretary HUD&PHED. An appointed MD serves a term of three years. The Secretary HUD&PHED has the authority to extend or abolish the appointment.

Generally speaking, three Deputy Managing Directors (DMDs) are appointed under the Managing Director (MD). The Deputy Managing Directors respectively oversee Finance & Revenue, Engineering, and Services. The Finance and Revenue DMD oversees a finance division and revenue & recovery division. The Engineering DMD oversees a construction I (West) division, construction II (East) division, and planning and design division. The Services DMD oversees O&M east and O&M west divisions, both of which manage sewers, a Water Resources division that manages the intake of groundwater and water treatment plants, a Distribution & Management (D&M) division that manages water distribution pipes, and a Drainage and Waste Water Management (WWM) division that manages the pumping stations for sewage and wastewater treatment plants. Apart from those divisions, an Administration division, Implementation & Coordination (I&C) division, and French Funded Project division have been installed directly under the MD in a recent organizational reform of WASA-F.

While WASA-F takes charge of the three sectors of Water Supply, Sewerage, and Drainage, its structure is organized by administrative functions (e.g., engineering and services) rather than the three sectors per se. As a result, the deputy director of services is in charge of the O&M of the sectors.



Source: WASA-F

Figure A5.2.1 Organogram of WASA-F

5.2.3 Personnel Management

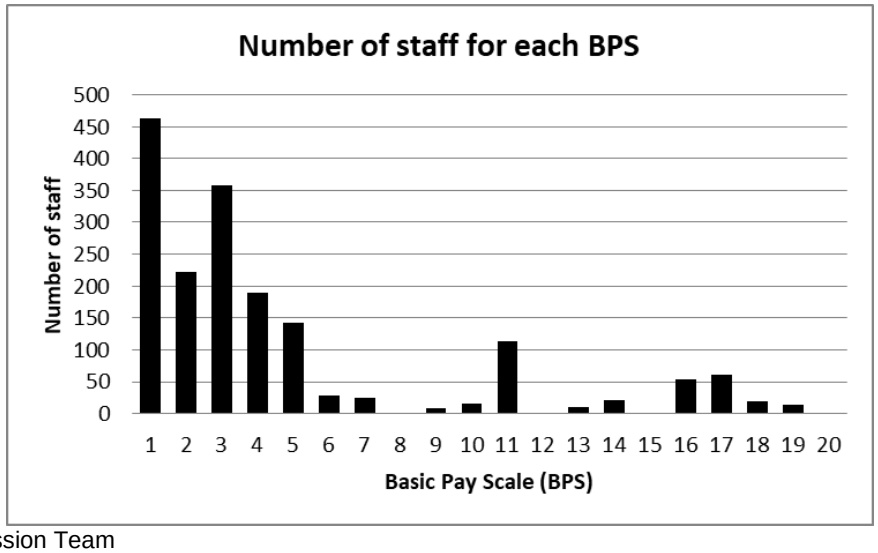
The Administration Division is in charge of personnel management. The personnel of WASA-F are ranked according to 20 Basic Pay Scales (BPS 1 to 20). Those ranked between 16 to 20 BPS handle administrative works, and those ranked 1 to 15 BPS handle practical works. For personnel ranked between BPS 1 to 16, advances up the BPS ladder are determined by the period worked. For ranks of up to BPS 17, the Managing Director of WASA-F has the appointment authority. Appointments/promotions of personnel ranked BPS 18 and above are decided by the DG FDA/FDA Governing Body. Personnel shifts within WASA-F are done according to the same rules. While the BPS ranking goes up together with the payment amount and number of years of service, the job designation (category) does not change. The designation of a sewer man, for example, ranges mainly from BPS 1 to 4, while that of a pump operator ranges from BPS 2 to 5.

Staff recruitment is carried out by public offers and written/oral examinations and is decided by the provincial government. WASA-F staff members retire upon reaching 60 years of age.

An official set of job descriptions for WASA-F has yet to be approved. An original draft of the job descriptions was created a long while ago and needs revision. Established job descriptions are necessary to strengthen the organizational structure. WASA-F, therefore, is preparing to draft a new set of descriptions adapted to the actual organization. For employee evaluations, WASA-F is using a specified form from the Punjab Government.

Following is a summary of the conditions entailed in the formation of WASA-F staff:

- **Figure A5.2.2** shows number of staff assigned to each BPS ranking. Persons ranked higher than BPS 16 account for 5% of all staff, while those ranked below BPS 5 account for about 80%.

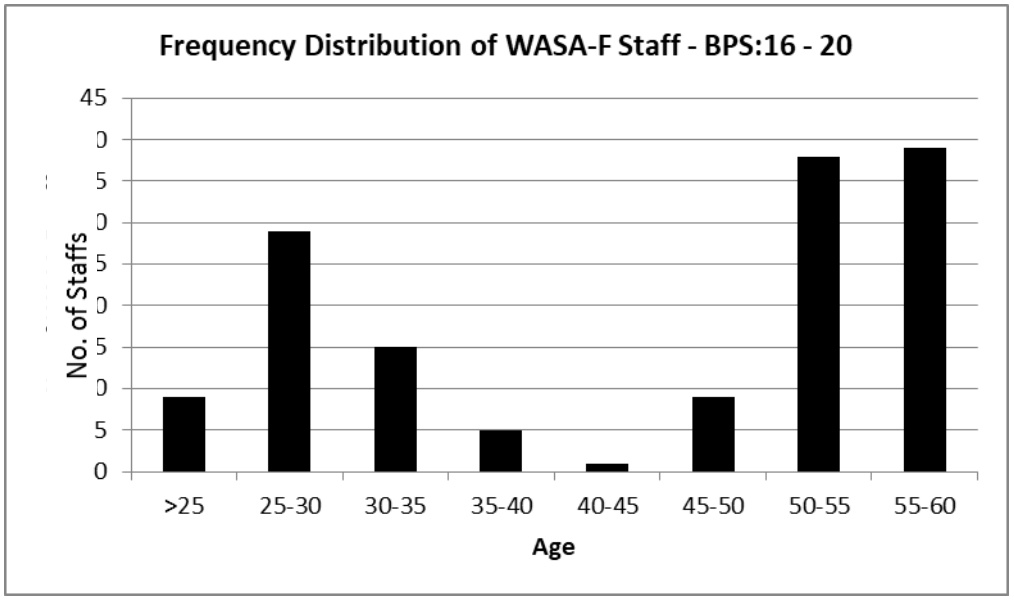


Source: JICA Mission Team

Figure A5.2.2 Number of Staff by BPS Ranking

- Working towards the budgeted number of 2,689 posts, excluding the separate budget for work-charged staff, 1,746 persons have been appointed as staff (1,782 at the time of the detailed planning study). As a result, 943 posts are vacant. Staff persons in administrative positions often serve multiple posts.
- The adoption of the staff is concentrated in two periods, namely, for the period after WASA-F's founding and from 2005 onwards. In particular, 53% of the administrative staff ranked at BPS 16 or higher are over 50 years of age and will retire within 10 years. A serious generation gap is observed in the age composition of WASA-F. (See **Figure A5.2.3**)

Two factors responsible for the many vacant posts are the number of retiring personnel and the reluctance of the revenue-deprived provincial government to approve the hiring of new people.



Source: JICA Mission Team

Figure A5.2.3 Age Breakdown of WASA-F at the BPS 16-20 Rankings

5.2.4 Human Resource Development

WASA-F lacks a human resource development plan. The only form of human resource development planning taking place at present is the planning for employee attendance of the training courses or workshops. This attendance plans are formulated by the Directorate of Information and Communication (I&C) instead of the Directorate of Administration, the entity in charge of human resource management.

The data on course attendance in 2016 shows that 193 employees attended in total, including 17 employees who attended eight courses held in other countries. Following are descriptions of a number of issues related to course attendance and the characteristics of the attendants.

- The domestic training courses include that by Al-Jazari Academy (former WASA Academy).
- Thirteen attendants attended 5 training courses in Japan.
- Officers ranked BPS 16 or higher, that is, those in the administrative layer, also attended training courses.
- The number of attendants per BPS ranking is shown in **Table A5.2.1**.

Table A5.2.1 Number of Training Course Attendants

BPS	Number of attendants in total, (A)	Number of staff persons in total, (B)	(A) / (B)
19	16	14	1.1
18	24	12	2.0
17	142	64	2.2
16	11	56	0.2
Total	193	146	1.3

- In many cases one officer attended a couple of courses.
- Very few administrative officials in the BPS 16 ranking attended courses.
- Attendance of these courses seemed to be a privilege of high-ranked officials.
- Employees ranked lower than BPS 15 had no plans to attend courses for human resource development.

The following are recommended improvements:

- WASA-F should formulate a comprehensive human resource development plan extending far beyond the scope of a training course attendance plan.
- More administrative officials ranked BPS 16 or more and other employees ranked lower than BPS 15 should attend related training courses.
- Assistant directors or senior engineers should plan out an OJT training scheme for workers with lower BPS rankings.

A5.3 Other Relevant Agencies

5.3.1 Irrigation Department, Punjab[13]

The Irrigation Department, Punjab is an organization holding jurisdiction over irrigation in Punjab Province. This department envisions the following: 1) Sustainable management of water resources, 2) Adequate, equitable, reliable irrigation supplies, 3) Enhanced agriculture productivity, 4) Increased employment and income, 5) Effective flood planning and management, and 6) Storage of water and construction of reservoirs.

1) Functions of the Irrigation Department

[13] Official website of the Irrigation Department (http://irrigation.punjab.gov.pk/)

The functions of the Irrigation Department, as enunciated in the Punjab Government Rules of Business, are summarized below:

- Rivers and riverine Surveys.
- Barrages: construction work and all matters connected therewith.
- Construction and maintenance of canals.
- Tubewells and other water utilization schemes.
- Flood control and flood protection schemes.
- Drainage schemes.
- Storage of water and construction of reservoirs.
- Basic and applied research in irrigation, hydraulics, groundwater, and land reclamation.
- Administration of the Canal and Drainage Act, 1873.
- Administration of the Soil Reclamation Act, 1952.
- Administration of the Land Improvement Tax Act, 1975.
- Assessment of water rates.
- Distribution of canal waters.

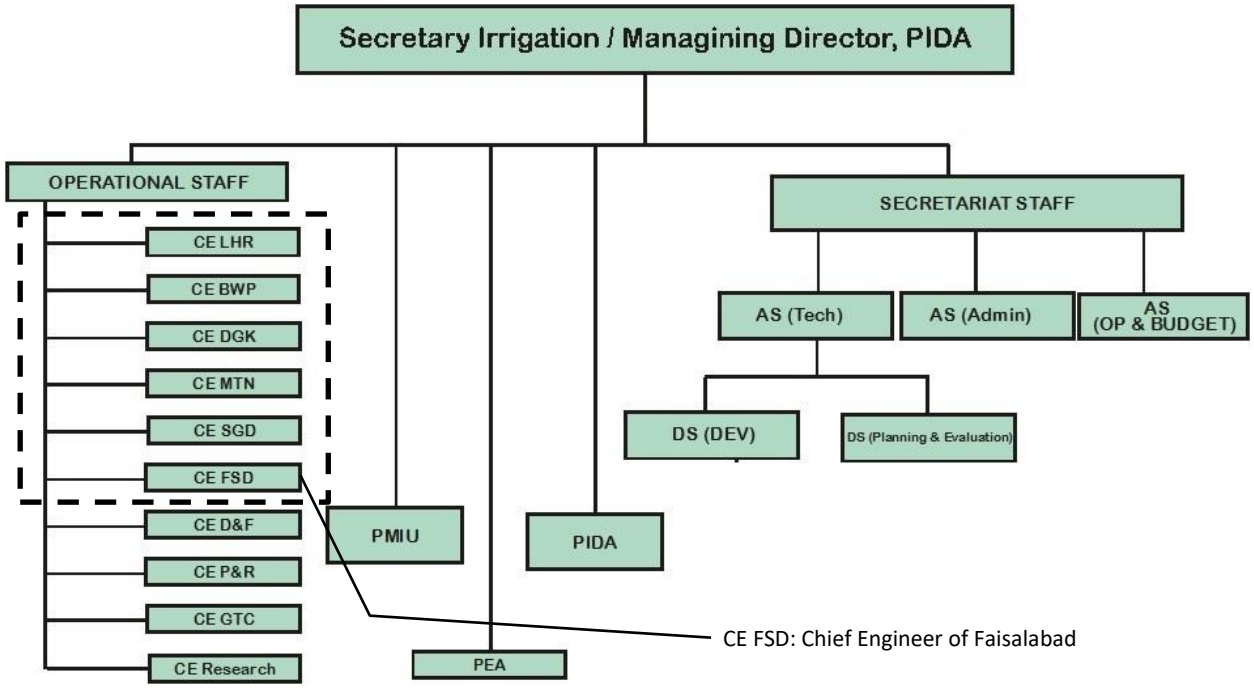
The following are the core functions of the department on a more specific level:

- Operation and upkeep of the irrigation system of the province;
- Planning, prioritizing, and implementing maintenance works through approved O&M Work plans and under third-party top-down supervision;
- Optimizing the use of water resources in the province by the equitable distribution of irrigation water supplies (about 54 MAF) through the 58,000 canal outlets;
- Assessing water rates based on actual field inspections by the revenue staff of the department;
- Implementing the development program portfolio and foreign-aided projects;
- Providing for and executing a plan for the management of river floods in the province, and constructing and maintaining flood protection programs/works;
- Promoting the participation of beneficiaries in the management of the Irrigation and Drainage Systems of the province, in line with requirements of the Punjab Irrigation and Drainage Authority (PIDA) Act, 1997;
- Administering the Electricity Act and matters to do with village electrification:
- Acting as the Personnel Department for over 52,000 employees of the Provincial Irrigation Department (handling matters related to career development, postings and transfers, promotions, and in-service training, in addition to the core personnel department functions).

The Irrigation Department in Faisalabad District grants approval for discharge of effluents such as domestic and industrial wastewater to main drains such as the Paharang Drain and Madhuana Drain, as well as for the abstraction of irrigation water.

2) Organization of the Irrigation Department

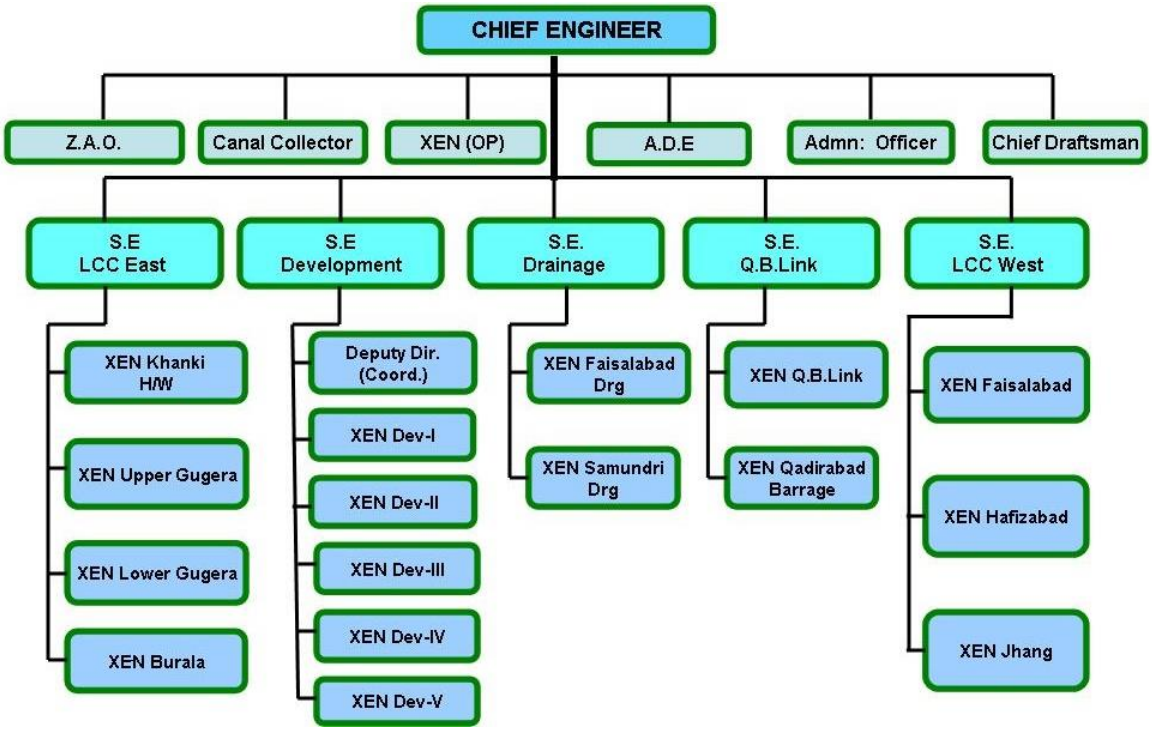
An organization chart of the Irrigation Department is shown in **Figure A5.3.1**. Punjab province is divided into 6 irrigation zones (Lahore, Bahawalpur, DGK, Multan, Sargodha, and Faisalabad), each of which is managed under a Chief Engineer.



Source: Official Website of the Irrigation Department (http://irrigation.punjab.gov.pk/organopid.aspx)

Figure A5.3.1 Organization Chart of the Irrigation Department, Punjab

Figure A5.3.2 shows an organization chart of the Faisalabad Irrigation Zone. Five Superintending Engineers (S.E. in the figure) are positioned under the Chief Engineer. Several Executive Engineers (XEN in the figure) are assigned to key irrigation structures such as Khanki Barrage (Head Works) and Qadirabad Barrage, and branches such as Upper Gugera and Lower Gugera. Rakh branch is managed by the Executive Engineers of Hafizabad.



Source: Official Website of the Irrigation Department (http://irrigation.punjab.gov.pk/fsdzone.aspx)

Figure A5.3.2 Organization Chart of the Faisalabad Irrigation Zone

3) Key agricultural and irrigation conditions in the Faisalabad Irrigation Zone and/or Punjab Province

Following is a summary of points key to grasping the irrigation and agriculture conditions to be considered for the purposes of water resources development and management:

- There are two cropping seasons, Kharif (April to September) and Rabi (October to March). Rainfall and river discharge are high in Kharif and low in Rabi.
- Faisalabad produces two categories of major exports crops, Kharif and Rabi. The former consists of Maize, Rice, Sugarcane, and Bajra; the latter, Wheat, Barley, Gram, and Barseen[14].
- The amount of irrigation water to be supplied is planned and estimated based only one the water allowance set per unit benefited area. Cultivated crops and crop patterns are not considered. Two water allowances based on the groundwater condition by area are applied: 13.2 l/s/km^2 (1.89 cusecs/1000 acres) and 19.9 l/s/km^2 (2.84 cusecs/1000 acres).
- The irrigation intensity in the design stage was 50 to 75%, whereas the actual intensity at present is 130 to 150%[15]. The difference shows us that irrigation water is in rather short supply.
- The total Culturable Command Areas (CCAs) to be irrigated at present are 12,266 km^2 (3.031 million acres) in Punjab province and 4,836 km^2 (1.195 million acres) in the Faisalabad Irrigation Zone.
- The agriculture area of the Faisalabad Peri-Urban area from 1973 to 2000 remained almost steady, at a slightly reduced area of around 60% of the total area. Later, from 2000 to 2013, it was radically reduced to 38% of the total area. This change shows the rapid expansion of the urban sprawl of the city over this period, mostly in the form of new housing schemes /colonies and haphazard growth.[16]

5.3.2 Environmental Protection Agency (EPA)

The Ministry of Environment headed by a Federal Minister was formerly the main responsible authority for policymaking on environmental protection in Pakistan. After the 18th Amendment of the Constitution, however, the environmental responsibility was shifted to the provincial government.

(1) Federal Environmental Protection Agency (Federal EPA or Pak-EPA)

Under the Pakistan Environmental Protection Act, 1997 (PEPA 1997), the Ministry of Environment works in collaboration with the Pakistan Environmental Protection Council (PEPC) and the federal and provincial Environmental Protection Agency (EPA) or Environmental Protection Department (EPD). (The EPD was created in Punjab as a body to grant environmental approvals or detect pollution separately from the EPA.) The PEPC and the Federal Environmental Protection Agency (Pak-EPA) are primary responsible for administering the provisions of PEPA 1997. The PEPC oversees the function of the Pak-EPA.

The functions and powers of the PEPC include formulation of national environmental policy, enforcement of PEPA 1997, approval of National Environmental Quality Standards (NEQS), incorporation of environmental considerations into national development plans and policies, and the provision of guidelines for the protection and conservation of biodiversity in general and the conservation of renewable and non-renewable resources.

The Federal government has also formed the Federal EPA (Pak-EPA), a body charged with a wide range of functions defined in PEPA 1997 under the leadership of the Director General. The Federal EPA (Pak-EPA) has overall jurisdiction over EIA/IEE issues. The following summarizes the scope of federal jurisdiction over the projects:

[14] Faisalabad Peri-Urban Structure Plan, April 2015
[15] Official Website of the Irrigation Department (http://irrigation.punjab.gov.pk/fsdzone.aspx)
[16] Faisalabad Peri-Urban Structure Plan, April 2015

- On federal land
- Military projects
- Involving trans-country impacts
- Bearing trans-province impacts.

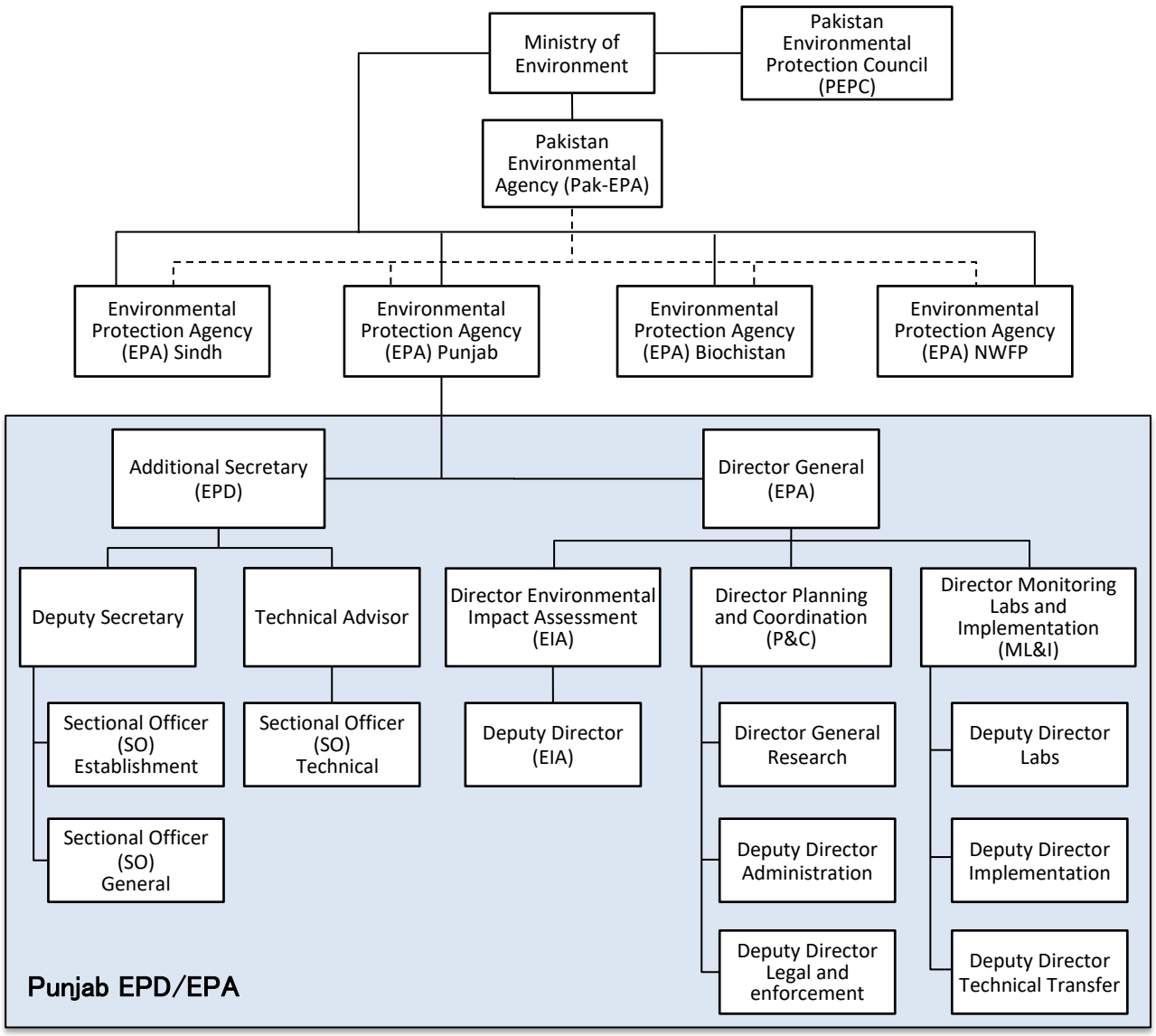
(2) Punjab Environmental Protection Agency/Department (EPA/EPD)

Each provincial government has its own environmental protection institution responsible for pollution control. The provincial environmental protection Agencies or Environmental Protection Department (EPA/EPD) are the provincial counterparts of the Federal EPA (Pak-EPA) , a body authorized to delegate powers to its provincial counterparts. EPA/EPD are formed by the respective provincial governments. A Director General who exercises powers delegated by the concerned provincial government heads the provincial EPA. The reports covering IEEs and EIAs are submitted to the concerned provincial EPA/EPD for approval.

The figure below depicts the organizational settings for the environment from the national level to provincial level. In Punjab province only, the administrative function and technical function are respectively assigned to the EPD (Environmental Protection Department) and EPA (Environmental Protection Agency). EPD and EPA, therefore, are full-fledged departments under the Government of Punjab. EPD is under administrative control of the Secretary, Government of Punjab. The Director General of the EPA is positioned under the secretary of the EPD and heads all of EPA Punjab. All of the functions in PEPA 1997 are overseen by the Director General of the EPA.

(3) District Environment Officer (DEO)

At the district level, the District Environment Officer (DEO) is assigned as the person responsible for supervising environmental issues in all sectors. The issues identified by the DEO are reported to the provincial EPA/EPD for legal processing. The DEO can take action against any development activity deemed to contribute to the environmental degradation of the country.



Source: Preparatory Study for Lahore Water Supply, Sewerage and Drainage Improvement Project, JICA

Figure A5.3.3 Organizational Settings for the Environment in Punjab

5.3.3 Pakistan Water and Power Development Authority (WAPDA)

In the late 1950s, the Indus Basin Plan (IBP) was formulated for planning, design, and construction activities connected with the development of water and hydropower resources. WAPDA was established in 1958 to execute projects relating to the IBP under the administrative control of the Federal Government.

Under pressure to complete the work for the IBP in a timely fashion, a large number of experienced engineers were relocated from the Irrigation Department to WAPDA over the period from 1960 to 1970.

Turning to groundwater, gradual rises in the groundwater level due to seepage from the canals through the extended irrigation canal network led to waterlogging in the area. In areas where the existing groundwater was brackish, the rising water table generated salinity hazards by pushing saline water up into the roots of plants. In response, a series of anti-waterlogging measures and groundwater development projects have been commenced to prevent these hazards under an overarching project called the Salinity Control and Reclamation Project (SCARP). SCARP has been promoted mainly in the Punjab province. The main

objective of SCARP have been to construct deep tubewells in the target area and to discharge the groundwater to lower the groundwater level to protect crop yields.

These projects were started in the 1960s by WAPDA as the major executing organization. Tubewells in excess of 10,000 have been constructed in SCARP. Necessary hydrogeological studies for the projects have also been carried out mainly by WAPDA.

5.3.4 Pakistan Council of Research in Water Resources (PCRWR)

PCRWR is a national organization set up to study water resources. It was established in 1964, initially as the Irrigation, Drainage and Flood Control Research Council (IDFCRC), under the Ministry of Natural Resources. It was placed under the Ministry of Science and Technology in 1970 and renamed the PCRWR in 1985. At first the organization served as a national institute for basic research in various areas of the water sector, especially irrigation, drainage, surface water, and groundwater management, groundwater recharge, watershed management, desertification control, rainwater harvesting, and water quality assessment. More recently it has been involved in quality improvement technologies and other advances in water resource management conservation.

As established based on the PCRWR Act of 2007, every direction, supervision, and executing right of the PCRWR is to be decided by a managing executive board. The board is headed by the Federal Minister for Science & Technology as President and the Federal Secretary as Deputy President, and composed of representatives from Federal and Provincial Departments and Technical Institutions, and Professionals and Farmers from all over the country.

PCRWR began mapping the entire Upper Indus Basin in 2004 and completed the task in 2014. Groundwater atlases are edited to pass on the information to farmers, as well as policymakers, development agencies, and well-drillers. The Council also monitors for Waterborne Diseases, researches Population and Water Supply, and runs a National Water Quality Monitoring Program for observation and testing of the quality of water at different locations of the country.

5.3.5 Punjab Government Servants Housing Foundation (PGSHF)

The PGSHF is a public organization established to supply housing to the staff of the provincial government on the basis of the Punjab Government Servants Housing Foundation Act, 2004. At present the Foundation is engaged in construction works in the Satiana area of Faisalabad City (PGSH SCHEME AT SATIANA ROAD, FAISALABAD). General inflation and sharp increases in housing prices make it is difficult for provincial staff to pay for housing with government remuneration. The Foundation is supervised by a Board of Directors headed by a Provincial Chief Secretary and composed of provincial staff persons as appropriate. A member of the Foundation can move to a house under the housing supply scheme.

Although the Foundation itself has no direct ties to groundwater works, water supply facilities are inevitably necessary for residential development. In the case of the Satiana area of Faisalabad City, four tubewells were constructed in the area along the Gugera Branch Canal as water sources for the development.

5.3.6 Tehsil (Town) Municipal Administrations (TMAs)

The TMAs are the main pillars of the new system for development-related work. As entities responsible for spatial planning and municipal services, they work closely with the Union Councils and other civil society and private organizations. The TMAs are responsible for providing, managing, operating, maintaining, and improving the following municipal infrastructures and services:

- Water supply, control and development of water sources other than the systems maintained by the

union and village councils;
- Sewerage, sewage treatment, sewage disposal, and stormwater drainage;
- Sanitation and solid waste collection and sanitary disposal of solid, liquid, industrial, and hospital waste;
- Roads and streets, other than those under the jurisdiction of or maintained by a district government or government or those maintained by union administration or a village council;
- Firefighting;
- Parks, playgrounds, open spaces; and
- Slaughterhouses

5.3.7 Community-Based Organizations (CBOs)

CBOs are organized by communities in each village. Each is tasked with ascertaining needs related to the water and sanitation of the community and providing support to Public Health Engineering for the planning, design, estimation, execution, and operation of water supply schemes. CBOs also operate & maintain rural water supply schemes.

The main roles of a CBO are as follows:

- Delivery of services according to an MoU (Memorandum of Understanding) and standards notified by the Public Health Engineering Department (PHED).
- Tariff-setting and collection of water charges for services rendered.
- Outsourcing to other operators (domestic private entrepreneurs, etc.).
- Consumer demand management and complaint redress.
- Participatory planning and oversight of construction work.
- Accountability to LGs (= Councils: Local Governments) for compliance with service standards as specified in the provincial policy, LG by-laws, and O&M MOU signed by CBO.
- Periodic reporting to the LGs and PHED.
- Support of awareness campaigns run by the provincial government.

CHAPTER A6 CURRENT WASA-F OPERATION AND MANAGEMENT

At present, WASA-F' operations and managements are summarized below.

- WASA-F has recently introduced the energy audit to measure operation efficiencies of the existing facilities; and the results showed the pump operation efficiency has improved gradually,
- Water qualities have been monitored daily, monthly and yearly depending on analysis items, at tubewells, water tanks at pumping stations and water treatment plans, overhead reservoirs (OHRs), ground reservoirs (GRs), waste water treatment plants, and so on,
- Non-revenue water (NRW) ratio is officially reported 33%; however, the measurement process is unclear, and French Funded Project estimated it as 55%.
- Individual IT systems (applications) such as: supervisory control and data acquisition (SCADA), customer information, and GIS, have been developed; next the development of an integrated IT system is desired,
- Current business plan has been carried out with monitoring 43 key performance indicators (KPIs),
- Water supply and sewer / drainage tariff structure for industrial and commercial was revised in 2016 and increased half time; however, that for domestic has been kept the same prices without any increase since 2007,
- Tariff collection efficiency is substantially low, about 28 % in water bill; less service level leads to less customer's satisfaction, and low tariff collection efficiency,
- An interview survey was conducted to measure customer satisfaction in this Project; a result of the survey showed that willingness to pay of customers is high if WASA-F's service level will be improved.

This Chapter examines the current situations, conditions, difficulties, efforts, related to water supply, sewerage, and drainage works by WASA-F.

A6.1 Current WASA-F Operations

Table A6.1.1 below summarizes the current operation and management of WASA-F.

Table A6.1.1 Current WASA-F Operation and Management

Field	Item	Actual Condition
Finance and Recovery	Tariff System	a) WASA-F has three types of tariff tables for domestic, industrial, and commercial customers. b) WASA-F charges both flat-rates and meter-rates for domestic, industrial, and commercial customers. *The industrial and commercial tariffs were revised on the 21st of October, 2016. c) All domestic customers have contracted on a flat-rate system. For industrial, only 93 customers supplied by bulk water have contracted for metered-rate supply.
	Bill Collection	a) The billing collection rate for domestic customers was approximately 30% as of August 2016. WASA-F staff are exempt from water tariffs. Government- registered religious/charitable units, departments, and mosques are charged 70% of the domestic rate. Free water stations are set up within the city. b) The monthly billing collection rates for industrial and commercial customers are approximately 70% and 40%, respectively. c) The billing collection rate went down after the tariff revision for industrial and commercial customers in October, 2016, whereas income has increased by 25% to 30%.
	Financial Condition	a) Budget of WASA-F

<table>
<tr><th>Field</th><th>Item</th><th>Actual Condition</th></tr>
<tr><td></td><td></td><td>
(PKR In million)
<table>
<tr><th>S/N</th><th>Description</th><th>Budget 2015-16</th></tr>
<tr><td>A</td><td>RECEIPT</td><td></td></tr>
<tr><td></td><td>1 Non-Development[17]</td><td>2081.622</td></tr>
<tr><td></td><td>2 Development</td><td>1861.614</td></tr>
<tr><td></td><td>Total</td><td>3943.236</td></tr>
<tr><td>B</td><td>EXPENDITURE</td><td></td></tr>
<tr><td></td><td>1 Non-Development[18]</td><td>2079.622</td></tr>
<tr><td></td><td>2 Development</td><td>1861.614</td></tr>
<tr><td></td><td>Total</td><td>3941.236</td></tr>
</table>
b) Operational Receipt (Non-Development) WASA-F (Estimated Budget) in FY 2015-16
<table>
<tr><th>S/N</th><th>Particular</th><th>PKR in million</th><th>%</th></tr>
<tr><td>1</td><td>Water Sales & Sewerage Charges</td><td>840.000</td><td>40</td></tr>
<tr><td>2</td><td>Urban Immovable Property Tax Share</td><td>290.000</td><td>14</td></tr>
<tr><td>3</td><td>Subsidy Grant from Government of Punjab</td><td>300.000</td><td>14</td></tr>
<tr><td>4</td><td>Monsoon Grant</td><td>60.000</td><td>3</td></tr>
<tr><td>5</td><td>PCGI Project</td><td>496.622</td><td>24</td></tr>
<tr><td>6</td><td>Miscellaneous/Other Income</td><td>93.000</td><td>4</td></tr>
<tr><td></td><td>Total for the Year</td><td>2,079.622</td><td>100</td></tr>
<tr><td></td><td>Opening Balance</td><td>2.000</td><td></td></tr>
<tr><td></td><td>Total Receipts</td><td>2,081,622</td><td></td></tr>
</table>
• The biggest component of the operational receipts of WASA-F in budget estimates, revenue through water sales and sewerage charges, amounts to 40% of the total receipts, followed by funds made available under Punjab Cities Governance Improvement Project funded by the World Bank (24%) and subsidies/grants from the Government of Punjab (14%).
c) Operational Expenditure of WASA-F
<table>
<tr><th>S/N</th><th>Particular</th><th>PKR in million</th><th>%</th></tr>
<tr><td>1</td><td>Pay & Allowance</td><td>847.120</td><td>38</td></tr>
<tr><td>2</td><td>Electricity for Water Supply & Sewerage</td><td>600.000</td><td>27</td></tr>
<tr><td>3</td><td>Repair & Maintenance Expenditure</td><td>61.503</td><td>3</td></tr>
<tr><td>4</td><td>PCGI Project</td><td>496.622</td><td>22</td></tr>
<tr><td>5</td><td>Other Expenditure</td><td>204.627</td><td>9</td></tr>
<tr><td></td><td>Sub-Total</td><td>2,209.872</td><td>100</td></tr>
<tr><td></td><td>Austerity / Corrective Measures by WASA</td><td>-130.250</td><td></td></tr>
<tr><td></td><td>Total</td><td>2,079.622</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>
• The biggest expenses are pay and allowances to the WASA-F staff. Note, however, that a considerably large share of operational expenditure (27% of the total) is devoted to the cost for electricity for water supply and sewerage.
</td></tr>
<tr><td>Organization and Human Resource Development</td><td>Organization</td><td>a) WASA is an administrative agency of the provincial government.
b) Rather than being divided into the three services of water supply, sewerage ,and rainwater drainage, the organization structure is divided into service, engineering, finance, etc.
c) There are many vacant posts due to lack of budget. (943 vacant posts as of Sept. 2016).
d) WASA engages a large number of working staff members. (3,009 persons as of Sept. 2016).</td></tr>
<tr><td></td><td>Human</td><td>a) Staff managed are managed by a Basic Pay Scale (BPS) with 20 rankings.</td></tr>
</table>

[17] The budget of WASA-F for Receipts and Expenditure is mainly classified into Non-Development and Development. Receipts in Non-Development (also regarded as Operational Receipts) are composed of: 1) income from water supply and sewerage, 2) grants, transfer, and subsidies from relevant institutions such as the Urban Immovable Property (UIP) Tax share, the Monsoon Grant, subsidies from the Government of Punjab, etc., and 3) other income.

[18] Expenditure in Non-Development, also regarded as Operating Expenditure, is composed of: 1) pay and allowances, 2) electricity for water supply and sewerage, 3) repair and maintenance expenses, and 4) other expenses.

Field	Item	Actual Condition
	Resource Management	b) BPS promotions are awarded based only on years served, which reduces the incentive to work hard. c) The job descriptions are undefined. d) WASA-F has no clear personnel evaluation system. e) Many staff members employed at the time of WASA-F's establishment will retire in the next few years.
	Human Resource Development	a) Capacity development is mainly implemented by assisting the Al-Jazari Academy in Lahore. b) At present, only staff from the administrative layer have training courses.
Customer Relation	Complaints Handling	a) WASA-F operates a Customer Relation Center established in HQ for 24 hours per day, receiving information by telephone, SNS, the Center website, etc. b) WASA-F has eight area offices in the city. When receiving a complaint from a customer, staff at each office respond. WASA-F keeps a record of complaints in a customer complaint database.
	Publishing and Public Awareness	a) WASA-F holds town meetings attended by social union representatives. b) WASA-F holds events such as promotions at school. (e.g., Karaoke contests) c) WASA-F broadcasts announcements on the radio.
	Customer Management	a) The Revenue (Domestic), Revenue (Industry & commercial), and Water Distribution & Management Directorate have customer information, but each Directorate is independent. b) WASA-F basically uses a metered-rate billing system. c) There seem to be a lot of un-registered customers in WASA-F.

Source: JICA Mission Team

6.1.1 Energy Audit

The operation and maintenance (O&M) works of WASA-F have been handled with an emphasis on an energy audit conducted since 2015. The Energy Management Cell therefore has played an important role in carrying out the energy audit. The audit is carried out in a series of important steps:

- Establishment of the energy audit team under the Energy Management Cell.
- Development of a collaborative approach for carrying out the energy audit.
- Capacity building of the energy audit team in accordance with the WASA-F energy system program/requirement.
- Purchase of instruments using the energy audit as required according to the necessity of the task.

Overall O&M expenditures is needed to meet the program and requirements of the energy audit system.

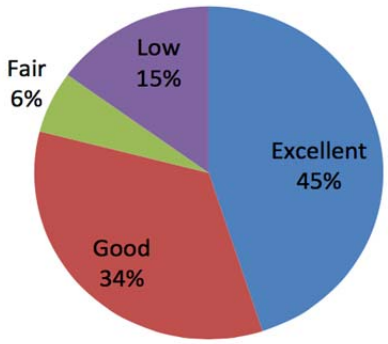
(1) Result of the energy audit on pumping stations

The results of the energy audit of each pumping station are shown in **Table A6.1.2** and **Figure A6.1.1** below. Only 15% of the pumps were found to have low efficiency, while 80% of the pumps had good or excellent efficiency. An inspection should be performed jointly with the energy audit team to evaluate the pump efficiency by a quantitative method.

Table A6.1.2 Result of the Energy Audit on Pumping Stations

	Zone	Number of Pumps				Total No. of Pumps
		LOW	FAIR	GOOD	EXCELLENT	
1	Chiniot Well Field	15	1	5	3	24
2	Jhang Branch	0	0	2	20	22
3	Rakh Branch	3	1	3	7	14
4	OHT & City Area	1	3	6	23	33
5	Water Works	1	0	0	10	11
6	East Division Disposal Pumps	2	5	24	7	38
7	West Division Disposal Pumps	7	2	27	19	55
	Total	29	12	67	89	197

Source: WASA-F O&M



Source: WASA-F O&M

Figure A6.1.1 Evaluation Result for Pumping System Efficiency

The pumping system efficiency is classified into four categories. The criteria for each category are shown in the table below.

Table A.6.1.3 Criteria for the Pumping System Efficiency Classification

Motor HP	Low (%)	Fair (%)	Good (%)	Excellent (%)
3-7.5	<44.0	44-49.9	50-54.9	>55
10	<46.0	46-52.9	53-57.9	>58
15	<47.1	48-53.9	54-59.9	>60
20-25	<48.0	50-56.9	57-60.9	>61
30-50	<52.1	52.1-58.9	59-61.9	>62
60-75	<56.0	56-60.9	61-65.9	>66
100	<57.3	57.3-62.9	63-66.9	>67
150	<58.1	58.1-63.4	63.5-68.9	>69
200	<59.1	59.1-63.8	63.9-69.4	>69.5
250	<59.1	59.1-63.8	63.9-69.4	>69.5
300	<60	60-64.0	64.1-69.9	>70

Source: Pacific Gas & Electric Company, USA

(2) Investment & Saving

According to the energy audit report, the costs for rehabilitations and replacements of the existing 41 pumps were a total of PKR 40.99 million in 2016. The efficiency improvement of the pumping system resulted in an 8% energy reduction with an annual saving of PKR 38.72 million (see **Table A6.1.4**).

Table A6.1.4 Investment & Saving Costs by Rehabilitation and Replacement of Pumps

Zone	Pumps Rehabilitated or Replaced (No.)	Annual Power Consumption (Mil. kWh)	Pumps Rehabilitated (No.)		Pumps Replaced (No.)		Cost Invested (Mil. PKR)	Annual Cost Saved (Mil. PKR)
			Impeller Adjust	Repair & Maintenance	Motor Replaced	Pump Replace		
Chiniot Well Field	16	1.77	15	11	-	1	13.09	23.04
Jhang Branch	-	-	-	-	-	-	-	-
Rakh Branch	4	0.07	3	2	1		3.21	0.89
OHR & City Area	4	0.08	4	1	-	-	2.97	1.02
Water Works	1	0.02	1	-	-	-	0.28	0.28
East Div. Disposal	7	0.23	6	1	-	1	5.42	2.98
West Div. Disposal	9	0.65	8	5	-	1	16.02	8.51
Total	**41**	**2.82**	**37**	**20**	**1**	**3**	**40.99**	**38.72**

Source: WASA-F O&M

The energy audit activities of WASA-F's facilities in 2016 were the first attempt to reveal certain electrical and mechanical conditions in conjunction with the pump efficiency improvements. Furthermore, it will require a total budget of about PKR 132.65 million for the installation of a power factor improvement (PFI) plant, variable frequency drive (VFD), water flowmeters, pressure gauges, current & voltage relays, volt & ammeters, motor terminal boxes, fuses, hour meters, and chlorinators, for the activities. The breakdown of the required expenses is presented in **Table A6.1.5**.

Table A6.1.5 Further Budget Requirement for Improvement of the Pump Systems

	Zone	Investment (PKR Million)	Improvement Interventions
1	Chiniot Well Field	15.58	▪ Impeller Adjustment ▪ Repair & Maintenance ▪ Replacement of Motor/Pump ▪ Installation of PFI plant, VFD, Water Flow Meter, Digital Pressure Gauge, Current & Voltage Relays, Volt & Ammeter, Motor Terminal Box, Fuses, Hour Meter & Chlorinator ▪ Proper/Safe Wiring ▪ Maintenance (Ratchet plate/gland leakage)
2	Jhang Branch	1.36	
3	Rakh Branch	7.16	
4	OHR & City Area	20.73	
5	Water Works	5.65	
6	East Division Disposal	25.57	
7	West Division Disposal	56.60	
	Total	132.65	

Source: WASA-F O&M

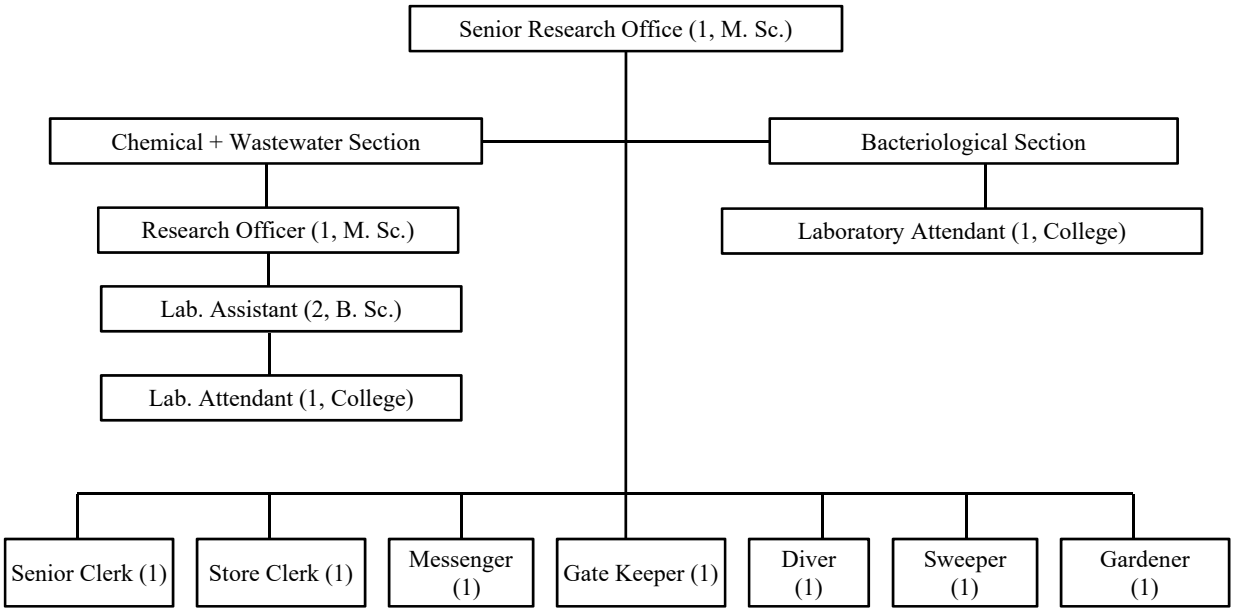
6.1.2 Water Quality Analysis Works

(1) Introduction

WASA-F established the Research Laboratory in 1978 as a body to monitor water quality and discharge WASA-F's duties as a provider of safe drinking water supply in the city. Initially the laboratory was furnished with equipment for analysis of basic elements. Later, on the recommendation of Japanese consultants in 1981, the laboratory was upgraded with new equipment and glassware. Still later, in 2008, the laboratory building was renovated and outfitted with more equipment.

(2) Organization

The existing organization chart and education background of the laboratory staff are shown in **Figure A6.1.2**. Thirteen persons work in the laboratory, of whom four are engineers and the remainder are technicians and others handling sampling, analysis support, etc. The P&D Director takes charge of the research laboratory directly.



Source: 1) Annual Water Quality & Assessment Report for the Year 2015, WASA-F
2) JICA Mission Team by hearing survey at the Laboratory

Figure A6.1.2 Organization Chart of the WASA-F Laboratory

(3) Water Quality Monitoring

Water quality monitoring is carried out based on a predetermined schedule. **Table A6.1.6** summarizes the water quality monitoring plan for the year 2015.

Table A6.1.6 Water Quality Monitoring Plan (2015)

No.	Locations/Sources	Frequency	Sponsored By	Analysis Item	No. of Samples	Remarks
1	Tubewells (29) in Chenab water source	Monthly	Water Directorate	Physicochemical (colour, pH, TDS, turbidity, hardness, Ca etc.)	29/month	Heavy metals: once a year
2	Tubewells (25) along the JBC	Monthly	Water Directorate	Physicochemical (colour, pH, TDS, turbidity, hardness, Ca, etc.)	25/month	Heavy metals: once a year
3	Tubewells (16) along the RBC	Monthly	Water Directorate	Physicochemical (colour, pH, TDS, turbidity, hardness, Ca, etc.)	16/month	Heavy metals: once a year
4	Clear water tank/OHR 1) TR (inlet &outlet) 2) JBC TR (in & out)	Daily	Water Directorate	Residual Cl2, Coliform	4/day	Residual chlorine should be tested on the spot.
5	Distribution networks +Consumer points (at random)	Daily	Lab.	Residual Cl2, Coliform	250/month	If residual Cl2 is zero, the bacteria should be isolated
6	Rectified complaints of leakages/new connections	Daily	O/M	Bacteriological	-	If reported
7	Wastewater (1) Chokera WWTP (2) Disposal stations (3) Industrial waste (4) Drains (Madhuana +Paharang)	Monthly Yearly Yearly Yearly	Lab.	Physicochemical (BOD, COD, settle-able SS)	6/month 2/year	To check the performance of the WWTP
8	Private Samples	Whenever provided to	Clients or Owners	Client's demand	---	Complete along with heavy metals

No.	Locations/Sources	Frequency	Sponsored By	Analysis Item	No. of Samples	Remarks
		Lab.				
9	Groundwater (different areas)	Yearly	Lab.	Bacteriological	10/year	In the summer session
10	Water before & after filtration units	---	Lab.	Physicochemical Bacteriological	5/year	As required

Source: Annual Water Quality & Assessment Report for the Year 2015, WASA-F

The actual results of the water quality monitoring are summarized in **Table A6.1.7**.

Table A6.1.7 Actual Results of Water Quality Monitoring (2015)

No.	Locations/Sources	Analysis Item	Total No. of Sample		Remarks
			Plan	Results (%)	
1	Tubewells (29) in Chenab water source	Physicochemical (colour, pH, TDS, turbidity, etc. - 13 items)	12*29= 348	160 (46%)	Samples were collected only from Jan. to Jul.
2	Tubewells (25) along JBC	Physicochemical	12*25= 300	0 (0%)	The reasons are not mentioned in the report.
3	Tubewells (16) along RBC	Physicochemical (colour, pH, TDS, turbidity, etc. - 13 items)	12*16= 192	108 (56%)	Samples were collected from only 8 to 11 wells.
4	Clear water tank / OHR 1) TR (inlet &outlet) 2) JBC TR (in & out)	Residual Cl2, Coliform	4*365= 1,469	1,207 (83%)	
5	Distribution networks +Main Sources (at random)	Residual Cl2, Coliform	250*12= 3,000	2,857 (95%)	
6	Rectified complaints of leakages / new connections	Bacteriological	-	-	
7	Wastewater (1) Chokera WWTP (2) Disposal stations (3) Industrial waste (4) Drains (Madhuana + Paharang)	Physicochemical (BOD, COD, settle-able SS)	12*6=72 2	0 (0%) 0 (0%)	No samples were collected for wastewater.
8	Private Samples	Physicochemical (colour, pH, TDS, turbidity, etc. - 13 items)	---	119	
9	Groundwater (different areas)	Bacteriological	10	0 (0%)	
10	Water before & after filtration units	Physicochemical Bacteriological	5	0 (0%)	
Total			5,657	4,451 (79%)	

Source: JICA Mission Team based on the "Annual Water Quality & Assessment Report for the Year 2015, WASA-F"

Table A6.1.8 shows the parameters that can be measured and cannot be measured by the WASA-F laboratory.

Table A6.1.8 Parameters that Can and Cannot Be Measured by the WASA-F Laboratory

No.	Pakistan Standard for Drinking Water	WASA Laboratory	Pakistan Standard for Wastewater	WASA Laboratory	Other Items for O/M	WASA Laboratory
1	E. Coli	O	Temperature	O	Electrical conductivity (EC)	O
2	Colour	O	pH	O	Carbonates (CO_3^{2-})	O
3	Taste	O	BOD	O	Bicarbonates (HCO_3^-)	O
4	Odour	O	COD	O	Sodium (Na)	O
5	Turbidity	O	TSS	O	Potassium (K)	O
6	Total hardness ($CaCO_3$)	O	TDS	O	Calcium (Ca)	O
7	TDS	O	Grease and oil	-	Magnesium (Mg)	O

No.	Pakistan Standard for Drinking Water	WASA Laboratory	Pakistan Standard for Wastewater	WASA Laboratory	Other Items for O/M	WASA Laboratory
8	pH	O	Phenolic	-	Total nitrogen (T-N)	O
9	Aluminum (Al)	-	Chlorides (Cl^-)	O	Total phosphorus (T-P)	O
10	Antimony (Sb)	-	Fluorides (F^-)	O	DO	O
11	Arsenic (As)	-	Cyanide total (CN^-)	-		
12	Barium (Ba)	-	Anionic detergents (MBAS)	-		
13	Boron (B)	-	Sulfates (SO_4)	-		
14	Cadmium (Cd)	-	Sulfides (S^-)	-		
15	Chloride (Cl)	O	Ammonia (NH_3)	-		
16	Chromium (Cr)	-	Pesticides	-		
17	Copper (Cu)	-	Cadmium (Cd)	-		
18	Cyanide (CN)	-	Chromium (Cr)	-		
19	Fluoride (F)[1)]	O	Copper (Cu)	-		
20	Lead (Pb)	-	Lead (Pb)	-		
21	Manganese (Mn)	-	Mercury (Hg)	-		
22	Mercury (Hg)	-	Selenium (Se)	-		
23	Nickel (Ni)	-	Nickel (Ni)	-		
24	Nitrate (NO_3) [1)]	O	Silver (Ag)	-		
25	Nitrite (NO_2) [1)]	-	Total toxic metals	-		
26	Selenium (Se)	-	Zinc (Zn)	-		
27	Residual chlorine	O	Arsenic (As)	-		
28	Zinc (Zn)	-	Barium (Ba)	-		
29	Pesticides	-	Iron (Fe)	-		
30	Phenolic compounds (as Phenols)	-	Manganese (Mn)	-		
31	Poly-nuclear aromatic hydrocarbons (as PAH)	-	Boron (B)	-		
32	Alpha emitters	-	Chlorine	O		
33	Beta emitters	-				

Note: “O” marks denote parameters that can be measured by the WASA-F laboratory.
Source: JICA Mission Team and the WASA-F laboratory

(4) Major Equipment and Issues of the Laboratory and Water Quality Monitoring

Table A6.1.9 summarizes the major equipment in the WASA-F laboratory, institutional issues facing the laboratory, and technical issues to do with the existing water quality monitoring system.

Table A6.1.9 Summary of Major Equipment in the WASA-F Laboratory, Institutional Issues Facing the Laboratory, and Technical Issues Regarding the Existing Water Quality Monitoring System

Items		Contents
1	Major equipment	pH meter (portable and bench top), DO meter, turbidity meter (portable and benchtop), EC and TDS meter, residual chlorine meter, spectrophotometer, COD test tube heater, BOD incubator, autoclave, oven, refrigerator, centrifuge, balance, water still, muffle furnace (not functional)
2	Major institutional issues	1) Shortage of guidelines for staff to handle noncompliant factories that discharge industrial wastewater into WASA-F’s sewer system. 2) Shortage of manpower (there are no specific persons, for example, assigned to handle wastewater quality analysis for the assessment of WWTP performance or factory wastewater). 3) Shortage of budget (there is no budget, for example, to purchase equipment, glassware, or reagents for basic wastewater quality analysis (e.g., Fe, Mn, and ammonia).
3	Major technical issues	1) Shortage of equipment (there are no velocity meters, for example, for measuring the flow rates of industrial wastewater). 2) Lack of databases for wastewater quality analysis results. 3) Interpretation of results obtained (increased knowledge of water and wastewater treatment is especially needed). 4) Improvement of QA/QC activities (external QC system participation, etc.) 5) Knowledge of wastewater treatment (especially industrial wastewater treatment). 6) Preparation of manuals and SOPs.
4	Others	Integrated water quality database (e.g. GIS) development and information dissemination to the public.

Source: The WASA-F laboratory and JICA Mission Team

6.1.3 Non-Revenue Water Reduction Activities

The official estimate for NRW by WASA-F is 33%. In the Extension of Water Resources for Faisalabad City Phase-I (2012 to 2015) implemented by French Funding, the NRW estimated is somewhat higher, at 55%. Recent studies conducted by the World Bank (WB) and the Extension of Water Resources Project financed by the Government of France (GOF) estimate the NRW (physical and commercial losses) in WASA-F to be almost 40-50%. An NRW monitoring structure should be established within WASA-F to monitor the high NRW.

Because of the flat rate, WASA-F does not keep track of measured volumes to the degree necessary to accurately grasp its revenue water. Water meters have been provided and installed using several foreign funding sources to rectify this problem.

(1) Organization

To reduce the NRW ratio from its current level of 33% (official WASA-F estimate), WASA-F established an NRW Cell in April 2016 and staffed it with eight persons, adapting a mechanism specified in the implementation plan of the Performance-Based Contract NRW Reduction Project by the World Bank. This NRW Cell is not a dedicated section, so all eight of its members concurrently serve in other departments.

In the Extension of Water Resources for Faisalabad City Phase-I (2012 to 2015) implemented by French Funding, the project engineers divided the water supply area into 16 DMZs and 91 DMAs and confirmed the hydraulic isolation by conducting zero pressure tests in each DMZ. In the course of the project, the project engineers closed the boundary valves of the DMAs for 7 days and calculated the leakage volumes in each DMZ. As a result, the leakage volume of the whole city was estimated at 37,567 m^3/day.

Currently, however, all of the boundary valves of the DMZs and DMAs are opened and the water supply operations of WASA-F are intermittent. Outside of the water supply times, WASA-F bypasses the Terminal Reservoir, delivering water from the 18 tubewells of Chiniot Wellfield directly into the arterial main system with the pressure of the intake pumps. This operation is carried out to prevent contamination of the pipeline during non-supply times. The boundary valves cannot be closed while the operation is underway. And in instances when the valves are closed, low water pressure or water supply failures occur in some areas. All of the valves in the DMZs and DMAs are left open for these reasons.

A SCADA system is introduced in the New Jhal Khanuana Water Treatment Plant. The flows and pressures at some inlet nodes to the DMZs are monitored in the Operation Room. No hydraulic isolation is achieved, however, so the system cannot be used for NRW monitoring of the DMZs and DMAs. This SCADA system has also yet to be completed, as many flowmeters and pressure loggers at inlet nodes are awaiting installation.

The monitoring of the NRW will have to be done monthly. An NRW monitoring structure should be established in WASA-F.

(2) Estimation of revenue water volume and the current status of water meter installation

NRW volumes are typically calculated by subtracting the revenue water volume from the distributed water volume. WASA-F, however, is prevented from accurately grasping the revenue water volumes due to the flat-rate. The water consumption units of domestic customers were surveyed in the French Funded Project.

(3) Water consumption units of domestic customers

In order to estimate the water consumption units, water flowmeters were installed at 1,000 domestic customers in the city. The measured water consumption varied from 254 to 731 l/household/day in the DMZs studied, depending upon the lifestyle, population density, usage of other sources, etc. The average water consumption unit was estimated to be 453 l/household/day. As a reference, the design water consumption is set at 40 gallons/c/day (almost 182 lpcd) in the design criteria for Punjab State. The average number of persons per household is 7. Therefore, 1,273 l/household/day is the design water consumption unit per household.

(4) Water meter installation

In total, 20,000 water meters were provided by France, of which 18,516 have been installed as of 2017. WASA-F has set a goal of meter installation rate of 100% by 2018. The achievement of this target mainly depends upon the availability of resources for procurement and installation.

Most of the water meters are installed on customer property to prevent theft of the meters. While access to the meters is easily permitted in the rural areas, households in upscale residential areas often employ armed guards, making access to the meters difficult. This latter factor may affect the progress of the field survey. Significant barriers to meter reading are expected in the future. The installed meters may also be affected or damaged by the operating conditions of the consumer pumps such as pump vibration or sudden suction. Although the metered-rate Table of WASA-F has been approved and published, there are no metered-rate customers and meter reading has yet to be implemented.

(5) Illegal connection

Illegal connections are one of the major issues of NRW. WASA-F, however, has been unable to grasp even the total number of household in the WASA Service Area. Based on a survey by the World Bank and Urban Unit, the total was estimated to be about 400,000 households. The current number of customers to which WASA-F supplies water is roughly 120,000. The difference is quite large. One of the reasons for the difference is the customers' prevailing practice of relying on their own groundwater sources. There are also estimated to be many unregistered customers who connect to the pipeline to consume water from the WASA-F system illegally. These customers are of course counted as illegal connection customers.

Therefore, JMT proposed that WASA-F implement a whole-city customer survey to grasp the numbers of customers. WASA-F agreed to the proposal and carried out a survey from Nov. 2016 to June 2017. According to the results, there were almost 404,000 households in the WASA Service Area, almost 250,000 households in the Water Served Area, 16,332 unregistered customers receiving water supply, and 49,621 unregistered customers receiving sewerage services. This survey result shows that there are approximately 120,000 potential customers in WASA-F. WASA-F's revenue increased by about 15 to 20 million PKR per month through the detection of unregistered customers.

(6) Leakage survey and repair

When a customer reports a surface leakage to the Customer Relation Center (CRC), WASA-F personnel go to the site to make the necessary repairs. According to the CRC record from January to September, 2016, 559 leakages were reported and 544 of them were repaired within 1 month of the reporting.

Water leakages occur in various places but often go unreported by customers. In addition, WASA-F members who discover water leakages from poor quality materials sometimes choose to leave them unrepaired in the belief that repairs would have limited effects and fail to prevent the appearance of new leaks from the same sources. Awareness reform and education are necessary for both customers and WASA-F staff.

WASA-F has yet to conduct a planned survey of leakages occurring underground. From 2012 to 2015, minimum flow measurements and leakage surveys were conducted in Phase I of the French Funded Project. The project engineers calculated leakage volumes of each DMZ from the minimum flow measurements in 2014. Based on their results, they then conducted a leakage detection survey covering about 1,056 km of WASA-F pipeline (out of the 1,515 km total) using helium-gas-sensing leakage detectors. The survey detected 497 leaks, out of which 458 were repaired. A leakage survey covering 500 km of pipeline using the same method is scheduled to take place in Phase II of the French Funded Project.

WASA-F adopts asbestos concrete pipes for the secondary and tertiary distribution pipes of its network. Experience in Japan shows that asbestos concrete pipes are prone to leakage. In addition, the ACP joints used in Pakistan are connected with very short collars. This gives rise to the possibility of water leakage at various joints and a high rate of leakage. Another important shortcoming of nonmetallic pipes is the difficulty in detecting water leakage by the acoustic sound method.

(7) Leakage-detection equipment

WASA-F has been outfitted with leakage-detection equipment by the French Funded Project (see shown in **Table A6.1.10)**. The contractor implementing the French Funded Project, however, used its own helium-gas-type leak detectors and chose not to grant them to WASA-F. The equipment listed below can be used effectively, with the exception of the ultrasonic flowmeter, which has a measurement range limited to pipes of 200 mm to 300 mm in diameter.

Table A6.1.10 List of Existing Leakage-Detection Equipment in WASA-F (Provided by the French Funded Project)

S/N	Name	Model	Outline	Nos
1	Leak sound logger	Permalog+	Permalog+ collects and records leakage noise. This equipment cannot analyze correlations between loggers. WASA-F has Patroller 2, which receives the data from each logger separately.	12
2	Correlation type leakage detector	MicroCorr Touch	WASA-F is unable to utilize MicroCorr Touch at present because of the low pressure and small number of fittings such as valves, fire hydrants, etc.	2
3	Sound-type leakage detector	DF Junior	The low pressure prevents WASA-F from utilizing DF Junior. This equipment, however, can be sufficiently utilized in the WASA-F system.	8
4	Insert-type flowmeter	HydrINS 2	A hole must be drilled into the pipeline to insert the equipment and measure the flow.	5
5	Pressure Logger	Vista +	Water pressure and flow can be measured at the tap. And with the combined use of HydrINS 2, measurements can be taken inside the pipeline.	5
6	Metal pipe locater	RD7000	More than 90% of the pipes in WASA-F are asbestos cement pipes. The use of this equipment is therefore very infrequent.	4
7	Portable ultrasonic flowmeter	ChronoFLO	This equipment can only measure the flow within a pipe size range from 200 mm to 300 mm.	5

Source: JICA Mission Team

Table A6.1.11 shows the equipment provided by GOPb and others. This equipment also can be utilized effectively.

Table A6.1.11List of Existing Leakage-Detection Equipment in WASA-F (Provide from GOPb and Others)

S/N	Name	Model	Outline	Nos	Donor
1	Road Measure	EN-R-1000	This equipment is used to measure the distance from the reference point to end point.	1	GOPb
2	Acoustic Rod	LSP-1.0 (1m type)	The acoustic rod identifies underground leakages by detecting the noise produced by the leaks.	1	GOPb
3	Portable Ultrasonic Flow meter	UF801P	The ultrasonic flowmeter measures the velocity of a fluid with ultrasound to calculate the volume flow.	1	GOPb
4	Pressure Recorder	FJN-501A	A water pressure gauge is used to measure the pressure of	1	GOPb

S/N	Name	Model	Outline	Nos	Donor
			water with the help of a graph inside the gauge for specific hours.		
5	Metal Locator	M130	A metal detector is an electronic instrument that detects the presence of metals nearby. Metal detectors are useful for finding metal inclusions hidden within objects or metal objects buried underground.	1	GOPb
6	Non-Metal Pipe Locator and Leak Detector	D305	A non-metal detector is an electronic instrument that detects the presence and measures the length of non-metal pipes such as HDPE, AC, PV, etc.	1	GOPb
7	Acoustic Leak Detector	AquaScope3 (AS3P)	The acoustic leak detector is equipped with a simple-to-operate digital acoustic leak locator with a superior crystal-clear sound.	1	GOPb
8	Metal Pipe Locator	501	This equipment is used to locate the paths and depths of buried cables, service wires, metallic pipe or conduit. It can also locate the end of a cut cable.	1	GOPb
9	Doppler type flowmeter	EAS2-10P	The Doppler flowmeter adopted is a simple type with doubtful accuracy.	1	Other
10	Electric acoustic Rod	FSB-8D	Low pressure limits the use of the FSB-8D by WASA-F. As things stand, however, the equipment can still be utilized in WASA-F to a sufficient level.	1	Other

Source: JICA Mission Team

Although WASA-F possesses many kinds of equipment, the staff can hardly be said to have sufficient training or experience to master the use of much of the equipment at their disposal. Capacity building in equipment operation through OJT will be a necessary component of the Pilot activities.

(8) Another NRW component: Authorized Unbilled Customers

"Authorized Unbilled Water Consumption" is another source of NRW. WASA-F staff are exempt from paying the water tariff. Also, some mosques and handicapped support facilities receive a 30% discount on the tariff. The water volumes consumed by these entities counted as NRW.

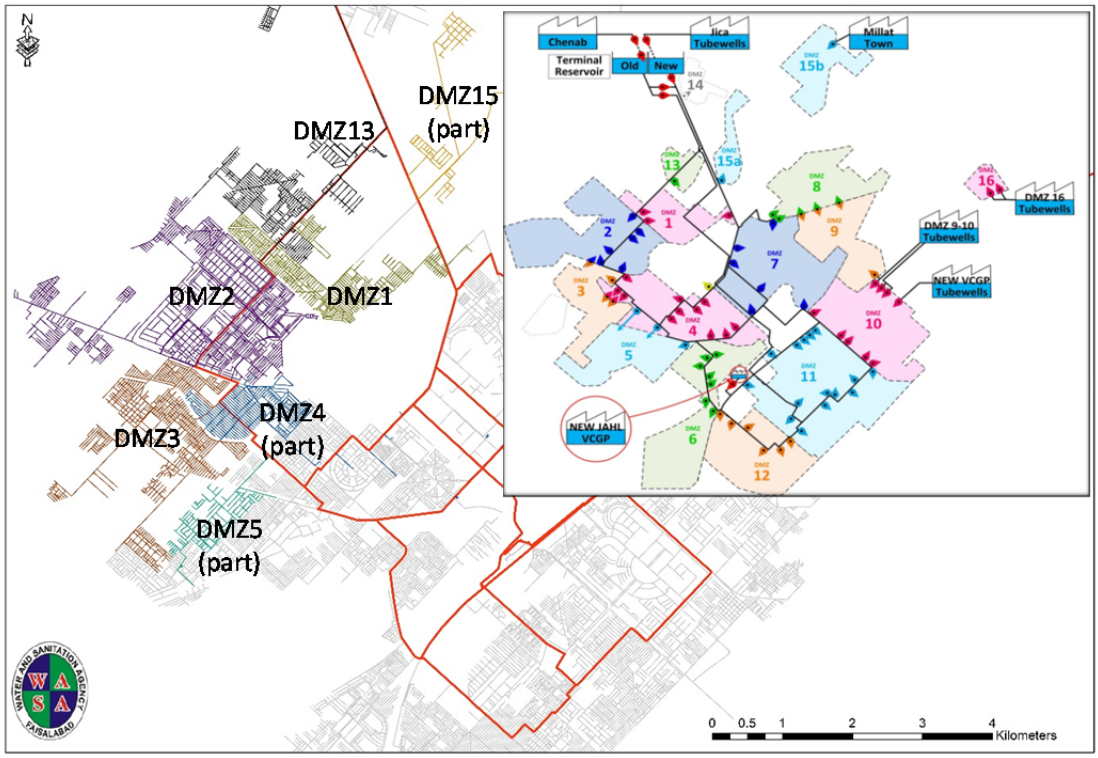
In addition, WASA-F has installed Free Water Stations at the sites of OHRs and is providing water to citizens for free. There are many areas within the WASA-F system where no water supply by pipeline has been developed. Not many people use the Free Water Station in areas with high rates of water supply by pipeline, but many customers near the borders of water supply areas draw considerable amounts of water from the Free Water Stations. In some cases customers even use truck to transport water from the stations.

The free water for WASA-F staff, discounts to mosques and handicapped support facilities, and installation of Free Water Stations all have welfare aspects and probably have been instituted at a policy level. Even so, the amount of NRW should be measured. High consumption at Free Water Stations is implicated as an especially strong contributor to problem. A system to measure the Authorized Unbilled Water Consumption will have to be established.

(9) Other projects related to NRW reduction

A Performance-Based Contract for an NRW Reduction Project (PBC PROJECT) has been scheduled by the World Bank. Target areas will be the West Side of Faisalabad City, DMZ1, DMZ2, and DMZ3 in Phase I, and DMZ4, DMZ5, DMZ13, and DMZ15 in Phase II. All of these areas are supplied from the TRs directly. It will therefore be easy to increase the distributed water volume and possible to achieve 24/7 supply. The installation of three automatic control valves is now being considered. After they are installed, the plan is to increase the supply volume significantly in these target areas. Foreign consultants are expected to participate in the PBC PROJECT. Over the three years allotted to project implementation, the contractor will be required to perform a wide range spanning from design and supervision of the general NRW management to the procurement of equipment related to NRW reduction, DMA creation, meter installation, leakage detection and repair, and illegal connection survey and disconnection. Hydraulic analysis, GIS development, planning of pipe replacement, improvement of the tariff system, etc.

will also be required. Eighty percent of the project budget will be paid at a fixed amount and the remaining 20% will be paid according to the NRW reduction achieved.



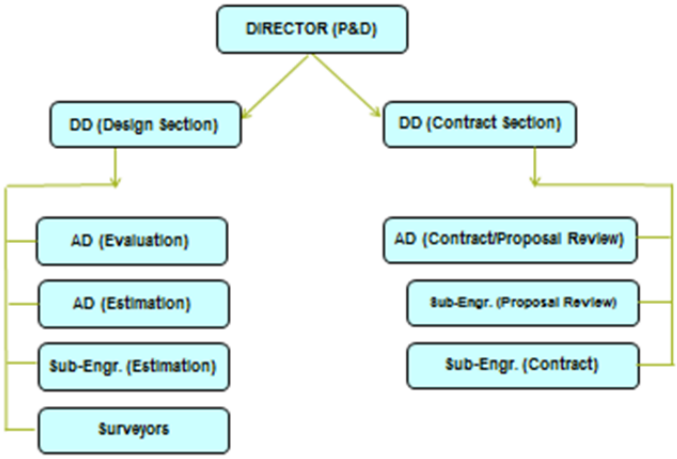
Source: Water and Sanitation Agency (DMA numbers were added by the JICA Mission Team)

Figure A6.1.3 DMZ Map

6.1.4 Procurement and Stock Control Works

(1) Definition and Procedure

Procurement is the act of buying or acquiring goods, services, or works from external sources. It is often carried out by a process of tendering rather than through the purchase of products directory from a seller.



Source: WASA-F O&M

Figure A6.1.4 Organization of Procurement Staff

The following procedure is adopted to maintain the supply & issuance of stock items, goods, accessories and spare parts in the WASA Water Store located at Jhal Khanuana Water Works Faisalabad.

- Initiation of Demand:
  First, all of the necessary items, tools, accessories, spare parts etc. are requisitioned by field staff and officials according to the field requirements and works.

- Preparation of Estimate:
  Officials such as the Sub Engineers, Assistant Directors, and Deputy Director of WASA- F make estimates while duly considering the availability of funds and requisition needs for field work.

- Approval of Estimate:
  The estimate is forwarded to a competent authority for approval through the controlling officer, i.e., the Director. The estimate must be approved in consideration of the three parameters of cost, quality, and duration.

- Award of Work:
  After the competent authority grants a technical sanction, the works are awarded to a contractor through a tendering procedure. The tender must be conducted in a manner that ensures accountability, transparency, and open competition, as is customary for any project funded with public money.

- Receipt of Items/Goods in Storage:
  Then supply items, goods, facilities, etc. prepared by the contractor are received and noted by the storekeeper in the stock register under the supervision of the controlling officer. The received items or goods are then stocked in inventory in the available specified place of storage.

- Issuance of Stored Items/Goods:-
  The stocked items/goods are issued according to the site requirement after the indent is received from the concerned officials with approval by the competent authority. The numbers of issued items/goods, accessories etc. are then noted again in the stock register.

Demand is again initiated, as above, in view of the available balance of items/goods etc. maintained in the stock register and repeated consultations with the field staff and officials.

(2) Inspection/quality control and billing/payment

The adage for procurement is to “achieve work of the best quality within budget and on time.” After the work is completed, inspection and quality control reviews must be performed by well-qualified staff from the Quality Control Division, a body established five years ago. These persons often must inspect the product according with the test processes before and after the construction work, depending on the nature of the work. If defects are found during or after the execution of work, the division will send a rejection report to replace the products as stipulated under the contract agreement. The payment will be furnished upon completion of proper quantity calculations and quality verifications, and may be disbursed midterm through the project as well at the final phase.

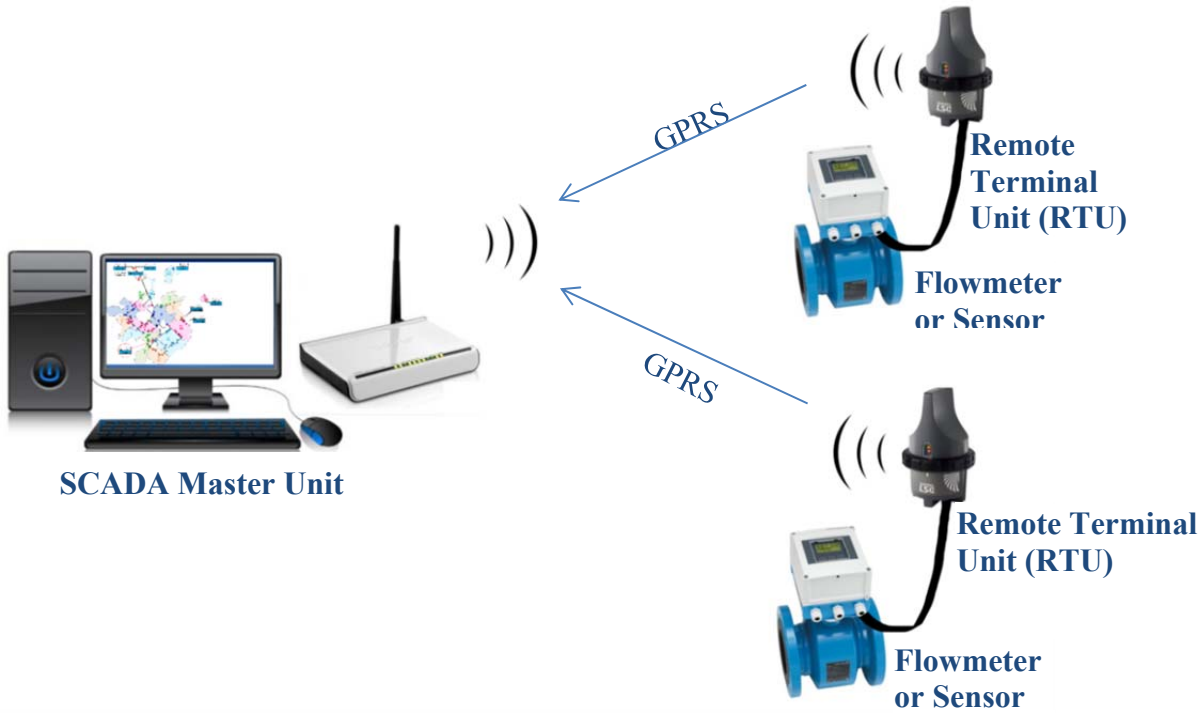
(3) Problems of procurement and stock control

WASA-F is sometimes unable to meet the procurement requirements from field workers, as the procurement demand for electrical and mechanical parts/equipment is always emergent. Preventive maintenance is lacking as a consequence of the fairly low skill level of the mechanical/electrical personnel and the constant budget constraints. In some cases, the purchasers can also see differences in the quality and cost of the same products and equipment on the market.

6.1.5 Monitoring System (SCADA)

(1) Definition

SCADA stands for "**S**upervisory **C**ontrol and **D**ata **A**cquisition." **SCADA** is a real-time technical process control system used to centrally monitor and/or remotely or locally control industrial equipment such as valves, pumps, sensors, etc. The system works through a combination of telemetry and data acquisition. The SCADA system established in New Jhal Khanuana WTP by the French Funded Project can now measure the flow volume and water pressure from the arterial main to each DMZ, but the SCADA system has yet to be completely constructed in all DMZs (in June 2016). At present only 6 DMZs have been completed, 5 have been partially completed, and the others are only planned. The flow volumes into the DMZs cannot be measured at present, as all of the boundary valves are left open and no DMA isolation is maintained.



Source: WASA-F O&M

Figure A6.1.5 SCADA System

(2) SCADA functionality

The SCADA system in WASA-F performs three functions:

- Data acquisition
- Networked data communication
- Data presentation

These functions are performed by four kinds of SCADA components:

- Sensors (either digital or analogue) and control relays: These interface directly with the managed system.
- Remote Telemetry Units (RTUs): Small computerized units deployed in the field at specific sites and locations. RTUs serve as local collection points for gathering reports from sensors and

delivering commands to control relays.
- SCADA Master Unit: A larger computer console that serves as the central processor for the SCADA system. The master unit provides a human interface to the system.
- Communication Network: This connects the SCADA master unit to the RTUs in the field.

(3) The case of WASA-F

One SCADA Master Unit and 62 Remote Terminal Units (RTUs, Sofrel LS42) have been acquired:

- 55 points of Flow measurements data
- 52 points of Pressure measurements data
- 3 points of Tank level measurements data
- 6 DMZ fully equipped
- 5 DMZ partially equipped

(4) Data Transmission of RTUs/SCADA in WASA-F

RTUs receive and store data from a sensor every 5 minutes. The daily storage data is automatically uploaded to the SCADA Master Unit via GPRS (General Packet Radio Service) network. The measurement locations are summarized in **Table A6.1.12**.

Table A6.1.12 Summary of Measurement Locations

Description	Total Number Required	Installed	Remaining Balance
Location of Sensor	**Distribution Network (DMZ):** Arterial Nodes (DMZs) = 88 Nos. **Main Production:** Inline Tubewells Outlet = 29 Nos. Inline Outlet & TR Inlet= 2 No. JICA Tubewells Outlet= 25 Nos. JICA Outlet & TR Inlet= 2 Nos. Terminal Reservoir Outlet = 3 Nos. **Tubewell Outlets** French Funded Project Tubewells = 10 Nos. Mansorabad Tubewells = 8 Nos. Manawala Tubewells = 2 Nos. Madina Town Tubewells = 4 Nos. Malik Pur Tubewells = 2 Nos. Construction Tubewells = 8 Nos.	**Distribution Network (DMZ):** Arterial Nodes (DMZs) = 45 Nos. **Main Production:** Inline Tubewells Outlet= 0 Nos. Inline Outlet & TR Inlet= 2 Nos. JICA Tubewells Outlet= 0 Nos. JICA Outlet & TR Inlet= 1 No. Terminal Reservoir Outlet = 3 Nos. **Tubewell Outlets** French Funded Project Tubewells = 0 Nos. Mansorabad Tubewells = 0 Nos. Manawala Tubewells = 0 Nos. Madina Town Tubewells = 0 Nos. Malik Pur Tubewells = 0 Nos. Construction Tubewells = 0 Nos.	**Distribution Network (DMZ):** Arterial Nodes (DMZs) = 43 Nos. **Main Production:** Inline Tubewells Outlet = 29 Nos. Inline Outlet & TR Inlet= 0 No. JICA Tubewells Outlet= 25 Nos. JICA Outlet & TR Inlet= 1 No. Terminal Reservoir Outlet = 0 Nos. **Tubewell Outlets** French Funded Project Tubewells = 10 Nos. Mansorabad Tubewells = 8 Nos. Manawala Tubewells = 2 Nos. Madina Town Tubewells = 4 Nos. Malik Pur Tubewells = 2 Nos. Construction Tubewells = 8 Nos.

Source: JICA Mission Team

The below attached figure shows the main production and arterial node numbers on which the SCADA is already installed

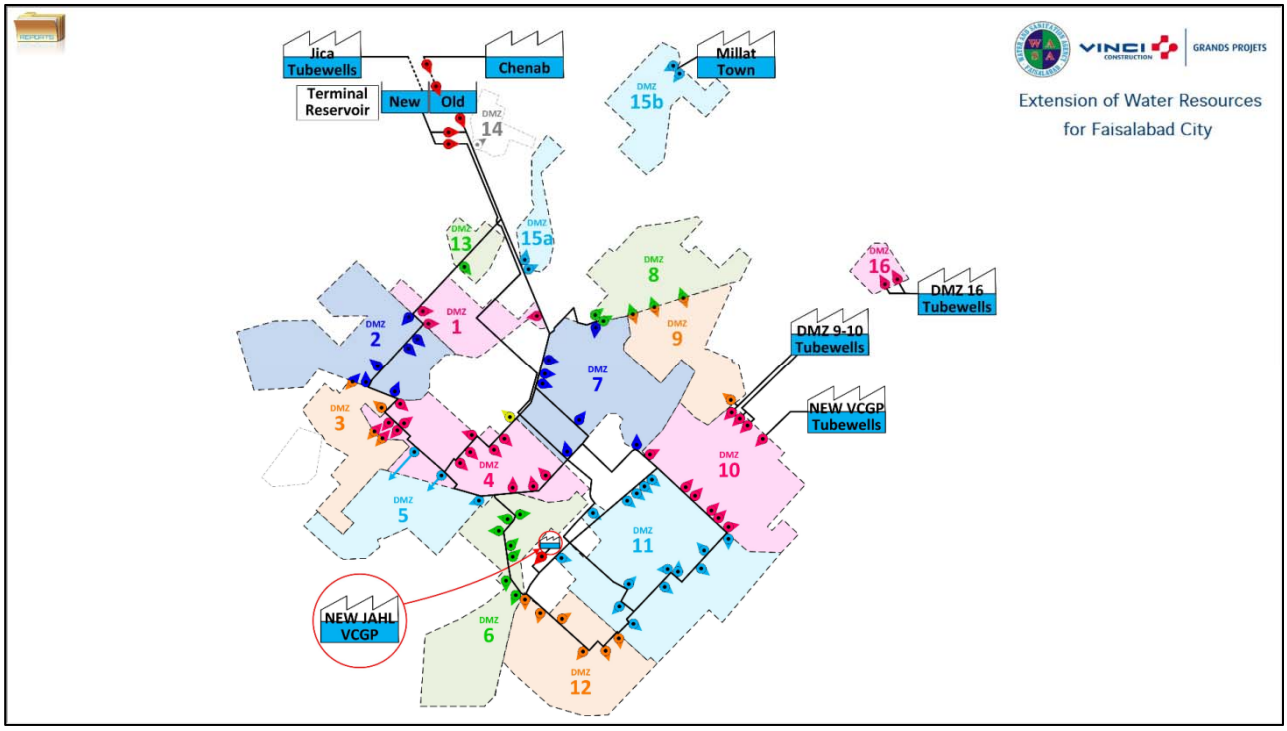
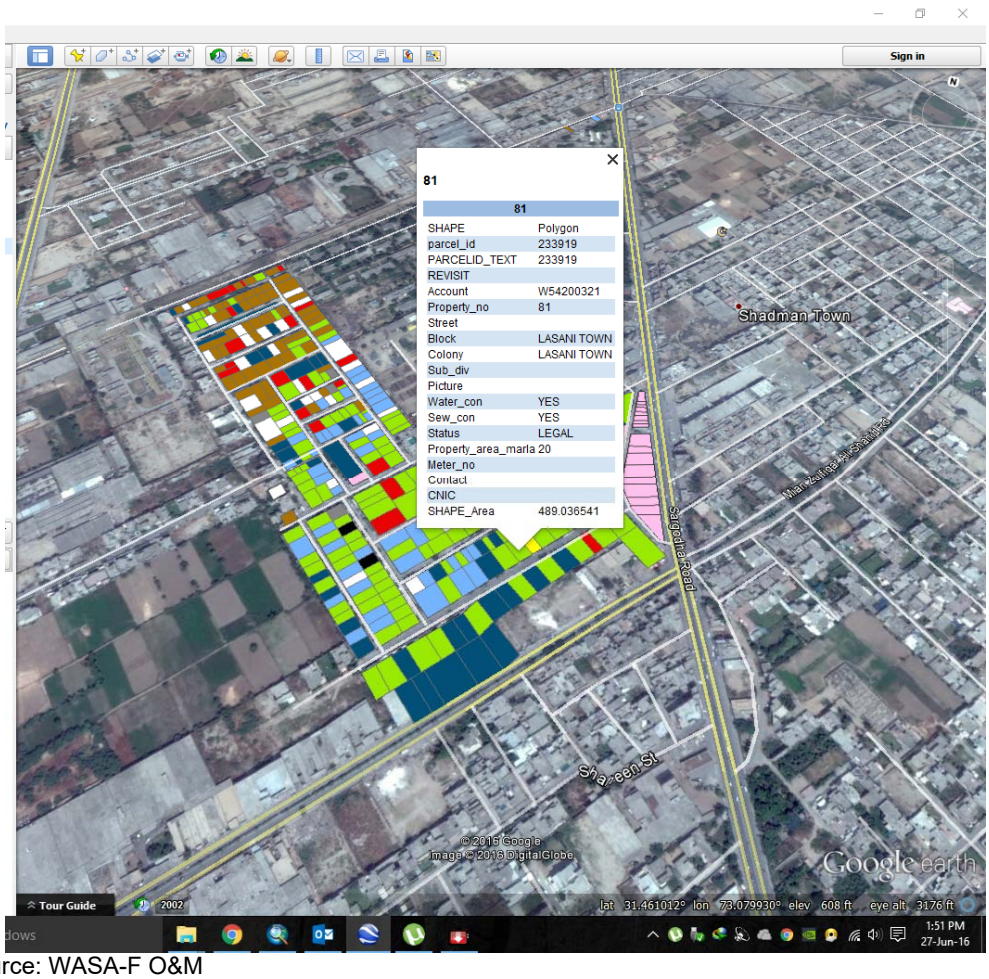


Figure A6.1.6 SCADA Master Unit in WASA-F

6.1.6 Information Management System

WASA-F has managed consumer information regarding both water supply users and sewerage connections. If any directorates require information of registered consumers of water supply and sewerage in detail, they generally submit a query to the computer section (billing section). WASA-F has information on bulk water users who consume supply water in large quantities (via large size connections). Connections and detailed information on connection sizes, consumed water volumes, and billing are maintained. WASA maintains information for the identification of defaulters to communicate with field staff through generating ledgers (detail information) to activate the processes for disconnection and payment recovery. WASA-F has a complaint database covering its water supply and sewerage system to identify poor or heavily affected areas. For planning purposes, the CRC (Customer Relation Centre) communicates with the WASA-F P&D department to keep track of the areas subject to the most frequent water supply and sewerage complaints. WASA-F also operates a website to publicly post profiles of WASA-F and information on the activities of the CLC (Citizen Liaison Cell: working on Faisalabad peri-urban area), procurement, new and on-going projects, resources, and various other information, along with an image gallery.



Source: WASA-F O&M

Figure A6.1.7 Consumer information with a single click

6.1.7 Public Relations

(1) Definition

The Citizens Liaison Cell (CLC) and Customer Relations Center (CRC) are the two main platforms at WASA-F that provide public opportunities for interaction with the Department. The CLC builds relations with the public and interacts with the public through meetings in the community. The CRC, on the other hand, develops relations when consumers call for rectification of complaints.

(2) Public relation measures

Campaign broadcasts on FM Radio deliver messages on the wise use of potable water and different activities arranged for schoolchildren on a quarterly basis. WASA-F launches campaigns through cable TV channels to immediately inform the public and consumers through free phone if any manhole cover is missing or broken. Messages warning the public not to throw garbage or solid waste in sewer lines are posted on hanging message boards.

Seminars and walks are arranged to disseminate messages on WASA-F activities. Desks have been established at every subdivision office to receive suggestions on ways to improve WASA services sounded out from WASA employees. Publicly elected officials are periodically invited via the Chairmen and Vice Chairmen of the Union Councils to give the public and consumers the opportunity to express their views and offer suggestions on service delivery. Soft messages are inducted from caller tunes while

receiving public complaints. WASA-F revenue defaulters are invited to share their reasons for not paying their bills. Periodic stalls are set up at prominent chowks on the city roads. Consumers campaigns to eliminate the drawing of water outside of supply hours are held constantly.

6.1.8 Current Business Plan

(1) Outline of Current Business Plan of WASA-F

WASA-F prepared a long tern (6 year) Business Plan in October 2013 with support from the Japan International Cooperation Agency. The plan principally aims to ensure the fulfilment of the Government policies and guidelines of the National Drinking Policy 2009, the National Sanitation Policy 2006, and so on. The implementation of the plan will assist in achieving sustainable, affordable, and qualitative water and sanitation services to consumers and enable WASA-F to become an efficient and effective business-like utility provider. Following is a summary of WASA-F's mission, objectives, goals and key milestones as explained in the Business Plan:

- To make customers feel welcome, appreciated, and worthy of WASA-F's best efforts in everything WASA-F does as a provider of water supply, sewerage, and drainage services.
- To achieve sustainable financial self-sufficiency.
- To train and motivate employees and develop cooperation and communication at all levels.

Operational strategies are employed to ensure the following targets: a) Safe and adequate drinking water to meet domestic, commercial, and industrial demands, b) Efficient and non-hazardous disposal of sewage collected from individual consumers, c) Self-sustaining organization to reduce financial burdens on the government, and d) Customer-friendly relationships to develop customer confidence in service delivery.

(2) Strategies and Actions

Seven key issues will be addressed to improve the drinking water services:

- Water production less than demand.
- Rapidly depleting groundwater resources.
- Water wastage due to theft and leakage.
- Water production efficiency of the installed system.
- Insufficient water tariff.
- Supervisory control and data acquisition system.
- Expansion of services to poor localities.

The key issues related to sewerage, drainage, and industrial waste are:

- Inefficient and aging network.
- Dangerous toxicity of industrial waste (Regulate the industrial consumer to treat wastewater for toxic chemicals before disposing-off into WASA system)
- Wastewater quality.
- Efficiency of installed machinery.
- Expansion of services.

The key tasks for organizational improvement are:

- Undertake a comprehensive organizational assessment.
- Review and rationalize the functions, responsibilities, structure, inputs, and results of various sections and positions.
- Prepare the organizational restructuring plan based on the contemporary practices of successful

utility providers around the world inconsideration of key efficiency and performance criteria.
- Develop a strategy to make employees feel like internal consumers. The environment should be friendly for all employees.

The Business Plan proposes the following specific actions:

- To discover and explore new water resources by conducting a detailed study and updating the master plan.
- To develop a comprehensive database for monitoring using the latest techniques in order to sustain these water sources for longer.
- To accurately determine the NRW and UFW and bring both to acceptable levels.
- To attain water production at an optimum level by arranging financing for electricity charges, replacement of old pumping machinery, and rehabilitation of treatment plants.
- To propose tariff rationalization to the Government of Punjab.
- To install equipment for advanced and central monitoring and supervisory control of the system.
- To conduct a comprehensive study to identify the root causes of system obstructions, and thereby improve the sewerage and drainage services.
- To develop a mechanism to monitor the quality of wastewater for effective wastewater quality control.
- To develop a strategy for the effective monitoring and periodic analysis of energy consumption by pumping and maintenance machinery.
- To identify water and sewerage services for unserved areas in poor localities.

(3) Implementation of Action Plans

A series of 6-year Action Plans were established to implement the Business Plan. Over a shorter time frame, Annual Action Plans were established based on duly prepared and approved annual budgets.

The Business Plan has been monitored using 43 Performance Monitoring Indicators (PMIs) established by the UU (Urban Unit) and PWOPs (Pakistan Water Operator Partnerships). Keeping in mind the technical and non-technical divisions of WASA Faisalabad, two Subcommittees have been proposed for the implementation of the Business Plan.

a) Subcommittee-I: WASA Services' Efficiency Improvement (Chairperson: DMD-Services)
Subcommittee-I was established to implement restructuring focused on operation and maintenance improvements on the following terms. (Chairperson: DMD -FA&R)

Terms:
- To investigate the current situation and causes of inefficiency in the technical directorates.
- To set the targets for efficiency improvement of the said directorates.
- To conduct problem analyses for the said directorates.
- To formulate strategies for efficiency improvement of the said directorates.
- To make a detailed Implementation plan for efficiency improvement of the said directorates.
- To monitor the activities of the detailed implementation plan for efficiency improvement of the said directorates.
- To monitor the performance indicators on the efficiency improvement of the said directorates.
- To improve the strategy and action plan through discussions with the JMT.

Sub Committee-I has been working on the following Proposed Work Module Projects:

Proposed Work Module Projects:

MP-1: Real Loss Reduction
MP-2: NRW Reduction Planning
MP-3: Network Operations Improvement

MP-4: Customer Support Improvement
MP-5: Energy Audit
MP-6: Energy Management Cell Establishment
MP-7: Replacement of Old-fashioned Facilities and Machines
MP-8: Promotion of Planned Energy Consumption
MP-9: Negotiation with FESCO on the Power Tariff
MP-10: Regular Inspections for O&M

b) Sub Committee-II: Financial and Organizational Improvement
Sub Committee-II was established to implement restructuring focused on financial and organizational improvements on the following terms:

Terms:

- To investigate the current situation and causes of inefficiency in the Finance, Administration, and Revenue directorates
- To set targets for efficiency improvement of the said directorates.
- To conduct problem analyses for the said directorates.
- To formulate strategies for efficiency improvement of the said directorates.
- To make a detailed implementation plan for efficiency improvement of the said directorates.
- To monitor the activities of the detailed implementation plan for efficiency improvement of the said directorates.
- To monitor the performance indicators on the efficiency improvement of the said directorates.
- To improve the strategy and action plan through discussions with the JMT.

Sub Committee-II has been working on the following Proposed Work Module Projects:

MP-1: Apparent Loss Reduction
MP-2: Billing and Collection Improvement
MP-3: Professional Staff Training/Awareness Raising for Energy Saving
MP-4: Financial Efficiency Improvement
MP-5: Organizational Efficiency Improvement
MP-6: Staff Efficiency Improvement
MP-7: Efficient Outsourcing Promotion
MP-8: Examination of the Customers Relations Centre (CRC)
MP-9: Using of CRC in Collections/Recovery

(4) Progress WASA-F's Current Business Plan and Issues Faced

With support from JICA experts, two committees have been established and the business plan has progressed. Significantly, WASA-F personnel can now calculate Performance Indicators (PMIs) by themselves. Once the present progress of the business plan is reviewed, PMI checks are conducted on a regular basis. It has been pointed out, however, that the two committees have not been opened recently. To confirm the progress of the business plan, the current status of the 98 actions described in the action plan has been assessed. The achievement rate of each action was evaluated on a rating scale divided into four levels of achievement. The results are shown in the **Table A6.1.13**. Given the low share of actions evaluated at Level A, only 11%, together with the high share evaluated at Level C/D, 59%, the actions plans under the business plan cannot be regarded as achieved as of this time.

Table A6.1.13 Achievement Level of Action Plans under the Business Plan

Categories		Number of Actions	Achievement Level (%)			
			A	B	C	D
1	Drinking Water Service Improvement	32	13	38	34	16
2	Sewerage and Drainage Service Improvement	14	0	21	57	21
3	Financial Sustainability	31	13	29	32	26
4	Human Resource Development	14	14	36	14	36
5	Customer Relations Centre	7	14	0	14	71
Total		98	11	30	32	27

Legend Level A: Achieved or almost achieved
Level B: Progressed but not achieved
Level C: Progressed a little
Level D: Not started yet

Source: JICA Mission Team

The business plan covers all the actions, structures, and processes WASA-F should establish as of the now and in the future. Regrettably, however, many of the activities have been halted. The following is a list of issues faced in the current Business Plan:

- The PMIs are good as general indicators but not as indicators of the outcomes of the Action Plan. The outcomes of the activities are therefore difficult to evaluate using the PMIs.
- While less expensive activities, such as the reinforcement of CRC, are carried out well, expensive activities such as construction and replacement works are often left undone.
- The Business Plan describes too many activities and fails to clarify their relative priorities.
- The challenges of the committee are not broken down into the efforts of each directorate.
- Unclear Job Descriptions have prevented the positioning of activities in the work of each DMD or Director.

A6.2 Current Tariffs for Water Supply and Sewerage Services

6.2.1 Current Tariff System of WASA-F

(1) Structures of Water Supply and Sewer/Drainage Tariffs

WASA-F imposes water supply and sewer/drainage tariffs on domestic customers at 2-month intervals and on business and industrial (manufacturing) customers every month. Even those not connected directly to the water supply system, i.e., those who obtain water from private wells for domestic purposes, are charged sewerage tariffs.

WASA-F's water supply and sewer/drainage tariffs for domestic, industrial, and commercial customers were revised in January 2007 in accordance with the Punjab Gazette issued on December 9, 2006. The industrial and commercial tariffs were later revised, in 2016, according to the Gazette issued on October 21 of that year. For domestic customers, meanwhile, no further revisions have been made since 2007. The current tariff structure is as published in the said gazette. The gazette specifies different tariff settings according to the type of dwelling or commercial and industrial facility and whether or not water meters are installed. The sewer/drainage tariffs imposed on hotels and restaurants, for example, vary according to the number of rooms, toilets, and sinks. Commercial and industrial facilities are billed an aquifer charge on private wells with diameters of 5 cm (2 inches) or larger. The table below shows WASA-F's water supply and sewer/drainage tariffs imposed on dwellings.

Table A6.2.1 WASA-F Water Supply and Sewer/Drainage Tariff (Domestic)

Unit: PKR/month/household

Description	Water supply (2007)	Sewer/Drainage (2007)	Total
Without water meter: Lot size		Approx. 70% of water tariff	
Up to 2.5 marla	83	55	138
Above 2.5-3.5 marla	124	83	207
Above 3.5-5.0 marla	145	97	242
Above 5.0-10 marla	242	161	403
Above 10-20 marla	322	242	564
Above 20-39 marla	644	403	1,047
40 marla or more	966	644	1,610
With water meter: Volumetric tariff system		Approx. 70% of water tariff	
5000 gal/month or less	39 / 1,000 gal	Same as above	
5000 gal/month-10,000 gal/month	40 / 1,000 gal	Same as above	
10,000 gal/month or more	48 / 1,000 gal	Same as above	

Note) 1 marla = 25.3 m2, gal=Gallon=4.5 liters
Source: Punjab Gazette issued on December 9, 2006

Table A6.2.2 WASA-F Water Supply Tariff (Industrial and Commercial)

Unit: PKR/month/connection

Description	Water supply (2007) (a)	Water supply (Rev. 2016) (b)	Increase (b) / (a)
Without water meter (1/4" ferrule): Lot size			
Up to 3 marla	322	483	1.50
Above 3-6 marla	483	725	1.50
Above 6-10 marla	805	1,208	1.50
Above 10-20 marla	1,288	1,932	1.50
Above 1-2 kanal	2,415	3,623	1.50
Above 2 kanal	3,220	4,830	1.50
Without water meter (1/2" ferrule): Lot size			
Less than 10 marla	1,610	2,415	1.50
10 marla to 20 marla	2,576	3,864	1.50
Above 20 marla	4,025	6,038	1.50
Without water meter (3/4" ferrule)	5,175	7,763	1.50
Without water meter (1" ferrule)	5,750	8,625	1.50
Without water meter (1.5" ferrule)	9,660	14,490	1.50
Without water meter (2" ferrule)	19,320	28,980	1.50
Without water meter (3" ferrule)	48,300	72,450	1.50
Without water meter (4" ferrule)	96,600	144,900	1.50
Without water meter (6" ferrule)	322,000	483,000	1.50
With water meter: Volumetric tariff system	53 / 1,000 gal	80 / 1,000 gal	1.50

Note) 1 marla = 25.3 m^2, 1 kanal = 20 marla = 502 m^2, gal=Gallon=4.5 liters
Source: Punjab Gazette issued on December 9, 2006; Punjab Gazette issued on October 21, 2016

Table A6.2.3 WASA-F Sewer/Drainage Tariff (Industrial)

Unit: PKR/month/connection

	Particulars	Sewer/Drainage (2007) (a)	Sewer/Drainage (Rev. 2016) (b)	Increase (b) / (a)
1	Limited waste / used water discharge factories (through toilets / sink / point / washbasin) i.e., calico chemicals, cold storage, embroidery, garments, table prints, biscuit factories, goli toffee factories, knitting & stitching units, glove factories, gatta / paper, medicine manufacturing units, ice factories, small chemical units, air jet hosieries (excl. washing units), and other similar units, etc. not mentioned above (per 1000 sft. covered area)	292	400	1.37
2	Waste / used water discharge from small units (through toilets / sinks / point washbasins) such as foundries, paint factories, dal factories, soap factories, loom factories (excl. washing, dying & processing hosiery) pipe factories, oil mills, pottery, works factories, sizing factories, plastic factories (per 1000 sft. covered area)	167	350	2.10
3	Weaving factories, godowns equipped with a single toilet / washbasin, tap, etc.	-	500	-
4	Bulk Waste / Used Water Discharge Units			
	Industrial units discharging wastewater per installed capacity/size.	46,690 / Cusec	58,365/ Cusec	1.25

Note) 1 sft = 1 ft^2 = 0.09 m^2, 1 Cusic = 100 m^3/hr
Source: Punjab Gazette issued on December 9, 2006; Punjab Gazette issued on October 21, 2016

Table A6.2.4 WASA-F Sewer/Drainage Tariff (Commercial)

Unit: PKR/Month/Connection

	Particulars	Sewer/Drainage (2007) (a)	Sewer/Drainage (Rev. 2016) (b)	Increase (b) / (a)
1	Shops, shopping centers, department stores, multi-story shops and arcades per point equipped with a single toilet / washbasin / sink / tap, etc. (up to 10 marla, single story)	121	200	1.65
2	Shops, shopping centers, department stores, multi-story shops and arcades above 10 marla (per 1000 sft. covered area)	-	450	-
3	Hotel / restaurant, etc. (up to 1000 sft) per bed / bath / bed room / tap washbasin / toilet / sink / point, etc.	81	130	1.60
4	Hotel / restaurant, etc. (above 1000 sft.) (per 1000 sft .covered area)	-	260	-
5	Private hospital, clinic, clinical laboratory per bed / bath / washbasin / sink / tap / point, etc.	58	100	1.72
6	Car service station per lift / bay	1,449	2,175	1.50
7	Motorcycle service station, etc.	201	300	1.49
8	Hair cutting saloon, beauty parlor, hamam, etc. (up to 2 marla covered area) per bath / washbasin / sink / tap / point, etc.	58	90	1.55
9	Hair salon, beauty parlor, hamam, etc. above 2 marla (per 1000 sft. covered area)	-	450	-
10	Multi-story commercial plaza, banks, and marriage halls (per 1000 sft covered area)	403	650	1.61
11	Government offices (per 1000 sft. covered area)	201	300	1.49
12	Private education depts. / schools / colleges / institutions universities, etc. (per 1000 sft covered area)	290	500	1.72
13	Four-star & five-star hotels (per 1000 sft. covered area)	3220 (per Acre)	500	-
14	Mechanical / vehicle workshop, petrol pumps, CNG stations per point equipped with a single toilet / washbasin / sink, tap, etc.	-	260	-
15	Govt. hospitals, medical dispensaries, and social security hospitals per bed room / tap / washbasin / toilet / sink /point	-	75	-
16	Cinema halls, theaters (per 1000 sft. covered area)	-	450	-
17	Other units / departments not covered under the above categories (per 1000 sft covered area)	290	450	1.55

Note) 1 marla = 25.3 m^2, 1 sft = 1 ft^2 = 0.09 m^2
Source: Punjab Gazette issued on December 9, 2006; Punjab Gazette issued on October 21, 2016

Table A6.2.5 Aquifer Charges (Fee on Tubewells)

Unit: PKR/ Cusec/ Month

	Units / Factories etc.	Aquifer Charges (2007) (a)	Aquifer Charges (Rev. 2016) (b)	Increase (b) / (a)
1	Industrial units receiving water through tubewells (the rate will be charged according to the discharge size of the tubewells / pumps motors, etc.) (per cusec discharge)	12,880	19,320	1.50
2	Textile processing and hosiery units (receiving water through tubewells / pumps motors, per month per cusec) (per cusec discharge)	10,465	13,000	1.24
3	Government agencies, semi-government agencies, corporations, irrigation departments, semi/independent organizations, local bodies receiving water through tubewells will be charged according to the discharge size of the tubewells / pumps motors, etc. (per cusec discharge)	12,880	13,000	1.00

Note) 1 sft = 1 ft^2 = 0.09 m^2, 1 Cusec = 100 m^3/hr
Source: Punjab Gazette issued on December 9, 2006; Punjab Gazette issued on October 21, 2016

(2) New Connection Fees

For new connections, customers fill-out connection requests and WASA-F performs the necessary installation works based on the requests. WASA-F charges the following rates for costs related to the installation.

Table A6.2.6 New Connection Charges for Water and Sewer (Domestic)

Description	Water (PKR)	Sewer (PKR)	Water & Sewer (PKR)
Up to 2.5 marla	2,040	1,795	3,835
Above 2.5-3.5 marla	2,163	1,879	4,042
Above 3.5-5.0 marla	2,226	1,921	4,147
Above 5.0-10 marla	2,517	2,113	4,630
Above 10-20 marla	2,757	2,356	5,113
Above 20-39 marla	3,723	2,839	6,562
40 marla or more	4,689	3,562	8,251

Note) The new connection charge includes a security deposit, estimate charge, development charge, and form fee.
1 marla = 25.3 m^2, 1 kanal = 20 marla = 502 m^2
Source: WASA-F

Table A6.2.7 New Connection Charges for Water and Sewer (Industrial)

	Water (PKR)	Sewer (PKR)	Water & Sewer (PKR)
1/4” ferrule			
Up to 3 marla	2,163	4,777	6,940
Above 3-6 marla	2,226	4,819	7,045
Above 6-10 marla	2,517	5,011	7,528
Above 10-20 marla	2,757	5,254	8,011
Above 1-2 kanal	3,723	5,737	9,460
Above 2 kanal	4,689	6,460	11,149
1/2” ferrule and above			
Up to 3 marla	4,900	4,777	9,677
Above 3-6 marla	4,963	4,819	9,782
Above 6-10 marla	5,254	5,011	10,265
Above 10-20 marla	5,494	5,254	10,748
Above 1-2 kanal	6,460	5,737	12,197
Above 2 kanal	7,426	6,460	13,886

Note) The new connection charge includes a security deposit, estimate charge, development charge, and form fee.
1 marla = 25.3 m^2, 1 kanal = 20 marla = 502 m^2
Source: WASA-F

Table A6.2.8 New Connection Charges for Water and Sewer (Commercial)

	Water (PKR)	Sewer (PKR)	Water & Sewer (PKR)
1/4" ferrule			
• Up to 3 marla	2,163	2,362	4,525
• Above 3-6 marla	2,226	2,404	4,630
• Above 6-10 marla	2,517	2,596	5,113
• Above 10-20 marla	2,757	2,839	5,596
• Above 1-2 kanal	3,723	3,322	7,045
• Above 2 kanal	4,689	4,045	8,734
1/2" ferrule and above			
• Up to 3 marla	4,900	2,362	7,262
• Above 3-6 marla	4,963	2,404	7,367
• Above 6-10 marla	5,254	2,596	7,850
• Above 10-20 marla	5,494	2,839	8,333
• Above 1-2 kanal	6,460	3,322	9,782
• Above 2 kanal	7,426	4,045	11,471

Note) The new connection charge includes a security deposit, estimate charge, development charge, and form fee.
1 marla = 25.3 m^2, 1 kanal = 20 marla = 502 m^2
Source: WASA-F

The rate of illegal connections is deemed to be potentially high. WASA-F is making effort to regularize unauthorized/illegal water connections and making them subject to the same installation listed above.

6.2.2 Actual Conditions Relevant to Revenue and Tariff Levels

(1) WASA-F Revenue

Water supply and sewer/drainage bills are collectively printed out with computers at the Revenue Office in WASA Headquarters and delivered to customers by a commissioned agency (by outsourcing). Customers pay the tariff through a bank transfer. **Table A6.2.9**. presents the planned sewerage tariff receipts (budget) alongside the tariff receipts actually received (revised budget) in 2015-2016.

Table A6.2.9 WASA-F's Water and Sewerage Tariff Receipts

OPERATIONAL RECEIPTS (in Million PKR)				
Serial	Particulars	Budget 2015 - 2016	Revised Budget 2015-2016	Budget 2016 -2017
A	Opening Balance	2.000	2.000	3.700
B	Income from W/S and Sewerage			
1	Water Supply Charge	239.000	175.917	257.600
2	Sewer Charges	363.000	279.263	419.400
3	Recovery of Water supply & Sewerage Arrears	238.000	160.898	240.000
	Total	840.000	616.078	917.000

Source: JICA Mission Team Customer Survey

WASA Faisalabad also applies different billing systems to different customers. Some customers pay only sewerage charges. A customer not using WASA water in the WASA service area is only required to pay sewerage charges (customers, for example, who draw surface or groundwater and who only consume bottled water for drinking). The billing collection rate is therefore higher for sewerage connection than for water, though the charges are lower.

Apart from the water and sewerage charges, WASA also earns revenue from connection costs, advertisements on WASA property, new development, the sale of bottled water, and other sources. These sources provide revenue equivalent to about 17% of WASA-F's income from water and sewerage charges, which makes them very important.

The selling price of a bottle of WASA bottled water is PKR 50, far lower than the prices offered by competitor bottled water vendors (PKR 100 to 200). The bottled water production in WASA is currently

insufficient to meet the market demand. Other incomes besides water supply and sewer/drainage charges are summarized in **Table A6.2.10**.

Table A6.2.10 Other WASA-F Income besides Water and Sewer/Drainage

(Million PKR)

	Particulars	Budget 2015 - 2016	Revised Budget 2015-2016	Budget 2016 -2017
1	Infrastructure charges	60.000	57.591	80.000
2	Annual income from the leasing of land and auctioning of wastewater	5.500	2.776	5.500
3	Income from leasing out the roofs of OHRs	8.000	12.968	12.970
4	Income from leasing out cranes and forklifts	0.000	0.099	0.100
5	Income from profits on deposits	2.500	2.169	2.500
6	Departmental/contingency charges from development schemes	10.000	25.886	10.000
7	Tender/enlistment/renewal fee	8.000	2.360	8.000
8	Other income	9.000	4.662	9.000
	Total	103.000	108.511	128.070

*Bottled water income is calculated as different income and not included here.
Source: JICA Mission Team Customer Survey

(1) Current Status of the WASA-F Water Tariff

There are two billing systems: a volumetric tariff system (metered-rate system) and fixed tariff system. WASA-F currently adopts a fixed tariff system per unit housing area for all customers. The minimum charge is PKR 83 per month, and typical households (5-10 marla) are charged PKR 242 per month, much less than they pay for electricity and gas. The revenue recovery rate is also very low, however, as the water quantity, water supply time, and sewerage services are all unsatisfactory. WASA-F relies on income from the water tariff to maintain sufficient business operation. In the future WASA-F plans to change from the fixed-tariff system to the metered system. No increases in revenue are expected, however, from the installation of meters and the charging of every customer at a metered rate. The modification of the billing method alone, without other changes in the quality of WASA-F's services, cannot be expected to improve revenue appreciably. The standardization of water supply devices may be more effective than an increase in tariff recovery rates in increasing the overall level of service.

Including the costs of meter installation and meter reading could potentially increase expenses overall. WASA-F should make it a priority to adjust the tariff under the meter system to an appropriate level in consideration of the business operation costs related to meters, costs not considered within the current tariff.

The current water fee is too low to achieve financial autonomous. The current production cost of tap water, as reported by WASA, is 9.84 PKR/m^3. The water supply unit price, 14.6 PKR/m^3, indicates that financial sustainability should be expected. This is contingent, however, on improved revenue collection to raise the revenue quantities from their currently low levels. It would be unrealistic to raise the flat-rate water tariff without offering the customer any apparent benefits. Instead of sticking to the current meter system when WASA-F changes to a metered system, the M/P policy should seek to achieve objectives such as the following and identify such as the reasons for the change in the metered-rate system, in its communications with customers:

- Improvement of water supply service;
- Improvement of water service operations;
- Funds necessary for business operation.

(2) Tariff Collection Rate

The tariff collection rate is very low in WASA-F, with only 28% of registered customers making payments. The main reasons for the low revenue recovery are poor water quality, low water quantities,

and low water pressure. WASA-F can improve its water tariff recovery by comparing the situations in high and low payment areas and considering the procedures necessary to improve its services. WASA-F has detailed revenue records for each administrative area (a total of eight administrative areas), as shown in **Table A6.2.11**. The collection rate for commercial connections was 37.8 %, higher than its overall collection rate of 27.7%, in August 2016. The rate for industry, meanwhile, was 61.7% (see **Table A6.2.12)**.

Table A6.2.11 Current Tariff Collection Rates (Commercial and Domestic)

Current Revenue Recovery (August 2016)		Commercial and Domestic		
Area (subdivision)	Category	All Consumers	Paying Consumers	Payment %
GM Abad	Domestic	29,589	9,041	30.6%
	Commercial	2,618	1,031	39.4%
Millat Town	Domestic	21,889	5,305	24.2%
	Commercial	2,965	1,041	35.1%
Civil Lines	Domestic	35,907	10,215	28.4%
	Commercial	1,952	879	45.0%
Gulberg	Domestic	43,950	13,086	29.8%
	Commercial	4,678	1,719	36.7%
Madina Town	Domestic	33,291	8,284	24.9%
	Commercial	2,265	866	38.2%
Peoples Colony	Domestic	40,087	9,147	22.8%
	Commercial	2,805	1,193	42.5%
Allama Iqbal	Domestic	21,593	5,234	24.2%
	Commercial	1,781	662	37.2%
Samman Abad	Domestic	25,743	6,667	25.9%
	Commercial	3,575	1,166	32.6%
Total	Domestic	252,049	66,979	26.6%
	Commercial	22,639	8,557	37.8%
	Domestic, Commercial	276,204	76,472	27.7%

Source: WASA-F

According to the above table, WASA-F delivered a total of 252,049 bills to domestic customers in August 2016. Approximately 110,000 of the above customers were households receiving WASA-F water supply services. Other customers were sent the bills only for sewer/drainage charges, that is, charges for connecting to and using the sewerage and drainage system under WASA-F's management.

Table A6.2.12 Current Tariff Collection Rate (Industrial)

Current Revenue Recovery (August 2016)		Industrial		
Area (subdivision)	Category	All Consumers	Paying Consumers	Payment %
A99	IND: Sewer APTMA	64	48	75.0%
AQF	Aquifer Charges	495	347	70.1%
I95	IND: Non-Sewer APTMA	863	464	53.8%
IWS	Bulk water with meter	94	77	81.9%
	Total	1,516	936	61.7%

Source: JICA Mission Team Customer Survey
APTMA: All Pakistan Textile Mills Association

Consequences for late or non-payment are also contributing to the low income overall. **Table A6.2.13** shows the records of customers in arrears.

Table A6.2.13 Arrears Records of Customers

Arrears Amount	Number of defaulters		
(PKR)	Sitara Sapna	Sarfraz Colony	Madina Town
0 - 1,000	203	472	1,375
1,001 - 5,000	43	97	720
5,001 - 10,000	17	50	141
10,001 - 50,000	21	125	367
50,001 - 100,000	1	32	8
> 100,000	0	2	1
Total	285	778	2,612
Arears by Years	Number of defaulters		
(Years)	Sitara Sapna	Sarfraz Colony	Madina Town
1 year	17	229	155
5 years	11	79	89
10 years	11	60	78

Source: JICA Mission Team Customer Survey 2016

At less than 30%, collection of domestic tariffs is highly insufficient. The main factor is low customer satisfaction with WASA-F services. In this sense, collective opinions must also be considered. A strong sense of community culture (e.g., close-knit "neighborhood associations") prevails in the region. Residents of neighborhoods or streets form groups and act collectively for their interests in relation to a wide range of matters affecting their living conditions (over 1,000 such organizations are thought to exist in Faisalabad). If residents protest tariff payment through such collective action, tariff modification and income improvement may become difficult. Consideration of the collective communities, as well as individual, is important.

Arrears do not occur when payments are missed. Some customers have failed to make payments for several years running, making it all the more difficult to make accumulated back payments. Apart from reducing the income for WASA-F, the difficulty in making back payments all at once is compounded as the period of non-payment lengthens year by year. A mood of animosity and distrust can often result. Measures to stop the accumulation of arrears, such as service disconnection, should be taken to avoid such situations.

In order to tackle these problems, a proper water supply quantity and supply duration, the basic requirements for any water supply agency, must be achieved. Once these basic requirements are achieved and water supply services are improved, customer service can be improved. Improved customer service will then lead to increased revenue and customer satisfaction, which will strengthen the management foundations overall.

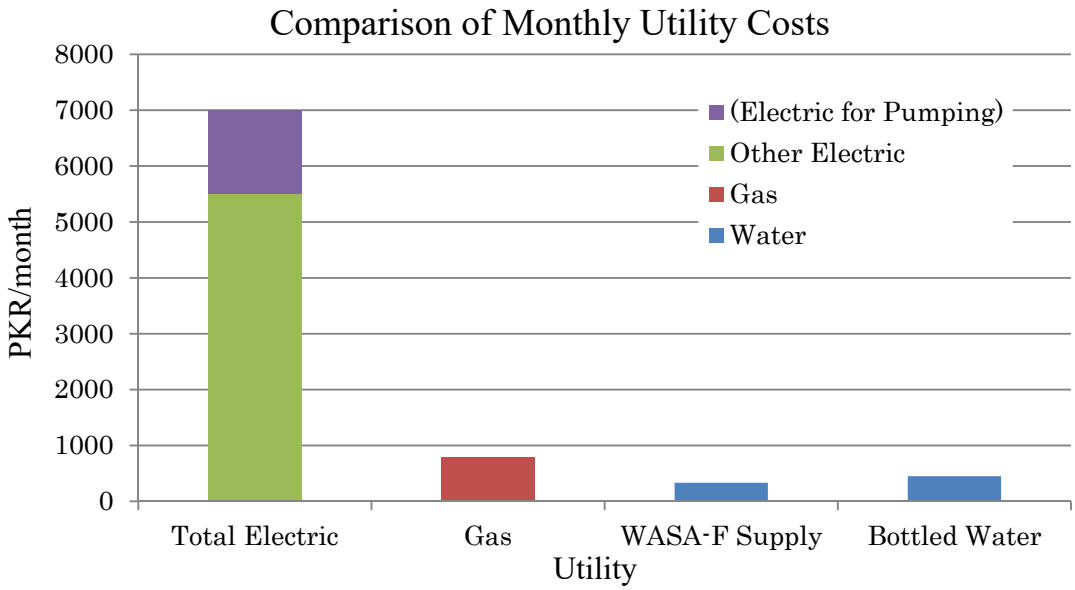
(3) Customer Database

The WASA-F database at present contains an incomplete listing of all of the housing in Faisalabad City. Many illegal connections and unregistered customers linked into the network are assumed. Hence, the current potential revenue from water tariffs vis-à-vis water and sewerage connections is unknown. Since January 2017, WASA-F has been carrying out a customer survey in its service area to grasp the actual numbers of users and prevent illegal connections. Recovered revenue falls fall short of covering the expenditures for services, forcing WASA-F to rely on funds from local government. At present, the actual number of customers that will have to be added to the system must be known in order to establish a demand and supply balance. Based upon this data, the water supply plans can be devised.

(4) Comparison with the Electricity Charges and Gas Rate

To check whether WASA-F water tariff (PKR 242 for a typical household) is appropriate, charges for electricity and gas were inspected and compared. Gas and electricity meters are installed and the charges are meter based. The electricity tariff applies two types of charges, peak and off peak, and is more complicated than the water tariff. A typical household (7 persons living in a 12 Marla house) incurs an

electricity bill of PKR 7,000 per month. Even small homes pay about PKR 3,000 per month. The gas tariff comes to about PKR 800, far less than the electricity tariff, by the same process. The monthly utilities of a typical household are compared in the figure below.



Source: JICA Mission Team Customer Survey 2016

Figure A6.2.1 Comparison of Monthly Utility Costs

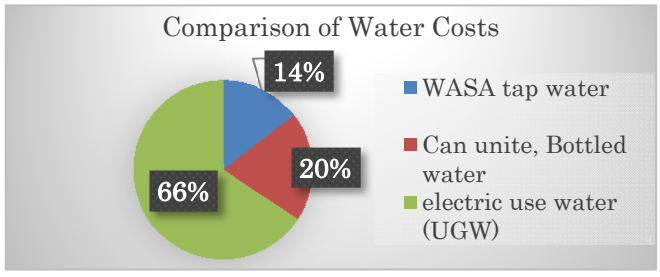
(5) Water Cost

Customers in a small number of households drink tap water directly, while many use bottled water for drinking. The WASA-F water tariff is not very expensive, but customers pay large amounts of money to obtain water by other methods. A breakdown of water expenditures by a typical household may fall somewhere in the following ranges:

1) Payment to WASA-F: PKR 242
2) Electricity charges for pumping up groundwater: PKR 1,500
3) Cost of bottled water for drinking: PKR 450.

Thus, customers spend a total of PKR 2,192 on water a month. This type of water usage in households can be observed throughout the entire city. In one M/P scenario, customers would shift to the use of WASA-F's piped water as their main water source when the water supply services were improved. Revenue would then increase, and the current tariff table could be revised with the shift to a metered-rate tariff system if the new water rate was still lower than the current water cost and maintained at a reasonable level vis-à-vis the willingness to pay and affordability discussed in Chapter A6.4.

Water Cost by Source	(PKR/Month)
WASA tap water	242
Bottled water	450
Electric use water	1500



Source: JICA Mission Team Customer Survey 2016

Figure A6.2.2 Water Cost of a Typical Household

(6) Meeting with each Department

Meetings were held with CRC, CLC, I&C, O&M, and GIS to investigate the factors that led to the current situation. Every department had points that require improvement. One point, revenue recovery, was commonly judged to require improvement in all departments. Support from the WASA-F departments is thorough, so action plans will be easy to prepare in the future. CRC is functioning in particular to improve the satisfaction of customers and increase the water tariff yield.

(7) Pilot activities

Pilot activities have been implemented in three areas to evaluate the possibility of improvement in water tariff collection. The conditions of these areas vary. The results of the project will validate the M/P.

(8) Process of water tariff revision

The water tariff will be revised step by step. First, a metered-rate system to replace the current water tariff system should be set. Once improvements to water supply services are achieved, the shift from a fixed tariff to metered-rate tariff will be possible. The tariff will then be revised by R&R in consultation with the WASA-F Managing Director. The revised tariff will require approval from the FDA and finally from the Punjab State Government.

(9) WASA-F Bottled Water

The bottled water business is present worldwide and the situation in Pakistan is no different. WASA-F has been conducting a project for bottled water production (19 liters) since 2015. This endeavor has proved profitable at the current price of 55 PKR per Bottle (2017). In fact, it is the only profitable business operated by WASA-F. The bottling process consists of reverse osmosis for purification and finally ozone treatment for disinfection. WASA-F's bottled water is in no way inferior in quality to the bottled water of other private companies. WASA-F's bottled water business makes profits. It can be considered a good policy for the organization and serves a large market.

(10) Facing WASA-F's System for Collecting the Water Tariff

The water tariff system of WASA-F should be switched from the current flat-rate system to a metered-rate system. As the population increases and development expands to the suburbs, accurate consumption volumes will be even more difficult to grasp. Efficient business operation for a city of this size is impossible without a solid understanding of the production and consumption volumes. Service improvement and 24/7 supply are requisite for starting the metered-rate system and increasing the collection rate.

Merits of a Metered-Rate Tariff System

- Increased water tariff income.
- Grasp of actual water consumption volume.
- Grasp of NRW.
- Exact calculation of production cost and estimated water rate.
- Proper water resource development based upon water consumption.

Demerits of a Metered-Rate Tariff System

- Water meter procurement and installation cost.
- Introduction of a new tariff system.
- Securement of meter inspection personnel.
- Materials required for the peripheral devices for the meters.
- Machinery and materials required for meter checks.

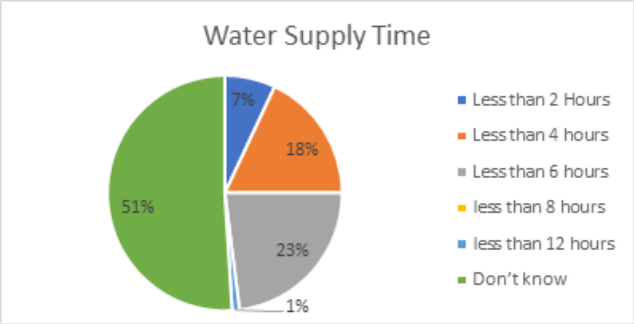
Increasing the tariff for the current flat-rate system would not give long term benefits to WASA-F. There are a number of customers who neither use water connections nor pay for sewerage connections. Hence, raising the current tariff will target only the customers who actually pay the bills. These customers make up only a small portion (28%) of the total customer base, and their actual water consumption is not yet known. A tariff increase at this point would decrease customer satisfaction while inflicting big damage upon the management. A similar effect was witnessed in November, 2016, when a hike in the industrial and commercial tariff brought in slightly higher payments but reduced the rate of revenue recovery. The recommendation, therefore, is that the water tariff system be shifted from a flat-rate system to metered-rate system in an integrated manner.

- Short-term behavior (1-3 years)
- Install meters in the areas where water service (water quantity, quality and pressure) will be improved (Pilot Activity for this Project). Ensure that the meter locations, installation process, and laying of pipes in consumer households are appropriate according to SOP prepared by the pilot activities. Then change the billing system to a metered type.
- Middle-term behavior (3-5 years)
- Expand the water supply area to the other DMAs. Shift the water supply area billing system to a metered type. Analyze water consumption and estimate the production cost. Finalize the water tariff increase for the meter system based upon financial planning and budget management.
- Long-term behavior (5-10 years)
- After the financial balance analysis is done, calculate the tariff increase and subsidies. Raise the price of water to an appropriate degree. Shift all areas to a meter system in the future.

Customers can pay water and sewerage charges at the nearest banks (financial institutions). Bill distribution is contracted to a third-party distributor who delivers the bills to consumers every one or two months.

A6.3 Customer Satisfaction

The customer survey carried out for this Project showed variation in the level of customer satisfaction in different parts of the WASA-F service area. The reason for the low overall level of satisfaction can be attributed to the low level of WASA-F's water service. The intermittent supply and low amounts of water make it impossible to hold the trust of customers. As a consequence, most domestic consumers rely on groundwater for daily uses such as washing. Because the groundwater of Faisalabad is unsuitable for drinking, customers source their drinking water from suppliers and distributors of bottled water. Residents therefore use several alternative water sources for different types of usage. WASA-F accommodates only a small portion of their needs. Customers wish for improved water service levels across the board. There have also been a number of complaints to CRC regarding sewage smell and a very low level of satisfaction overall. Hence, improvements in the water supply are an important prerequisite for tariff revision.



Source: JICA Mission Team Customer Survey 2016

Figure A6.3.1 WASA-F Water Supply Time in the Customer Survey Area

Table A6.3.1 Types of Bottled Water Used in the Customer Survey Area

Response to the questionnaire: What kind of bottle water do you buy for daily use?	
Can Units	272
Filtration Plant	15
Private Filtration Plant	1
Private Bottled Water	113

Source: JICA Mission Team Customer Survey 2016

WASA-F received 7,222 complaints over the one-year period from July 2014 to June 2015. Of those complaints, 1,396 were concerned with water supply (see the details below) and the remaining 5,826 were related to sewage and drainage.

Table A6.3.2 Numbers and Types of Major Complaints on Waterworks Reported to WASA-F

	Leakage	Inadequate water volume	Irregular water quality (Cross-contamination with sewer, etc.)	Total
July 2014	28	65	54	147
August	24	33	49	106
September	31	24	53	108
October	43	19	33	95
November	41	18	12	71
December	55	21	19	95
January 2015	49	18	26	93
February	40	16	35	91
March	40	15	49	104
April	40	21	62	123
May	40	48	64	152
June	62	58	91	211
Total	493	356	547	1,396

Source: WASA-F

Table A6.3.3 Numbers and Types of Major Complaints on Sewerage and Drainage Works Reported to WASA-F

	Sewer Blockage	Broken Manhole Slab	Missing Manhole Cover	Drainage Blockage /Cleaning	Total
July 2014	407	20	75	5	507
August	353	17	72	3	445
September	630	44	72	11	757
October	229	34	51	2	316
November	215	38	64	7	324
December	186	37	58	4	285
January 2015	318	53	58	5	434
February	317	54	76	11	458
March	444	59	72	10	585
April	334	126	108	4	572
May	286	108	67	5	466
June	505	86	69	17	677
Total	4,224	676	842	84	5,826

Source: WASA-F

Complaint Monitoring Centers are located within the WASA-F Headquarters and eight other sites in the city. These centers receive reports on leakage, water volume, and water quality. Nine complaint officers are assigned. A Complaint Registration System and GIS-based Management System operated on mobile and PC network platforms are established.

(1) Establishment of CRC

CRC receives customer complaints on a daily basis via SMS, telephone, and the CRC website. Upon receiving the complaints, it issues directions to relevant directorates at headquarters to resolve them. The received information is recorded in the database and adequately segregated to resolve the complaints completely. This system was initiated as a Complaint Management Cell (CMC) in 2011 and was later modified into a Customer Relation Cell (CRC) in 2014. The status of incoming daily complaints can be viewed from a display screen placed in the CRC Control Room. The complaint registration process has been improved at a rate of 5%.

(2) Role of CRC

Complaints from customers are received by the CRC website, e-mail, Whatsapp® and SMS messages, a toll-free line, direct desk service, and other channels. The complaints are filtered appropriately and tabulated each month. In the monsoon season, sewerage-related complaints are mostly registered. After the system receives a complaint, it notifies the relevant department and records the details. The data shows improvements in the efficiency of the system compared to last year.

Table A6.3.4 Changes in the Complaints Received by CRC (Comparison between 2015 and 2016)

Detail of the Complaints Received by (CRC) WASA-FAISALABAD						
Month	Manhole cover (Sewerage)	Manhole slab (Sewerage)	Drainage (Sewerage)	Water supply leakage	Low pressure/ No water supply	Contaminated water
September 2015	492	68	99	9	58	41
September 2016	322	38	45	10	37	48

Source: WASA-F

(3) Publicity

WASA-F held a publicity event in which it released a WASA commercial song. The people attending the event were educated about WASA-F services and the issues faced by WASA. The event was broadcasted on the local cable channel and also radio. WASA-F's Bottled Water service was also introduced at the event. Overall, the event was a good step in improving public awareness. This process will be important for the pilot activity implementation.

(4) Customer Survey

A customer survey of 140,000 households was conducted by PCGIP in 2014. The survey collected basic information on water supply from each household to ensure water business improvements based upon the findings. While the data was too scanty and incomplete to use in master planning, it did confirm that customers demanded water supply with good pressure on a 24/7 basis. Achieving this demand will require an increase in the water tariff in the future.

(5) Field Survey

A field survey of six areas where WASA-F water was available was conducted in 2014. Feedback from customers regarding the service was recorded at random during the survey. Sewage overflow, short water supply duration, and low pressure were the major concerns of the customers. The survey was conducted by WASA-F staff who were able to respond to the customers' queries and provide satisfactory justifications to appease them. WASA-F can gain the trust of its customers by improving its services.

(6) Meeting with each Department

The CRC groups the four east and west areas into eight subgroups (two subgroups per area). One person in charge of each area receives and records feedback from customers. Much of the feedback is made up of requests to lower the water tariff rate.

(7) Pilot activities

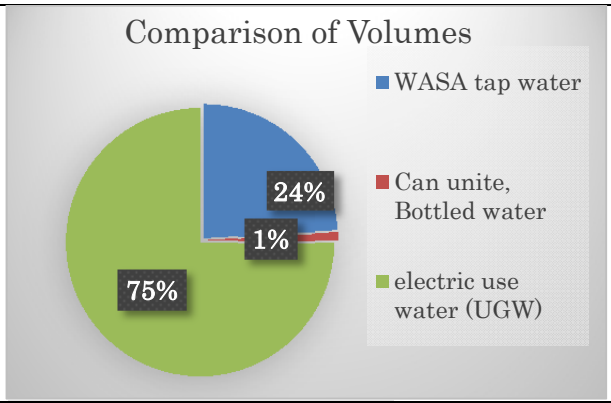
Improvement of customer satisfaction along with the tariff yield makes up another major part of pilot activities. The customer situations differ from one selected pilot area to the next. While the basic targets for each pilot area will be the same, the procedures adopted will differ according to the conditions. Once the targets are achieved it will be possible to expand the activities to other areas.

A6.4 Willingness to Pay and Affordability for Water Supply and Sewerage Tariff

6.4.1 Current Water Usage

Unable to rely on WASA-F's supply water, many households now use groundwater to meet their domestic needs. According to an interview survey carried out by the JICA Mission Team (JMT) at typical households in the Pilot areas, the breakdown of water usage per person per day (l pcd: liters per capita per day) was as follows: WASA-F water, 33 liters; groundwater, 103 liters; bottled water, 1 liter; total, 137 lpcd. Figure A6.4.1 summarizes the results of the interview survey.

Source	Volume	In Liters
WASA-F Water	7 m^3/month	7000 l/month
Bottled water (19 l)	15 bottles/month	285 l/month
Groundwater	720 l/day	21,600 l/month
Total		28,885 l/month
Typical Household	7.2 persons living in 12 Marla house	
	30 days/month	
Water Usage	WASA tap water	33 lpcd
	Bottled water	1 lpcd
	Groundwater	103 lpcd
	Total	137 lpcd



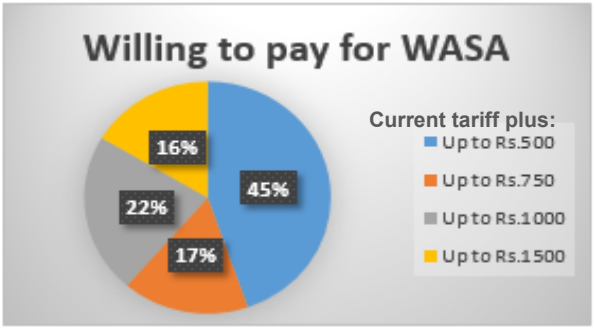
Source: JICA Mission Team

Figure A6.4.1 Water Use of Typical Household

6.4.2 Willingness to Pay

The high dependence on groundwater can be attributed to low WASA-F's service quality and long-standing social norms of the area. The payment rates are high for the electricity tariffs but low for the water tariff. The survey found that many households would be willing to pay if WASA-F services were improved (sufficient water volume, pressure, and quality). Nearly half (45%) of the residents interviewed would be willing to pay up to 500 PKR/month, in addition to the current charges, in order to bring about improvements in WASA-F services. A further 17% would be willing to pay up to 750 PKR/month more; 22%, up to 1,000 PKR/month more; and 16%, up to 1,500 PKR/month more. The results are summarized in the **Figure A6.4.2** below. Assuming that customers currently pay 1,500 PKR/month for electricity to pump up groundwater from their private wells, the expense would count toward water use. The electricity cost for pumping could therefore be shifted to a willingness to pay for WASA-F water supply once customers were satisfied with WASA-F's service level.

Willing to pay for WASA	
Up to Rs.500	177
Up to Rs.750	66
Up to Rs.1000	88
Up to Rs.1500	65



Source: JICA Mission Team

Figure A6.4.2 Willingness to Pay for Water Supply Services (in Addition to the Current Tariff)

From the **Figure A6.4.2**, the weighted average efficiency is computed at approximately 817 PKR. Supposing the mean level of current water tariff structure is 242 PKR/month, the willingness to pay for water supply is estimated to be 1,059 PKR/month (817 +242 = 1059 PKR), subject to improvement of the water supply service.

6.4.3 Affordability to pay

Water and Sewer bills that come to less than 5% of total household income are considered affordable (OECD, 2010[19]), of which 3% for water bills and 2% for sewer bills are deemed appropriate taking into account the current tariff structure (i.e. sewerage tariff is approximately 70% of water tariff). According to Chapter 2.3.3, the average household income in Punjab Urban (urban areas in Punjab province) was 46,616 PKR/month (or approximately 47,000 PKR/month) in 2015-2016. Assuming an average household income of 35,000 PKR/month (75% of that in Punjab Urban) in Faisalabad City, water bills of up to 1,050 PKR/month (3% of 35,000 PKR/month) can be considered affordable. Apart from the water bills, the sewer bills are set at less than 2% of the total household income, or up to 700 PKR/month (2% of 35,000 PKR/month). That is, the maximum affordable level for the water and sewer tariff can be estimated at 1750 PKR, or 5% of the total household income.

The affordability limit of 1,050 PKR/month in water bill is less than what residents currently expend on groundwater pumping from their private wells (i.e., 1,500 PKR/month in electricity costs; Figure A6.2.2, Water Cost). Moreover, the willingness to pay estimated from the interview survey in the previous section was 1,059 PKR/month.

The affordable levels of water and sewer bills are summarized in **Table A6.4.1** below.

[19]Pricing Water Resources and Water and Sanitation Services, OECD (2010).

Table A6.4.1 Affordability of the Water and Sewerage Tariff

Unit: PKR/month

	Income Distribution of Punjab Urban(1)	Income Distribution of Faisalabad(2)	Affordability Limit(3)	Assumable Water (W) and Sewer (S) Tariff (4)
Lowest Quintile	19,000	14,000	700	W = 420 & S = 280
Average Quintile	47,000	35,000	1,750	W = 1,050 & S = 700
Highest Quintile	69,000	52,000	2,600	W = 1,560 & S = 1040

Data from the Household Integrated Economic Survey, HIES, Punjab Province (2015-2016)
75% of (1) in light of page 21, Poverty & Social Impact Analysis in Punjab Urban, Urban Unit (2010)
5% of (2), referring to Pricing Water Resources and Water and Sanitation Services, OECD (2010)
3% of (3) for Water and 2% of (3) for Sewer.

Grounds for estimated monthly household income in Faisalabad is also shown in **Appendix AA6.1, Household Income in Faisalabad,** in the **Supporting Report**.

The current water selling price of WASA-F is calculated as 8.4 PKR/m^3 from a monthly water bill of 242 PKR/month (typical household) divided by a household water use of 28,885 l/month, estimated by the interview survey (**Figure A6.4.1**) on the assumption that all water demand was fulfilled by WASA-F water. A monthly water bill of 242 PKR/month and water selling price of 8.4 PKR/m^3 are considered much less than the reasonable tariff and could be raised to levels comparable to the willingness or affordable levels. Note, however, that a cross-subsidy for the low-income group should be considered when raising the tariff.

As a reference, water tariff and income level in principal cities in the world is also shown in **Appendix AA6.2, Comparisons for Water Tariff Level and Income Level in Principal Cities in the World**, in the **Supporting Report**.

CHAPTER A7 ANALYSIS OF WASA-F FINANCIAL PERFORMANCE

A7.1 Objective and Analytical Framework for the Current Study

The overall objective of the current chapter is to analyze and assess managerial capacity of Water and Sanitation Agency-Faisalabad (WASA-F) in financial management to help develop a medium and long-term investment plan that aims to provide quality services to meet demands of all beneficiaries in the city of Faisalabad by 2038. Against this, following sections deal with (i) numerically articulating and preliminarily assessing the Agency's financial performances to date, (ii) reviewing the accounting system currently in place at WASA-F to draw the Agency's inherent issues in policy and operational dimensions to improve financial accountability and manageability in pursuance of the overall objective, (iii) identifying deficiencies and/or shortfalls in day-to day financial operations to suggest measures for the betterment of quality and quantity of the Agency's services within the current and foreseeable institutional, organizational, and personnel frameworks, and (vi) pin-pointing policy and operational issues of specifically relevance to help discuss measures and methodology amongst all of the concerned parties for enabling the Agency to financially be self-sustainable and allocate funds to investment programs to come.

Analytical methodology adopted in this chapter on WASA-F financial performance has duly been based on accrual accounting in line with the US *Generally Accepted Accounting Principles (GAAP*). In so doing, the study highlighted financial documents/data as recorded and analyzed by the WASA-F Revenue Division and subordinate IT Section database, while referring to the Auditor's WASA-F Audit Reports (2010-14) to pursue the specific objectives of (i) numerically articulating the WASA-F financial performance, (ii) identifying associated policy and operational issues, and (iii) sequentially assessing WASA-F financial capacity to undertake the proposed Long-term investment scheme, and (iv) drawing analytical inputs to the prospective *Business Plan*. Subsequently in the Final Report B6.6 and 6.7, and C11.9, , cashflow analysis of the selected water supply and the Phase-1 sewerage projects with *Financial and Economic Internal Rate of Return (FIRR/ EIRR)* as feasibility indices will take place in the light of numerically assessing service profitability and allocative efficiency attributed to the proposed sector project.

A7.2 Accounting Analysis: Baseline Features of WASA-F Financial Management System

This section deals with the very first and crucial findings of institutional and operational impediments to WASA-F financial sustainability as a preposition to the thorough understanding of accounting analysis which follows this section. The very first finding to note regarding WASA-F financial management would be, among others, the ambiguity of financial records in the relevant documents and database information which is an inherent shortfall by the use of *modified accounting*. As reiterated in the Audit reports, the said accounting system which intermediates *"Cash Accounting"* and "*Accrual Accounting*" basically records and reports financial performance in the form of *income statement,* while discarding other financial documents, *namely*, *Balance Sheet, Cashflow Statement*, and others of relevance. This accounting method, together with the lack of operational data/information including precise quantity of water supply and sewerage/drainage treatment, makes it difficult for the Agency to figure out the unit cost of operations and associated efficiency indicators, thereby leading to the Agency's likely misconduct in day-to-day data recording/analyzing and reporting to Management for decision-making. In the light of dearth in preparing precise and approved financial documents for managerial objectives, WASA-F has since its establishment not prepared or disclosed Annual Reports with audited financial statements, while leaving the room for policy and operational discussions transparency and accountability in financial management and information disclosure.

With other notable features of WASA-F financial system and operations as specified and summarized in the following **Table A7.2.1**, current semi-cash accounting hampers WASA-F other operational capacity in capturing correct and timely information for managerial planning and decision making. Typical of these symptoms include, but not limited to, (i) Agency's disparate cash position with extremely low *Account*

receivable turnover rate (ARTR) of 0.4-0.8[20], (ii) lack of the concept and practice of *cumulative depreciation* of tangible fixed assets in Balance Sheet, such that the agency encounters difficulty in capturing obsoleteness of machines/facilities in operation and devising future investment plans, and (iii) a huge chunk of benefit foregone, namely, *payment arrears* which is included in accumulated accounts receivables[21]. *Account receivables* and *payment arrears* of WASA-F now recorded in the database are respective of PKR 1.7 billion (81.6% of current asset, 2014) and PKR 2.43.0 billion (2016) as depicted in **Figure**s **A7.2.1** and **A7.2.2**.

In the meantime, one of the managerial characteristics attributable to WASA-F finance is the very small portion of non-operating revenue out of the aggregate, which is merely 3.1% in average over the period of 2011-2013[22]. As seen in the financial statements of public water supply undertakings in Japan, Yokohama City Water Supply Division, for instance, budgeted 19.5% of non-operational income out of gross revenue estimate of PKR 78.5 billion (JPY 86.4 billion) in 2017[23]. WASA-F would consider further promoting current business of land facilities leasing to raise gross operating revenue.

Table A7.2.1 Salient Features of WASA-F Operational Financial Management

	Facts	Policy Implications
1. WASA-F Accounting System	(1) As regulated by the Provincial Government, WASA-F adopts modified cash basis of accounting in lieu of accrual accounting[24] (2) Financial Statements comprises only Income Statement	As profoundly recommended by the Auditor (*Audit Reports 2012*), it is recommended for WASA-F to allocate managerial resources to (i) establish internal audit system, and (ii) prepare Financial Statements fully in compliance with GAAP (accruable accounting)
2. Definition of operating revenue/expenses	WASA-F *Operational profit* comprises operating and non-operating revenues (transfer payments, non-operating business revenues) which does not comply with GAAP	WASA-F *operational profit/loss* is as par a *recurrent profit/loss* in the US GAAP, which comprises operational + non-operational profit/loss. Large chunk of operational profit emanates from transfer payments (tax allocation), which is *non-operational* by accounting definition
3. WASA Financial Recording and Reporting	No annual reports except *Annual Activity Reports* in *Urdu* and *Budget Statements*, which provide only financial transactions (Flow)	Needs for preparing Annual reports which explicitly record and numerically report the financial position and performances of public services as given by Balance Sheet and Cashflow Statement
4. Accounts Receivables: Non-cash revenue - vulnerability of financial basis	Of the aggregate current asset of PKR 2.1 billion, account receivables stand at PKR 1.7 billion, while accounting for 81.6% (2014, Figure A7.2.1)	Accounts Receivable Turnover rates; 0.4-0.8 taking 1.5 -2.5 years to convert to cash (WASA-F considers 57 months to recover[25]) Urgent needs for (i) collecting cash, and (ii) realigning asset account in BS by writing-off non-performing receivables
5. A huge chunk of Hidden Treasure for Future Project Financing (Cash revenue)	(i) Accounts Receivables, (ii) Arrears outstanding, (iii) payments evasion, (vi) illegal connections, (v) groundwater, and (vi) future revenues from new investment projects	There sure will be a room for WASA-F to expand and foster its income basis by duly enforcing the collection of unpaid revenue which includes (i) accounts receivables: PKR 1.7 bill, (ii) Arrears: PKR 3.0 bill, (iii) evasion: PKR 0.7 bill, (vi) illegal: 0.3 bill, and (v) PKR 2.2 bill, in aggregate around PKR 8.0 billion (2016), (vi) PKR 228.3 mil26
6. NRW Pilot Study	introducing metering and new tariff	A remarkable milestone to upgrade WASA-F financial

[20] ***Account Receivable*** (AR) is a non-cash revenue as recorded in *Balance Sheet* measuring entity's liquidity and implying vulnerability in financial settlements. In general, public enterprises accounting in the developing economies reveals high rate of AR, hampering agency's recurrent activities (salary and wage payments, procurement of goods and services, daily service operations, and others of relevance). ARTR is empirically accepted as Sound and Robust, with 6.0 and higher as a benchmark indicator. ARTR 0.4 means that an entity needs 3 years of time to recover cash from notes.

[21] As of May 2017, aggregate arrears amount to PKR 2,700 million, accounting for around 250% of the Agency's one-year service earnings (water supply and sewerage/drainage). (source WASA-F IT database, May 2017)

[22] Source: Aslam Malik & Co., *Op. Cit., 2011, 2012, 2013*ADnc

[23] Source: Yokohama City Water Supply Division, *Yosan Gaiyo (Budget Outlook) 2017,* p, 2, p. 14

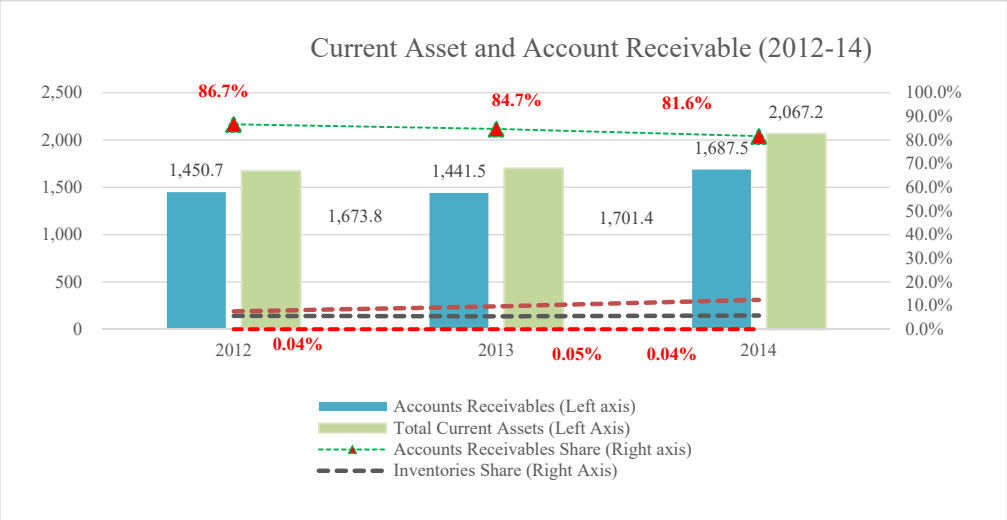
[24] At the time of drafting the Interim Report, the legal and regulation framework for WASA-F accounting system has not been discussed with the Agency as well as the local government officials in concern, as such the issue of transferring the accounting system to Accrual accounting at WASA-F would take place during the DRF/R preparation

[25] WASA-F *Performance Indicators* #35 Collection period, 2016

[26] Refer to sub-section 7.5.1 (Table A7.5.3)

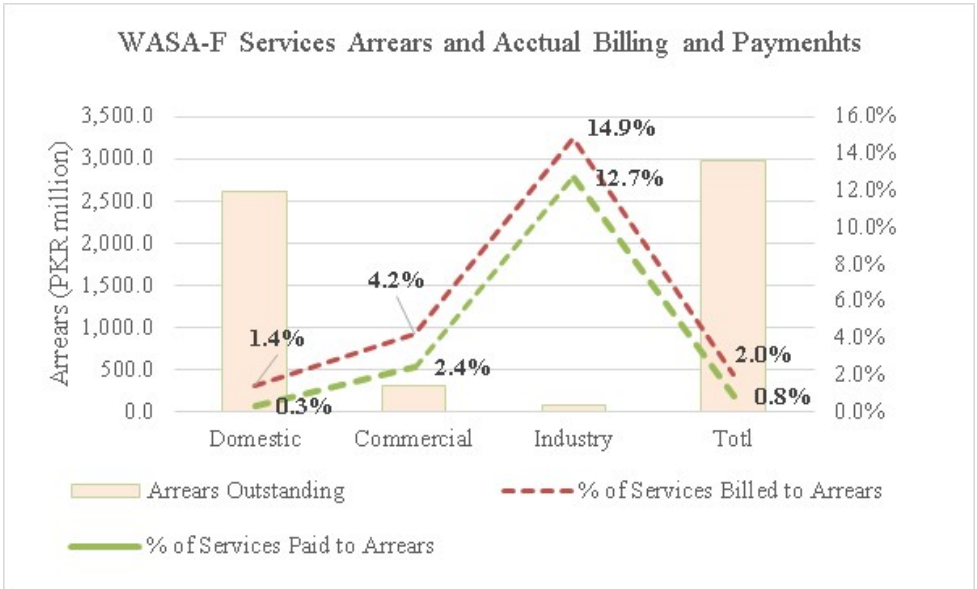
	Facts	Policy Implications
and Water Pricing	systems to raise Willingness to Pay for the water supply service	management to sound and robust operations, with the introduction of **costing-based pricing** system
7. Non-operating revenue	3.1% in average (2012-14, *Audit Report*)	Public service entity's new business model: example 10.7% (Yokohama city water supply, average 2014-15)
8. Tariff-hike of industries/commercial beneficiaries	Vice-chairman of WASA-F was quoted on 30 April as saying that the water tariff levied on commercial/industry beneficiaries was increased in October 2016	Consequently, annual operation income increased by PKR 8-9 million per month, contributing by and large 8.5% of increase to current chunk of operating revenue

Source: JICA Mission Team



Source:Audit Report, WASA-F IT-Database, JICA Mission Team

Figure A7.2.1 WASA-F Cash-position Figure



Source: WASA-F IT-Database, JICA Mission Team

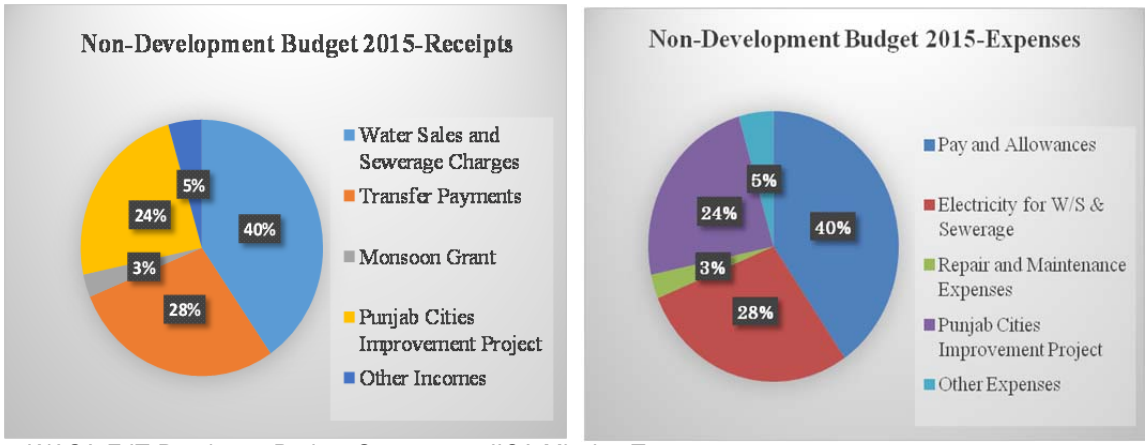
Figure A7.2.2 WASA-F Arrears Outstanding and Fee Collection

A7.3 Analytical Results: WASA-F Financial Performance

7.3.1 Line-item Budgeting and Operational Confinements

WASA-F constitutes part of Faisalabad District Government while duly undertaking public service delivery in water supply and sanitation to, though limited, the citizens in the service area. In understanding the agency's financial performance in the past, internal and external documents of relevance, reports, and specific figures stowed in the IT section database are of importance and utilized for current evaluation in numerical terms. Financial performance of the Agency as reflected in the WASA-F Budget statements and Audit Reports has recently been on a favorable condition, while posting positive net profits in the recent years. In his light, the Agency has not been a sick institution which records a large chunk of deficits every year.

Nonetheless, this favorable view on the Agency's financial performance would somewhat be reserved because the Agency runs not on an efficient and effective basis, but the public service undertaking has confined its operations within the size of revenue regardless of the quality and the needs of beneficiaries[27]. As visualized by figures in the following **Figure A7.3.1**, actual receipts and expenditure of WASA-F operational (Non-development) budget have almost been as par by item. Specifically, water supply and sewerage/drainage income (PKR 0.8 billion) ≈ employees' pay bills and fringe benefits (PKR 0.8 billion), Federal and Provincial transfer funds (PKR 0.6 billion) ≈ electricity bills for water supply and wastewater/drainage pumping (PKR 0.06 billion), Monsoon Grant ≈ repair and maintenance (PKR 0.06 billion), and other cost items are both in income and expenditure exactly identical (PKR 0.5 billion).



Source: WASA-F IT-Database, Budget Statements JICA Mission Team

Figure A7.3.1 Comparison of Non-Development Budget Receipts and Expenditure (2015)

In this light, it would be noteworthy to point out that the above-mentioned Agency's operations have, to a certain extent, been in line with *line-item budgeting* in the framework of *Public Financial Management* (PFM)[28]. With this, the Agency's budgeting and associated operations have not been functioned as tools in pursuance of policy targets which are specifically to be planned and figured out in a short- and medium-term framework. Should WASA-F face the opportunity to upgrade service quality in the days ahead as somewhat an autonomous body, budget planning and execution processes may need to be reengineered to a *supply-side (result-oriented) budgeting,* with policy goals (spending) coming ahead, followed by financial planning considering how much from where WASA-F could get required funds.

[27] Access to, quantity of, and quality of WASA-F water is very much limited as reflected in Chapter 3 in particular. This view was also stressed by the Auditor who took responsibility of external auditing from FY 2011-2015 on the occasion of interview to and discussion with Mr. Aslam Malik, CPA, on 22 May 2017 in Lahore)

[28] *Public Financial Management* is conceptual and operational framework for the public sector reform/reengineering in the developing economies, as initiated and guided by the International Monetary Fund (IMF) and the World Bank (WB) since the end of the 1990's.

Another view of reservation on the WASA-F financial performance as reflected in the *Budget Statements* lingers on aggregate net profit therein where net profits/losses of "Operational" (by definition *recurrent* revenue which is a summation of *operational* and *non-operating revenues* in US GAAP) and development accounts are all combined in income statements. With this, WASA-F has posted a little margin of "operational net profit" in the recent -3 years, while water supply and sewerage/drainage services running deficits.

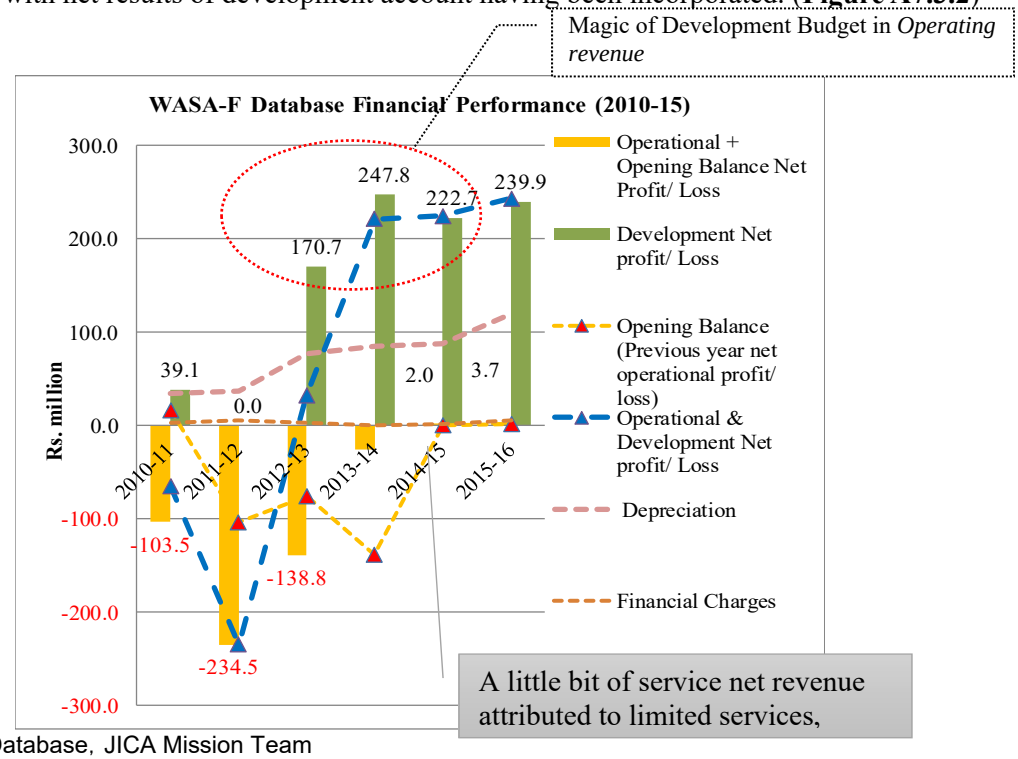
Against the background of the Agency's accounting system and budgetary overview, financial performance as revealed in its own data sources will follow hereafter. It would be reiterated that current analysis remains still indicative due to discrepancies in figures between and in data sources arising from accounting methodology.

7.3.2 Financial Performance by WASA-F Budget Statements and IT Section Revenue Database

(1) Overall Growth in Operating Revenue and Expenditures

1) Revenues

Over the past period of 2012 to 2015, WASA-F posted annual average growth rate of *operating revenue* at 15.6% and 18.2% in nominal terms for the cases of with- and without- the ***opening balance*** in *operating revenue*, respectively[29]. Given the average inflation rate of 7.9%, *operating revenue* as per 2012 price level grew 7.7% and 10.3% for respective of the same case as immediately above. On the basis of net profit/loss, the Agency posted positive output of PKR 2.0 million in 2015, in the wake of continued deficits in the previous years. Yet WASA-F has posted positive results of service operations as reflected in Budget Statements, with net results of development account having been incorporated. (**Figure A7.3.2**)

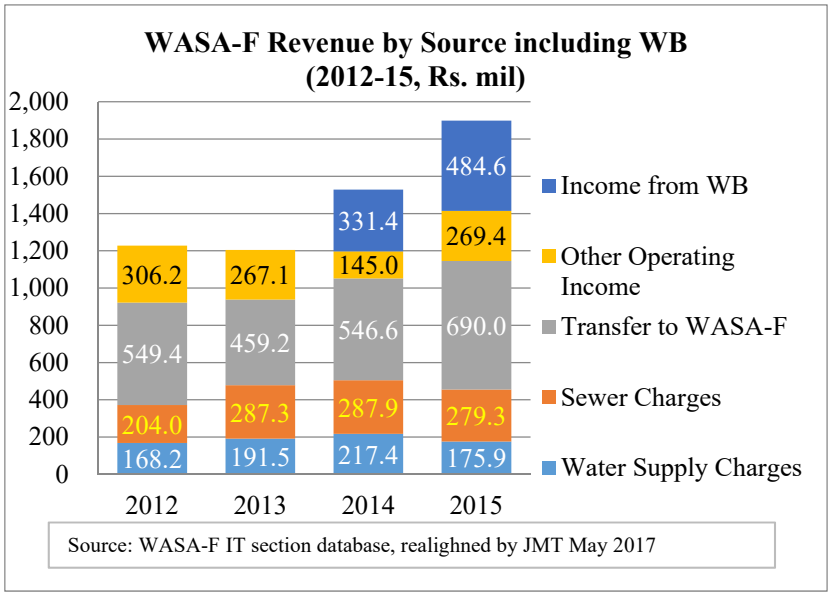


Source: WASA-F IT Database, JICA Mission Team

Figure A7.3.2 Net Profits and Losses in Operational and Development Budget Operations

[29] In the Budget Statement, WASA-uses the terminology of *Total Receipts* for the accounting clause of operating revenue plus carryover

Notably, a large chunk of revenue increase emanated from the size of transfer payments in the form of tax allocation and grants[30] and Provincial government transfer, with the annual average growth rate of 7.9%. Overall change in growth of revenue and expenditures Income Statement indices is depicted in **Figures A7.3.3** and A7**.3.4** which appear subsequent to the paragraph on expenditure immediately below. Together with preceding **Figure A7.3.1**, it would be reiterated and stressed that the Agency's financial management of cash/non-cash transactions (revenue and expenditure payments) is, by and large, confined to a *line-budgeting* mechanism[31], while posting the amounts of revenue and expenditure at almost as par every year.



Source: WASA-F IT-Database, Budget Statements, JICA Mission Team

Figure A7.3.3 Revenue by Source 2012-15

2) Expenditures

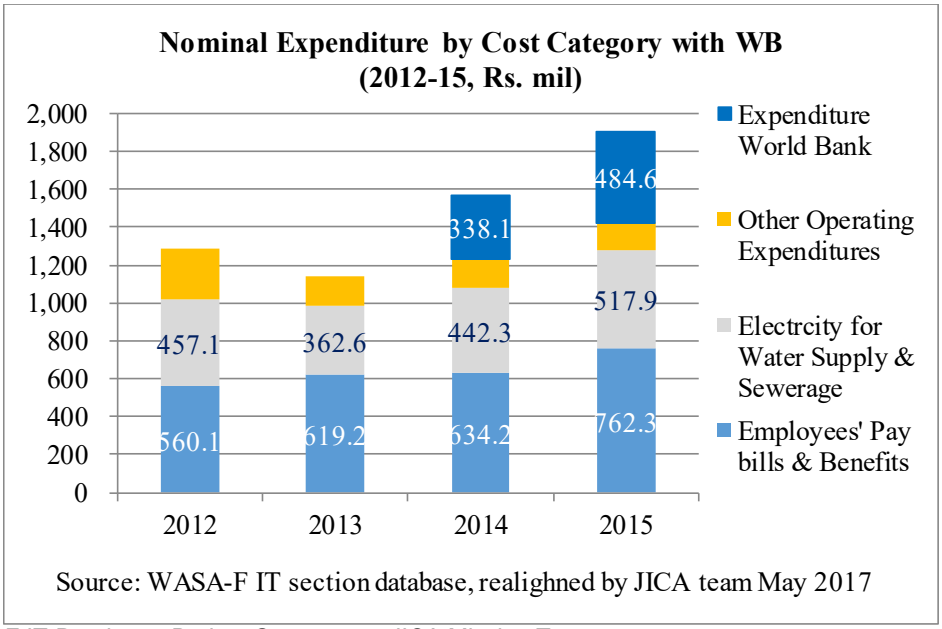
"Operational expenditures" in aggregate from 2012 to 2015 increased by 3.3% and 13.9% in nominal terms for respective of without the WB project[32]-related and with cases. Specifically, those of employees' wage and fringe benefits (*Establishment* expenditure) and electricity grew respective of 10.8% and 4.3% in nominal terms. Provided that the average annual inflation rate as indicated by Consumer Price Index (CPI) over the same period is 7.9%[33], labor costs has increased by 2.9% in real terms.

[30] Urban Property Improvement tax and Monsoon grant

[31] Inefficient resource allocation through budgeting procedure is defined as *line-budgeting* in the framework for *Public Financial Management*, which is an administrative impediment to *Result-oriented budgeting*

[32] The Punjab Cities Governance Improvement Project (PCGIP), a 5-year loan transferred as grant to WASA-F through Punjab State Government (Fiscal year 2013 through 2017)

[33] Source: IMF, *World Economic Outlook Database*, October 2016, CPI 2012 (11.4%), 2013 (7.4%), 2014 (8.4%), and 2015 (4.5%)



Source: WASA-F IT-Database, Budget Statements, JICA Mission Team
Note) Expenditure World Bank is the same as expenditure the Punjab Cities Governance Improvement Project (PCGIP) [13]

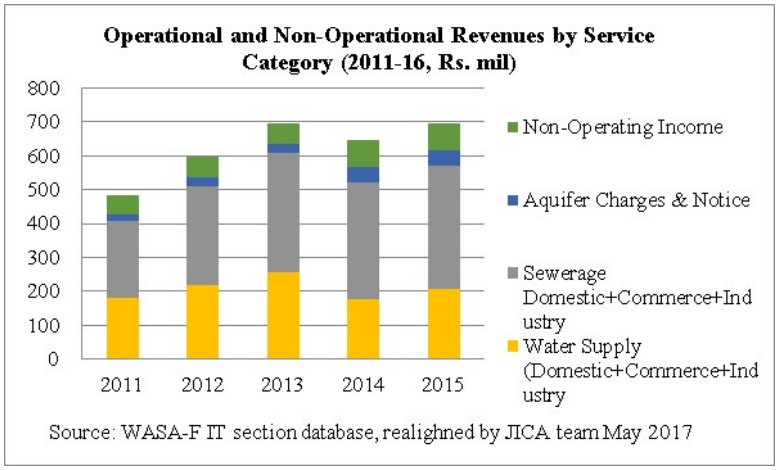
Figure A7.3.4 Expenditure by Source 2012-15

3) Operating revenue by Sector and Beneficiary

Breaking to specific sources in gross revenue, salient findings include, as depicted in **Figure**s **A7.3.5** and **A7.3.6** below, the followings.

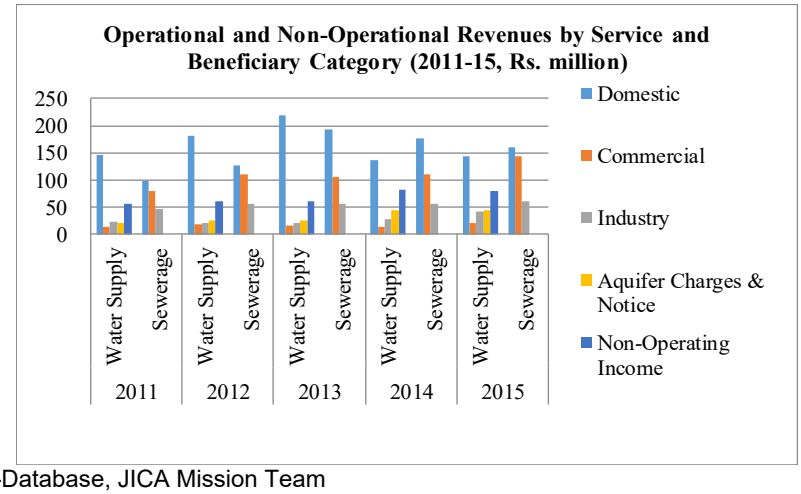
(a) more than a half of WASA-F operating income (water supply and sewerage/ drainage) emanates from the sewerage sector service, while accounting for 52.4% of the aggregate in 2015;
(b) water supply and sewerage/drainage services received cash- and non-cash revenue respective of PKR 175.9 million and PKR 279.3 million in 2015, with nominal growth rate over the period of 3.6% and 12.6%, respectively. In real price terms, revenues from water supply service over the same period downsized by 6.4%.
(c) WASA-F has since 2011 posted the annual average growth rate of sewerage at about 11%, whereas the rate of water supply at around 1% over the same period;
(d) WASA-F financial documents do not explicitly reveal the costs accrued to each of the service sectors, thus leading to ambiguity in estimating unit cost of service (Cost Accounting) and relevant managerial decisions of necessity; and
(e) by beneficiary category, households (domestic) sector bears a large part of pecuniary contribution, while accounting for 44.6% of the total in 2015, followed by commercial, industrial, non-operating, and aquifer charges of 24.5%, 15.4%, 11.9%, and 6.5%, in that order[34].

[34] Source: WASA-F IT section database, realigned by JICA team May 2017



Source: WASA-F IT-Database, JICA Mission Team

Figure A7.3.5 Revenues by Service Category (2011-15) Figure



Source: WASA-F IT-Database, JICA Mission Team

Figure A7.3.6 Revenues by Service and Beneficiary

Viewed in immediately above, sewerage service accounts for more than a half of the WASA-F aggregate (operating and non-operating) revenue, with the domestic sector beneficiaries as a large chunk of demand. In this connection, targeting sewerage service beneficiary would be a target group for firmly raising WASA-F revenue in the forthcoming years to come.

4) Ratio Analysis

Should the net profit to sales ratio (by definition, net profit ÷ sales) and the cost coverage ratio (by definition, total revenue ÷ total expenditure) be estimated in line with the WASA-F financial documents and accounting method, results are summarized in the following **Table A7.3.1**. As given in the chronological shift of financial performance to the profit-earning public service entity in the wake of 2012, WASA-F would positively and profoundly be accessed as a financially and operationally sound-management-oriented institution. In tandem, it would be in need to look into the service quality and quantity in supplying services whether or not WASA-F has downgraded service quality to save costs.

Table A7.3.1 Net Profit Ratios and Cost Coverage Ratios (2010-15)

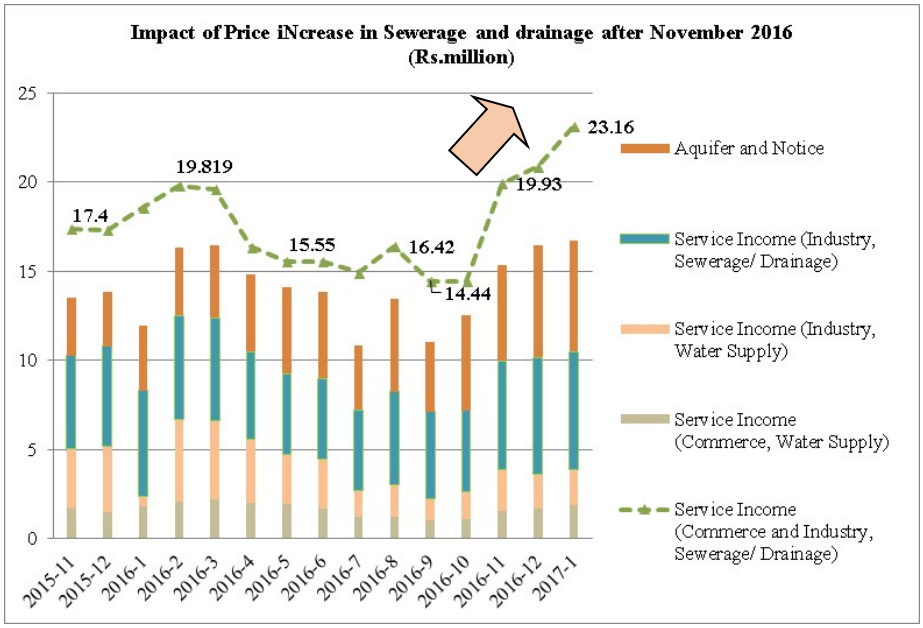
	2010	2011	2012	2013	2014	2015
Net profit Ratio	-1.74%	-4.44%	1.59%	6.46%	6.49%	7.35%
Cost Coverage Ratio	0.98	0.96	1.02	1.07	1.07	1.08

Source: WASA-F IT-Database, JICA Mission Team

Tabulated and detailed data for WASA-F financial statement and ratio is also shown in **AppedixAA7.1, Accounting Analysis of WASA-F Financial Statement**, in the **Supporting Report**.

(2) Sewerage and Drainage Tariff-Hike for Industry and Commercial Sector Beneficiaries

WASA-F raised tariff of sewerage and drainage services levied on the industry and commercial sector beneficiaries on November 2016[35]. Numerical evidence of avail for the measurement of the effects of price-hike turned out to be positive in policy decision, while recording revenues rose from both the industry and commercial sector. Specifically, revenues increased by respective of 13.7% and 18.5% from October 2016 to January 2017[36] (**Figure A7.3.7**).



Source: WASA-F IT-Database, JICA Mission Team

Figure A7.3.7 Monthly Revenue by Service and Beneficiary (Pre-Post Tariff-hike)

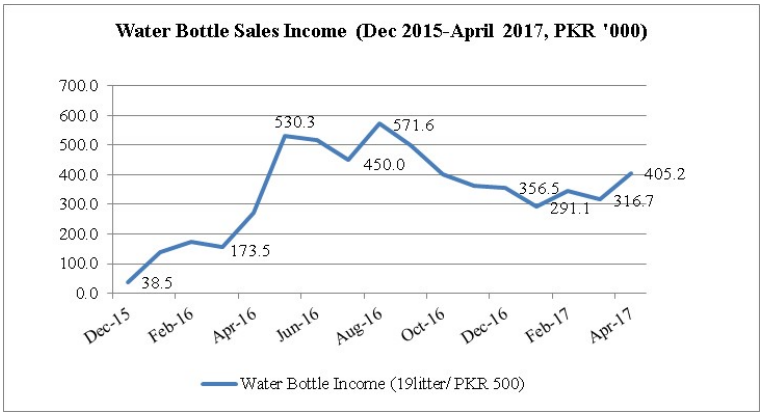
(3) Water Bottling Business

WASA-F embarked on the water bottling business in December 2015 to sell 19-liter-bottle for PKR 900. While there has been a fluctuation to a greater extent by season and associated temperature, the concerned business posted revenue of PKR 0.4 million in April 2017. One year-basis-revenue from the beginning to November 2016 was PKR 4.1 million, with 0.2% of nominal increase in sales revenue over 17 months[37]. In this regard, WASA-F would accordingly assess pecuniary value of the service in terms of financial profitability. Monthly revenue of the business in concern is depicted and given below in **Figure A7.3.8**.

[35] While WASA-F issues combined tariff bills of sewerage and drainage, revenues from sewerage and drainage are mostly substantially from beneficiaries and transfer payment of the State Government of Punjab (Urban Immobile Property Tax Share), respectively.

[36] Water revenue from the domestic sector was 19.8% of increase over the same period of time. (Source: WASA-F IT Section database, May 2017)

[37] Source: WASA-F Revenue (Industry/Commerce), realigned by JMT, May 2017



Source: WASA-F IT-Database, JICA Mission Team

Figure A7.3.8 Chronological Fluctuation in Monthly Revenue of Water Bottling Business

7.3.3 Referential Note on Numerical Discrepancies in WASA-F Documents and Audit Reports

The Aslam Malik and Co., a Lahore-based audit corporation, took responsibility of WASA-F auditing from 2010 through 2014[38]. While the audit report of 2014 has not yet been submitted to WASA-F, accounting analysis by the JMT took place based on the preceding 4 year-Audit Reports. Some of the salient features of the concerned Reports are, among others, (i) the audit reports duly gave it a try to prepare financial documents in the format of *Financial Statements* as defined by *Generally Accepted Accounting Principles* (*GAAP*), with not only Income Statement, but also Balance Sheet (B/S) and Cashflow Statement (CFS), (ii) incorporating huge amounts of non-cash *carryovers* of the preceding year to the following years in Income Statement, which likely makes misunderstanding on the size of financial transactions in a year[39], (iii) audit reports split recurrent (operational) and development budgets in Income Statement in compliance with GAAP, and (iv) audit reports still include transfer payments (tax allocation) as well as fees and other revenue in "Operating revenue", which are, by definition, to be defined as non-operating revenue.

As reiterated in preceding sub-sections, the accounting method has not been shared by financial experts of WASA-F and Auditors, as such a number of numerical discrepancies in accounting and financial figures have been found. These include, among others, Carryovers (*Opening Balance*) and Non-operational (Development Budget) in Income Statements. *Carryover* in the audit reports comes in place as *Capital Contribution* in *Owners' Equity* (*Capital Reserves*), and this *the source of funds* is transformed mostly to tangible fixed assets as *the use of funds* in Balance Sheet[40]. With this, audit report does not incorporate carryovers to revenue/expenditure transactions in Income Statements, whereas WASA-F incorporating into *Operating revenue* as *Total Receipts*. As reference, some of the discrepancies which have been found in the financial documents of WASA-F and Audit Reports are summarized in **Table A7.3.2** below.

Note that DSR denotes Debt Service Ratio (debt service ÷ disposable income) which indicate the degree of debt burden on entity's financial soundness. While both figures by WASA-F and Audit Report remain low, the point of concern is not-too-small discrepancy of records between these two financial documents.

[38] In this connection, Mr. Malik, the auditor, is quoted as saying that audit corporations responsible for public auditing should be replaced in 5-year-intervals by Law. (hearing by JICA team on 22 May 2017)

[39] Audit report and WASA-F Budget Statement in the fiscal year 2014 record PKR 546.9 million and PKR 0.0 million as *Carryover* and *Opening Balance*, respectively.

[40] This is surely a non-cash accounting stock, thereby no direct contribution for pecuniary transactions in the Agency's day-to-day operations. (Source: Discussions with Auditors on 22 May 2017 in Lahore)

Table A7.3.2 Numerical Differences in WASA-F and Auditor's Financial Documents

	Amounts (Rs. Mil)		Managerial Accounting Ratios	
	Auditor's Reports	WASA Docs/ Database	Auditor's Reports	WASA Docs/ Database
Opening Balance	546.9	0		
Net Operating Profit	148.7	2.0	10.6%	0.07%
Net Profit	174.7	224.7	12.5%	6.5%
Development Budget	NA	26,066.0	NA	
(ref) Interest Expenses	44.5	1.2	DSR- 3.2%	DSR-0.01%
Depreciation	27.6	87.4	Cumulative-NA	BS-NA

Source: Audit Report, WASA-F IT Database, JICA Mission Team

7.3.4 Cost Accounting of WASA-F Water Supply

As previously noted, all of the operational costs accrued to both of the service categories are recorded in a consolidated account, and as such no unit cost estimation by service category has taken place thus far. For instance, one sheet of electricity bill is issued to WASA-F with no separation of specific payment amounts, making it impossible to allocate electricity costs to each of the cost centers in the entity. Taking this in view, current sub-section provides the indicative unit cost of production/treatment by service category, together with estimated labor efficiency as given by the index of per head revenue of water supply and sewerage/drainage services. In due course of somewhat hypothetical and indicative analysis, the estimated unit costs of water supply and sewerage/drainage services based on the WASA-F and audited financial data have been figured out at PKR 14.4 in 2014. Physical burdens the Agency bears in daily operation are 7-18 hour-pumping at (i) 4 water treatment plants, (ii) 79 operating tube wells, and (iii) 4 intermediate terminal reservoirs (storage tanks) for water supply, and at 38 disposal stations for sewerage and drainage services. The basis of water costing by the use of WASA-F financial reports/ documents/ data is given below in **Table A7.3.3.**

Table A7.3.3 Assumptive Variables and Parameters for Cost Accounting by Service

	2010	2011	2012	2013	2014
Operating Cost	622,758,678	684,373,493	955,999,033	1,076,848,593	1,224,020,829
Depreciation	32,542,763	31,219,257	29,558,641	28,546,143	27,574,566
Interest Charges	14,682,349	57,468	833,759	89,336	44,536
Total Production cost per year	669,983,790	715,650,218	986,391,433	1,105,484,072	1,251,639,931
Total Production cost per day	1,835,572	1,960,686	2,702,442	3,028,723	3,429,150
Water supply per day (MGD, 2016)	53.1	53.1	53.1	53.1	53.1
Water supply per day (mil m^3)	0.24	0.24	0.24	0.24	0.24
Water supply cost PKR/ m^3	7.7	8.2	11.3	12.7	14.4

Source: WASA-F IT-Database, JICA Mission Team

(1) Implicit subsidy to water consumers

Indicative analysis of water pricing takes place herewith, while comparing assumptive unit cost of supply both at base and peak periods and average tariff in place now. Based on water demand in quantity, unit costs accrued to supply service to domestic beneficiaries are figured out at PKR 613.4/m^3 and PKR 920.2/month/ household for respective of base and peak periods in a year. Assuming that the water income

now in place stand at PKR 334 per unit, it would be noted that WASA-F supply water to beneficiaries with huge subsidy (**Table A7.3.4**)

Table A7.3.4 Indicative Water Supply Cost to Domestic Beneficiaries per Unit (PKR/month)

	Base Period	Peak Period	Remarks
Water Consumption m^3/day/capita	0.2	0.3	empirical data
Water Consumption m^3/day/Household (HH) (7 heads/HH)	1.4	2.1	demographic data
Water Consumption m^3/month/Household	42.6	63.9	30 days/month
Production Cost of water	14.4	14.4	PKR/ m^3
Water Cost of Supply/Month/HH (PKR)	613.4	920.2	

Source: WASA-F IT Database, JICA Mission Team

(2) Indicative Profitability by Service

Besides the assumptive parameters and variables as provided thus far, repair/maintenance cost has presumably been split **50:50** to respective of Sewerage and Water supply service sectors[41]. With the estimated revenue of PKR 375.8 million and PKR 240.3 million attributable to respective of sewerage/drainage and water supply services, net profits are negative thereby leading to a *revenue to cost ratio* of 0.50 and 0.59, in that order. Note that it would be preferably considered for the sewerage sector to be more emphasized, while keeping potentiality of the water supply sector in view. This is because the sewerage sector (i) earns higher income and the room for larger sum of tariff collection, and (ii) lower efficiency because of higher cost and associated needs in reducing cost. (**Table A7.3.5**)

Table A7.3.5 Indicative Profitability by Service Sector

	Sewerage/Drainage	Water Supply	Remarks
Wage/Labor cost	61.0 %	39.0 %	By number of employees and BPS wage
Labor Cost (PKR mil)	465.0	297.3	Total: 762.3
Power & Gas	50.4 %	49.6 %	
Electricity/energy cost (PKR mil)	258.8	262.6	Total: 521.4
Repair & Maintenance	35.95	35.95	Total: 71.9
Total Costs Attributed (PKR million)	760.2	596.4	Total: 1,356.6
Operating Income (PKR mil)	375.8	240.3	excluding transfer & non-operation π (profit)
Net Profit (PKR mil)	△384.4	△356.1	
Profit/Loss Ratio	**0.50**	**0.59**	Revenue is lower than cost, running deficits

Source: World Bank, WASA-F IT Database, JICA Mission Team

(3) Indicative Labor and Operation Efficiencies by Service Sector

Besides, labor efficiency indicators, *namely*, per capita operating income for water supply and sewerage/drainage services are estimated at respective of PKR 0.42 million and 0.38 million, provided that the number of employees deployed and revenue by service are as given in the following **Table A7.3.6**. As regards operational efficiency, unit operation costs of water supply and sewerage/drainage services are estimated at respective of PKR 6.4/m^3 and 2.3/m^3, as summarized in **Table A7.3.7** below.

[41] Source: WASA-F IT Database May 2017

Table A7.3.6 Estimated Per Capita Operating Income (PKR million, 2015)

	Work force (Regular +Contract)	Operating income (PKR mil, 2015)	Operating Income per head (PKR mil)
Water Supply	512+64 = 576	240.3	0.42
Sewerage/Drainage	887+95 = 982	375.8	0.38

Source: WASA-F IT Database, JICA Mission Team

Table A7.3.7 Estimated Unit Operating Cost by Service Category (PKR/m^3)

	Water supply and Sewerage Treatment	Operating cost	Unit Cost of production
Water Supply	93.06 mil m^3	596.4 PKR mil	PKR 6.4/m^3
Sewerage/Drainage	332.15 mil m^3	760.2 PKR Mil	PKR 2.3/m^3

Source: WASA-F IT Database, JICA Mission Team

Meanwhile, WASA-F perceives unit water production cost at around PKR 14.4/m^3/day, which is somewhat higher than the analytical result given immediately above[42]. While further elaboration of figures and discussions with officials in concern are of importance in the days to come, the Agency's perceived cost of PKR 14/m^3 of water would be that of consolidated services enveloping water supply and sewerage and drainage together. Numerical maneuver given in the following **Table A7.3.8** would provide, to some extent, the basis on which the Agency has developed the estimate, while taking in view WASA-F financial documents and Audit Reports[43].

Table A7.3.8 Analytical Sequence of WASA-F Perceived Unit Cost of Water

	2010	2011	2012	2013	2014
Operating Cost (PKR mill)	622.8	684.4	956.0	1,076.8	1,224.0
Depreciation (PKR mill)	32.5	31.2	29.6	28.5	27.6
Interest Charges (PKR mill)	14.68	0.06	0.83	0.09	0.04
Total Production cost per year (PKR mill)	669.98	715.65	986.39	1,105.48	1,251.64
Total Production cost per day (PKR mill)	1.84	1.96	2.70	3.03	3.43
Water supply per day (MGD, 2016)	53.1	53.1	53.1	53.1	53.1
Water supply/day (mil m^3)	0.24	0.24	0.24	0.24	0.24
Water supply cost PKR/m^3/day	**7.7**	**8.2**	**11.3**	**12.7**	**14.4**

Source: WASA-F IT Database, JICA Mission Team

Ddetailed analysis for WASA-F financial management is also shown in **AppedixAA7.2, Financial Management of WASA-F**, in the **Supporting Report**.

7.3.5 Comparative View of Performances: Faisalabad and Yokohama (2016)

Just for reference, financial performances attributed to Faisalabad and Yokohama public service undertakings are figured out regardless of factor endowments and other conditions. The numbers of population in Faisalabad and Yokohama City are almost as par, standing at around 3.5 million. While the operating size and income of water supply in Yokohama overwhelm those in Faisalabad, profitability as borne out by the operating income and expenditure ratio doesn't seem so large. This is because of high cost accrued to supplying quality service (safety, quantity, risk aversion) by Yokohama City authority in charge. (**Table A7.3.9**)

[42] WASA-F high-ranked officials inclusive of very recently posted MD (Alternate) and JMT expert discussed in this connection on 16 May 2017 for shared understanding

[43] Sources: *Audit Reports* 2010-2013, WASA-F IT section database

Table A7.3.9 Comparative Performances of Faisalabad and Yokohama (2015)

	Faisalabad	Yokohama	Remarks
Population	3.5 million	3.5 million	Almost as par
Water Supply Operating Income	PKR 1,414.5 mill	PKR 80,975.8 mill	*Yokohama City Annual Report 2016*, p. 46
Water Supply Operating Cost	PKR 1,422.4 mill	PKR 74.717.0 mill	Depreciation/interest payments included
Water Production	0.2 mill m^3/day	1.1 mill m^3/day	Yokohama 5 times as much
Number of employees	1,557	1,564	Almost as par
Unit Cost of water	PKR 14.4	PKR 171.4	Yokohama 12 times as high
Operational Income per employee	PKR 0.80 mill	PKR 39.5 mill	Labor efficiency
Operating Income Expenditure ratio[44]	0.99	1.08	Profitability: Yokohama (2015)

Source: WASA-F IT Database, JICA Mission Team

A7.4 Policy and Operational Considerations

The underlying factors which is likely to have defined operational and financial management of WASA-F in the aspects of day-to-day activities, resource allocation, accounting recording/reporting, mentality, and mind-set would be pointed out. These factors positively and sometimes adversely affect the Agency's shortfalls in providing quality services, as discussed in the previous sections. With these factors in view, the issues to be addressed and sequential suggestions are summarized herewith. Note that the issues considered in this section have duly been discussed with the concerned officials at WASA-F and the Provincial Government[45].

1) WASA-F as an administrative part of the provincial government in charge of water supply and sewerage/drainage service delivery
2) Modified cashflow accounting method currently used in WASA-F

7.4.1 Policy-related Considerations

(1) Financial Autonomy

In close consultation with the Provincial and District governments, as well as the federal government, as necessary, WASA-F would take initiatives to administratively be transformed to an autonomous body with the capacity and experiences of self-sustainable financial management. In so doing, discussions on the delegation of power from the administering bodies in planning, budgeting, and personnel policy[46] decision making would take place.

In due course of reengineering WASA-F to an autonomous public service undertaking, the introduction of accrual accounting and financial statements duly in compliance with the GAAP and internal audit scheme would be imperative. This transition to the global-standard accounting system will delineate financial position for decision-making within WASA-F, and in tandem facilitate external resources (ODA, government supports, the private sector) to pour resources to WASA-F. Further, as part of discussions on the financing tool of the Agency to commence the construction/ rehabilitation Project, legal power to issue development bonds by WASA-F would be considered in tandem with the enhancing of the Agency's institutional and human capacity in financial and accounting management.

(2) Special Revenue Account for Governance and Quality Service-oriented Mind-set

Closely together with policy discussions on the shift of WASA-F to financially autonomous body either within the government or independent public service undertaking, the Agency and relevant government

[44] Operating income expenditure ratio (OIER) ≡ operating income ÷ operating cost, business operation is primarily profitable when OIER exceeds one (1).
[45] Mr. Salman Yusuf, Additional Secretary, Mr. Muazzam Jamir Malik, Under Secretary, Housing, Urban Development and Public Health Engineering Department, Provincial Government of the Punjab
[46] This phase in particular highlights an incentive system with (i) salary and benefits besides the current BPS system and (ii) promotion

officials would discuss the possible establishment of water supply/sewerage and drainage sector *Special Revenue Account* which is in principle separated from the Provincial government consolidated account. This dependency in financial management will inevitably foster the Agency's mind and actions to take steps toward self-sustainable and sound financial management. In this light, policy discussion with the central government would be in need on the current legal scheme for establishing *water supply sanitation sector special revenue accounts* in the framework of *public finance (administration) law for local governments* and amendment, if necessary[47].

(3) Sector Budgetary Support

In a bid to expeditiously proceed with the shift of WASA-F to financially autonomous body while enhancing institutional and human capacity in financial management, a proper size of external support in funding to the relevant government(s) and WASA-F would be considered. Viewed in this light, concessional lending to the Federal government by Sector Budgetary Support would come in place for discussions and necessary actions to come, with which borrower is allowed to use replenish funds to non-specified payments during project implementation thereby fostering borrower's administration capacity of loan funds as well as improving public services.

Policy issues for consideration, as given immediately above, will be summarized in the following **Table A7.4.1.**

Table A7.4.1 Policy Considerations

FACTS	Policy Implications
WASA-F Modified Cash Accounting System in place	In a bid to provide quality services on an appropriate costing and pricing, the introduction and internalization of accrual accounting system at the earliest opportunity possible will be suggested. This transition eventually makes s the entity transfer to a financially autonomous body on a financially sound management
Consolidated Account in the Provincial Government which does not separate WASA-F public services from other administrative services	In a bid to secure financial and operational transparency and accountability in WASA-F, the establishment of *Special Revenue Account* for water supply and sewerage/ drainage services will be suggested, while splitting the concerned service account from the government consolidated account and budgeting system
Shortfalls in financing capacity on Pakistani-side and impediments to expeditious Project aid by Development Partners	In the implementation of the envisaged investment scheme, the World Bank/ the Asian Development Bank/ the UK DFID-advocated quick and a large-scale disbursement of funds to the Pakistani counterpart by providing sector budgetary support type collaboration to facilitate efficient and quick implementation of the Project

Source: JICA Mission Team

7.4.2 Operational Considerations

(1) Ensuring Basis of Cost Accounting for Management Decision-Making

Because of the current accounting system of Modified Cashflow Accounting, financial records in Balance Sheet and Cashflow Statement (Statement of Change in Cash Position) are in lack in the Agency's financial documents, and the basis of cost accounting and associated managerial decision-making are insufficient while taking in view the consumers-oriented public services. To this end, it would be imperative to introduce the US (or UK) *Generally Accepted Account Principles (GAAP*)-complied accruable accounting to WASA-F associated with reinforced human capacity in accounting knowledge

[47] Skepticism on special revenue accounts was that the concerned sector budgeting and execution become likely *self-suitable (Otemori-yosan).*

and experiences[48]. In tandem, the introduction of metering system at both ends of supply and consumption for accurate recording and operational decision-making should be expedited.

(2) Internal Audit System

As profoundly advised by the Auditor for the Agency (2010-14)[49], WASA-F will consider to allocate human and financial resources to specialized internal audit section which is directly attached to Managing Director to record numerical information, analyze, and prepare WASA-F financial documents inclusive of Financial Statements (Financial Auditing). In addition, internal audit also performs as guiding and leading experts to secure governance within the Agency and to bring about result-oriented public services through monitoring and evaluation (M/E) as well as policy recommendations (*performance auditing*).

(3) Realigning Account Receivables in Current Asset and Recovering Arrears

Cash position of WASA-F has, as reflected in the preceding section of A7.2, long been far behind what it could be, with neglected cash revenues in the form of arrear outstanding (PKR 2.5 billion, 2015) and account receivables (PKR 1.4 billion, 82.3% of current asset, 2013). Resulting paucity of cash surely undermines the maneuverability of service operations inclusive of procurement of materials and electricity/gas needed for service delivery.

In this light, WASA-F will, in close consultation with external accounting experts, clarify non-performing/non-cash revenue in budget statements database so that relevant financial documents well reflect actual size and performance of the Agency. Writing-off of these revenue-foregone would be a choice in so doing.

(4) Computerized Billing and Collection System

Tariff collection efficiency in terms of water pipe connection (physical) and revenue (financial) are respective of 27.2% and 69.1% as given by WASA-F document[50]. In a bid to smoothly and expeditiously increase tariff revenue, WASA-F would further enhance the IT section by replacing obsolete hardware for newer computer/server systems and increase the number of IT experts/staff such that the billing/collection system is to fully be computerized. In tandem, tariff/charge collection works on spot will also be computerized while using hand-in device which simultaneously record the receipts and connect with the main server at the headquarters.

Operational issues for consideration, as given immediately above, will be summarized in the following **Table A7.4.2.**

[48] Concerned officials at WASA-F and the Provincial Governments are somewhat reluctant to practically introduce the accrual accounting method with (i) consistency with the government accounting system (*Modified cash accounting*), (ii) cost of transmitting to the new system, and (iii) a paucity of human capacity in knowledge and operational experiences

[49] Aslam Malik and Co., *Audited Financial Statements of WASA-F, 2012*, Basis of Disclaimer of Opinion, 2013

[50] Source: WASA-F Performance Indicators, 2016. (indicator numbers of 37 and 38)

Table A7.4.2 Operational Considerations

FACTS	Operational Implications
Deficiency in accounting system by the current modified cash accounting system hampers appropriate costing and pricing, leading to inefficient and discretionary performance in service offerings	Expeditious introduction of accrual accounting system, associated with equipment and human assets, would be in need with a view to assuring timely and correct information to managerial decision-makings for quality services and beneficiaries' satisfaction. Also, well-managed accounting practices give confidence to external financiers and oversighting Provincial government in the case of the entity's borrowings for development projects.
Internal as well as external audit systems are far behind what they should be in a sense of *Public Financial Management*	WASA-F will set up internal audit section to watch financial management, as well as enhancing capacity of performance evaluation of the entity within its own institutional framework
A large chunk of non-cash current assets (Accounts Receivables) and unpaid tariff remain lead to cash-crunch within the entity, thus leading to limited capacity to provide quality services.	Realigning the entity's assets by reinforcing accounting system (accrual accounting) as well as tariff recovery from customers' payment evasion will profoundly be recommended for reinstalling sound and transparent financial management and financing capacity of the entity
Tariff collection rate still running behind the actual revenue amounts	The needs for enhancing WASA-F IT-based tariff billing and collection system will be reiterated to WASA-F management in a bid to quickly and efficiently collect service recoveries from users

Source: JICA Mission Team

(5) WASA-F Billing and Collection System Currently in View

Currently the designated private-sector company distributes bills to the customers, and in general customers pay bills at designated local banks or payment kiosks. There are 48 commercial banks in Pakistan, of which 14 have association with WASA-F for bill payment windows. This method is simple for customers.

Viewed in this light, some of the suggestions on the operational improvement of WASA-F tariff collection and revenue increase would include (i) simultaneous collection of tariff with payment bill-distribution to each of the beneficiaries, (ii) improve access to bill payments by increasing banking institutions/ mail post offices in the region to receive tariff payments, (iii) coupling the payments of water/ wastewater tariff with electricity bills, and others of relevance.

A7.5 Financing Capacity of WASA-F for Envisaged Investment Program and Projects

Current section briefly deals with financing capacity of the Agency and sponsoring local and central governments in proceeding with investment projects to come in the short-/medium-time framework to upgrade the quantity and quality of the entity's services by the Master Plan target year of 2038. Initial investigation will highlight the operational scenario of WASA-F as indicated by performance indicators, immediately followed by the fiscal margin and debt sustainability of the Federal and Provincial governments. In the light of the second issue above, it would be noted that detailed debt sustainability analysis (DSA) and associated assessment of fiscal capacity of the central and provincial government for external borrowings would encounter difficulty at this moment in time due to a paucity and/or lack of their debt information. This means that in carrying out DSA in the World Bank (WB)/the International Monetary Fund (IMF) Debt Sustainability Framework (DSF), data on the size of annual debt services in long-term is a MUST to capture.

7.5.1 WASA-F Plausible Margin of Project Financing to Come

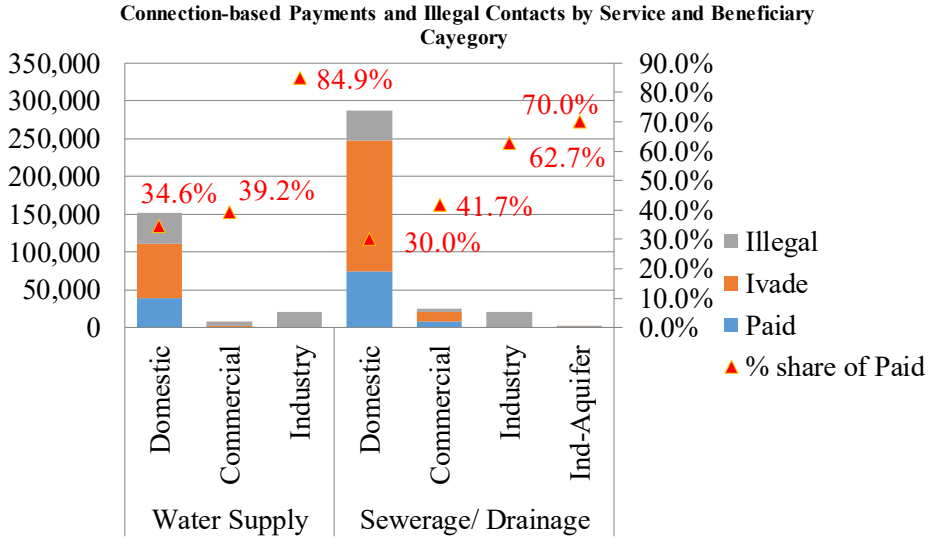
In anyway discussing investment capacity for forthcoming development projects, WASA-F may not be affordable to finance new investment scheme with a paucity of operating revenue and poor cash position as reiterated in preceding sub-sections. Faced with this vulnerability in financial management, the Agency would endeavor collecting cash/liquidity from revenue sources within it. These *benefits foregone*

(under-utilized income sources) may include (i) payment arrears, (ii) account (bills) receivables, (iii) payments evasion, (vi) illegal connections, and (v) voluntary shift from pumping groundwater to WASA-F water supply and associated revenue from connections. This sub-section tries to figure out how much of revenue could the Agency assume to receive to the maximum extent possible, on a set of assumptive conditions. Regarding payments arrears and accounts receivables, amounts recorded in WASA-F database are PKR 3,000 million and PKR 1,700 million. The number of water supply connections is 178,762 in aggregate, of which domestic, commercial, and industry beneficiaries are 151,230, 7,439, and 20,093, in that order. Likewise, the total connection of sewerage and drainage stands at 334,393, of which domestic, commercial, industry, and aquifer beneficiaries are 287,059, 25,566, 20,928, and 840, in that order. Of all of these beneficiaries, payees of domestic, commercial, industry, and aquifer sectors account for 34.6%, 39.2%, and 84.9% in that order for water supply service, and 30.0%, 41.7%, 62.7%, and 70.0% in that order for sewerage and drainage services[51]. The share of payees in the domestic sector lingers at a modest level for both of public services. Together with the numbers of tariff evasion and illegal connection, this is summarized in **Table A7.5.1** and depicted in **Figure A7.5.1** below. Note that the number of illegal connections is intuitive as empirically perceived by WASA-F officials.

Table A7.5.1 Number and Shares of Payees, Evasion, and Illegal Connection[52]

	Domestic		Commercial		Industry		
	WS	Sewer/Drainage	WS	Sewer/Drainage	WS	Sewer/Drainage	Aquifer
Connection	111,230	247,059	2,439	20,566	93	928	494
Paid	38,499	74,111	955	8,577	79	582	346
% share	34.6%	30.0%	39.2%	41.7%	84.9%	62.7%	70.0%
Evasions	72,731	172,948	1,484	11,989	14	346	148
Illegal connections	40,000	40,000	5,000	5,000	20,000	20,000	346
Illegal connections, % of total	26.4%	13.9%	67.2%	19.6%	99.5%	95.6%	41.2%
Consolidated Average tariff[53]	148.2		602.7		7,222.8		

Source: WASA-F IT Database, JICA Mission Team

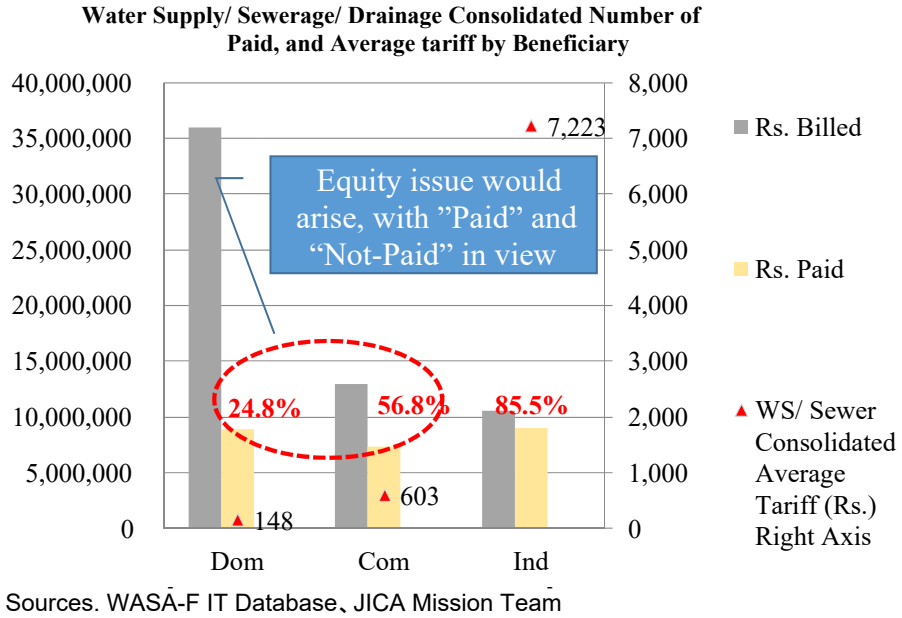


Source: WASA-F IT-Database, JICA Mission Team

Figure A7.5.1 Number and Shares of Payees, Evasions, and Illegal Connections[54]

[51] Source: WASA-F IT section database, May 2017
[52] Source: WASA-F IT Database, May 2017
[53] Source: WASA-F IT section database, Monthly bills issued and paid by beneficiary category, May 2017
[54] Source: WASA-F IT Database, May 2017

Provided that the average tariff of water and sewerage/drainage/aquifer charge and fees per connection are PKR 148.2, 602.7, and 7,228.8 in that descending order, tariff evasion amounts to PKR 324.4 million, PKR 67.3 million, and PKR 18.4 million for domestic, commercial, industry and aquifer beneficiaries, in that order, making a sum of PKR 410.2 million in aggregate. Likewise, illegal connections put financial losses of PKR 306.8 million in aggregate, with PKR 11.9 million, PKR 6.0 million, and PKR 288.9 million per annum by domestic, commercial, industry, and aquifer beneficiaries, in that order. With this, total losses accrued to tariff evasions and illegal connections amount to PKR 717.0 million per annum[55]. Consolidated amounts of billed and paid by beneficiary category per month are depicted and given in **Figure A7.5.2** below. Specific figures are summarized in **Table A7.5.2** below.



Sources. WASA-F IT Database、JICA Mission Team

Figure A7.5.2 Consolidated Amounts Billed and Paid by Beneficiary Category per Month

Table A7.5.2 Incremental Income by Collecting "Unpaid" and "Illegal" Connections

(PKR million, Year)

	Domestic	Commercial	Industry	Total
Billed (PKR Mil)	431.5	155.7	126.8	714.0
Paid (PKR Mil)	107.1	88.4	108.4	303.8
(1) Evasion (PKR Mil)	**324.4**	**67.3**	**18.4**	**410.2**
Illegal connections (#)	80,000	10,000	40,000	130,000
Average Tariff per connection by Category (PKR).	148.2	602.7	7,222.8	
(2) Incremental income by collecting "**illegal**" connections (PKR mil)	**11.9**	**6.0**	**288.9**	**306.8**
(3) Aggregate: Plausible Recovery of Uncollected Operation Income (PKR mil)	**336.3**	**73.4**	**307.3**	**717.0**

Source: WASA-F IT Database, JICA Mission Team

Assuming that (i) groundwater pumped up by domestic water users accounts for 75% of the aggregate 137 liters per capita per day (lpcd) consumption[56], (ii) WASA-F daily water production is 53.1 MGD[57], and (iii) current WASA-F service (excluding transfer and Development Budget) stands at PKR 0.6 billion annually, prospective tariff-gain in water demand due to voluntary shift from groundwater pumping will be in total PKR 2,151.1 million, with PKR 1,008.0, PKR 220.1, and PKR 922.0 million for domestic,

[55] Source. Ibid., May 2017. Note that the original data on tariff payee and evasion is in a form of consolidated accounts, while enclaving water supply and sewerage/drainage service beneficiaries.
[56] *Chapter A6* of this, WASA-F, bottle water, and groundwater account for 33, one (1), and 103 lpcd, in that order
[57] *Ibid*, Appendix, p. 4

commercial, and industry sectors, in that order. Further, should the analysis incorporate possible tariff gain attributable to the proposed investment projects which aim at fulfilling 100% of current demand for water supply and sewerage/drainage treatment services, incremental revenue would be PKR 228.3 million.[58]. (**Table A7.5.3**)

Table A7.5.3 Parameters and logic for Revenue Estimation (PKR million)

	Water Supply	Sewerage/Drainage	Total (PKR million)
Current service coverage[59]	70%	75%	
Service Revenue (current coverage 2015)[60]	240.3	375.8	616.1
Plausible Revenue at 100% supply	343.3	501.1	844.4
Prospective Revenue	103.0	125.3	228.3

The overall outlook of analytical result on the recovery of financial benefits foregone, alias, plausible capacity of WASA-F for project financing in the days to come, is hypothetically revealed at PKR 7,596.4 million in aggregate, and given in **Table A7.5.4** and **Figure A7.5.3** below.

Table A7.5.4 Plausible WASA-F Financial Margin for Financing Investment Projects to Come

Plausible Source of Finance	Amounts (PKR million)	Remarks
Payments arrears	3,000.0	Continued efforts for collection in need
Accounts Receivables	1,700.0	Continued efforts for encashment and write-off as necessary
Payments evasion	410.2	Continued efforts for collection in need
Illegal connection	306.8	Computerized customer ledger and enforcement of penalty rules/regulations
Voluntary shift from groundwater	2,151.1	Delivering services in quality and quantity, and possible regulation to strict pumping
Revenue from proposed Project to come	228.3	*Project Financing* method
Total[61] (PKR million)	7,596.4	Very assumptive

7.5.2 Financing Capacities of Federal and Provincial Governments for Project Funding

As regards financing capacity and credibility of the Federal and the Provincial governments to support funding the concerned investment scheme to come, discussions on the country's macro-framework will be in need as to whether or not the government could share financial burden by offering fiscal transfer from the coffers for the agency's new project in the short- and medium-time framework. In carrying out discussions, a brief look was considered at transfer payments (grants)-dependency in finance at the Agency and government levels.

As revealed in **Figure A7.5.3**, a "Chain reaction of transfer payments" from the Federal/development partners down to WASA-F, implying lesser degree of fiscal freedom in the capacity of WASA-F as well as sponsoring governments to provide development funds for new projects. Against this, Federal government revenue and debt sustainability would need to be considered in forecasting WASA-F financing capacity for development programs to come. External fund and technical supports will also to be considered for the expeditious implementation of the envisaged investment scheme.

[58] Concerned estimation in this sub-section is as a matter of course very simple, hypothetical, and assumptive, only to prove rough overview of fund availability for WASA-F to fully supply services to fulfill the demand in the city of Faisalabad by forthcoming investment projects.
[59] Source: WASA-F *Performance Indicators*, 2017. This percentage is deemed including all residents who can access to any one of: WASA's service connections, free stations (public taps), private wells, public hand pumps, and private venders, etc.
[60] Source: WASA-F IT Section database, May 2017
[61] Hypothetical analysis currently in lace does not incorporate possible contribution from decreasing technical leakage of water due to relevant information of no avail

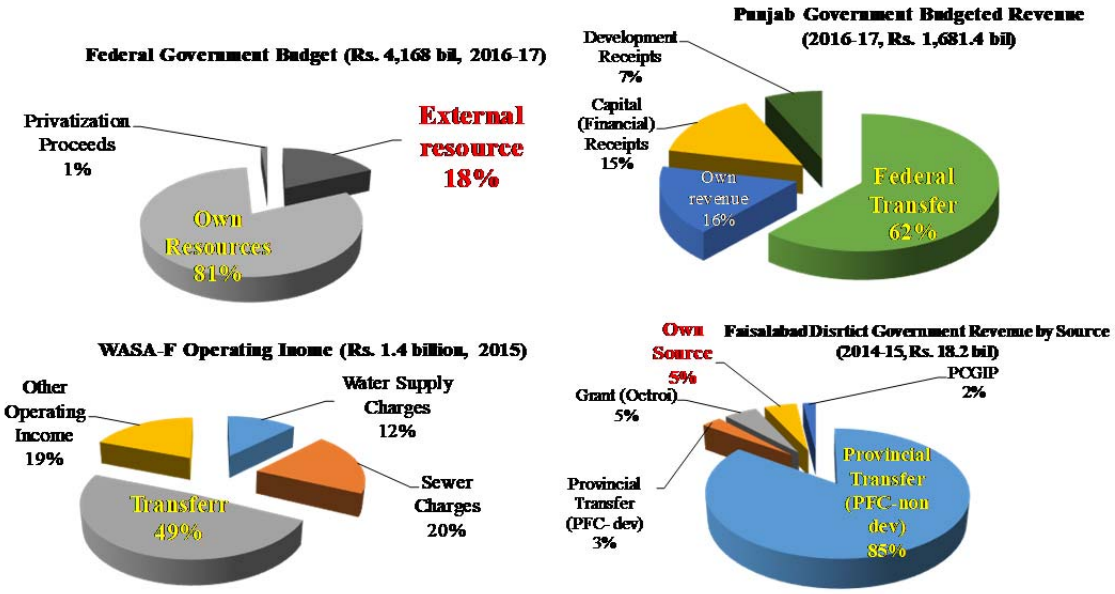


Figure A7.5.3 Transfer and Self-Generated Funds in Revenue Structures (2016)[62]

Viewed in this light, a firm commitment is needed by the Federal as well as the Local government to intervene with financing schemes and associated policy discussions with development partners on plausible offering of concessional loans. Financial and technical partnership with the international financing/ development aid institutions will help constitute national integrity and dignity amongst the people of Pakistan and Faisalabad in particular.

[62] Sources: WASA-F Budget Statements 2016, Federal Government, Finance Division, *Budget in Brief 2016-17*, Provincial Government of Punjab, Finance Division, *White Paper Budget 2016-17*, DFC-development and non-development denote the provincial government transfers to Faisalabad development and recurrent budgets.

CHAPTER A8 FINDINGS AND ISSUES IN THE WATER SECTOR

WASA-F services for water supply, sewerage, and drainage works must be improved with strategic promotional activates. For that reason, a Capacity Assessment (CA) for WASA-F was conducted in order to share the results of diagnosing the current state, and to understand the baseline and also understand changing process of the capacity of WASA-F. Factor analysis was then carried out by examining relationship of findings and issues found in the CA. The factor analysis of the current problems and policies for future business improvement of WASA-F is presented in **Appendix AA8.1**, **Current Problem Analysis and Business Improvement Policy in WASA-F**, of the **Supporting Report**.

This Chapter summarizes the findings and issues on current WASA-F water supply, sewerage, and drainage works, and proposes the future directions to be improved.

A8.1 Capacity Assessment of WASA-F

8.1.1 Purpose of the Capacity Assessment

The definition[63] of Capacity Assessment (CA) is as follows:

"The process of broadly assessing both the current state of the developing countries' capabilities for handling issues (capacity) at multiple levels—including the individual, organizational, and societal levels—and the extent to which the development process has brought about positive changes, that is, Capacity Development (CD), and then sharing the results from this with concerned parties in order to formulate CD strategies."

A CA of WASA-F was implemented for following purposes:

- To share the diagnosis of WASA-F's current capacity to create strategies for CD.
- To understand WASA-F's baseline capacity and the process by which it changes, and if possible, to examine the potential for modifying the CD strategies in the implementation of the Master Plan.
- In particular, to confirm the inferior aspects of WASA-F's capacity and improve them in the M/P implementation.

8.1.2 Method of Capacity Assessment (CA)

JMT conducted a CA of WASA-F in March 2017 and shared the results with the C/Ps of WASA-F. The CA was implemented by the following methods:

- A CA focused on water supply works was implemented in accordance with "Handbook of Capacity Assessment for the Urban Water Supply Sector and Water Utilities in Developing Countries," June 2010" (the "Handbook").
- The Utility Basic Checklist (UBC) was selected for the CA of WASA-F.
- A UBC was newly created for sewerage and drainage works for a CA of the same for this report in accordance with the Handbook.
- WASA-F's works were evaluated by assigning a 5-level rating to each of 37 items :

  Level 1: Very Serious
  Water and sewerage utilities rated at this level require all-round assistance in all fields.

[63] Handbook of Capacity Assessment for Urban Water Supply Sector and Water Utilities in Developing Countries, JICA (June 2010)

Level 2: Serious
Water and sewerage utilities rated at this level require broad assistance in many fields,

Level 3: Needs Improvement
Water and sewerage utilities rated at this level require partial assistance in some fields.

Level 4: Good
This level reflects model conditions that water and sewerage utilities in developing countries should seek to emulate in the foreseeable future.

Level 5: Very Good
This level reflects the conditions of water and sewerage utilities in developed countries.

Appendix AA8.2 ,Utility Basic Checklist (UBC) for Water and Sewerage Works Entity for Capacity Assessment (CA), of the **Supporting Report** presents the results of UBC for WASA-F according to the above rating.

The CA focused on 37 questions categorized into the three categories of large, medium, and small, as shown **Table A8.1.1**.

Table A8.1.1 Actual Conditions of Operation/Administration

Categories		
Large	Medium	Small
Aspects to be improved mainly through Facility Investment (FI)	Expansion	Water supply service coverage
		Sewerage service coverage
		Purification plant
		Water resource
		Wastewater Treatment Plant
	Rehabilitation/replacement	Conditions of Water Supply facilities
		Conditions of Sewerage facilities
Aspects to be improved mainly through Capacity Development (CD)	Technical aspects	Distribution network management
		NRW reduction
		Water quality control of the Water Supply
		Sewer pipe network management
		Water quality control of Sewerage
	Non-technical aspects	Financial improvement
		Organizational development
		Public relations
Aspects to be improved mainly through a Program Approach		

Source: JICA Mission Team

8.1.3 Results of the Capacity Assessment of WASA-F

(1) General Matters
Results of 5 levels evaluations of WASA-F works are as follows; Level 1: 38%, Level 2: 32%, Level 3: The following levels were assigned to the categories in the evaluation of the WASA-F works: Level 1, 38%; Level 2, 32%; Level 3, 27%; Level 4, 2%; Level 5, 0%. Level 1 (Very serious) and Level 2 (Serious) corresponded to 70% of the whole.

- The low levels assigned to water and sewerage services and financial improvement are noteworthy.
- Level 4 was achieved in only one category: public relations – complaint handling
- (Level 5 was not achieved in any category.)
- In general, WASA-F requires support not only with the expansion of facilities but also the preparation and implementation of CD plans.

(2) Aspects to be improved mainly through Facility Investment (FI)

The following are the most serious problems in the current water supply works:

- The overall water supply coverage is only 25%,
- The water purification plants has a capacity deficit of 31%,
- The groundwater level is declining caused by excess pumping and groundwater quality is brackish in some areas,
- The supply of surface water is often suspended caused by canal closure,
- The ratio of AP is 11.6% in the primary pipe network versus 93.2% in the secondary pipe network,
- Operations are interrupted due to breakdowns and power saving by high electricity bill

While the current status of the sewerage works is not as serious as that of the water supply, it still needs improvement. Master Plans should therefore be established for the improvement of both the water supply and sewerage facilities.

(3) Aspects to be improved mainly by Capacity Development (CD)

Regarding technical aspects to be improved mainly through CD, the following items are noted:

- The water pressure at customer premises is low and intermittent.
- Customer meters are only installed in some areas
- The water quality of the WWTP effluent does not conform to the standard.
- Industrial effluent is not periodically monitored.
- No human resource development training is provided for personnel assigned BPS rankings of 15 or lower.

Regarding non-technical aspects to be improved through CD, the following items are noted:

- WASA-F suffers a very low cost-recovery rate because of its very low tariff-collection rate, fixed tariff system, and low tariff level.
- Budget allocation is poorly managed because of the low tariff collection and WASA-F's lack of independence.

The low service level causes the low tariff collection rate, which in turn causes the poor budget allocation. All of these factors ultimately result in a lack of budget to maintain the facilities or even the electricity to operate them. An effective Business Plan should be implemented to stop or reverse this negative spiral.

Capacity Assessment of WASA-F Management

Category			Question			Level					Remarks
Large	Medium	Small				1	2	3	4	5	
Aspects to be improved mainly by Facility Investment (FI)	Overall		Q	1	: Existence of long or mid-term plan for facility expansion, rehabilitation, etc.	■	■	■			MP was established, it needs to be revised.
			Q	2	: Continuity of supply	■					Intermittent water supply totaling 7 hours a day throughout the whole area (budget shortage, power shortage, stopped facilities)
	Expansion	Water supply service	Q	3	: Overall water supply coverage	■					About 25% (110,000/440,000)
		Sewerage service	Q	4	: Overall sewerage service coverage	■	■				About 32 % (140,000/440,000)
		Purification plant	Q	5	: Surplus purification capacity	■					Deficit of the capacity of water purification plant : 31 %.
		Water resource	Q	6	::Securing of water source	■					Reduction of level, depletion, salt watering of groundwater source, There is a time to stop supply of surface water sources
		Wastewater Treatment Plant	Q	7	: Treatment rate to generated wastewater	■	■				31%, Estimated wastewater amount: 294 thousand m3/d, capacity of existing WWTP: 91 thousand m3/d
	Rehabilitation/replacement	Conditions of facilities of Water Supply	Q	8	: Civil structures (such as basins and chambers in water purification plants)	■	■	■			Water leakage from the civil engineering structure occasionally occurs.
			Q	9	: Transmission and distribution mains	■					The ratio of AP is 11.6% in the primary pipe network, but 93.2% in the secondary pipe network
			Q	10	: Service connections	■	■	■			All service connections has been replaced since 2004, There is a problem with the material used
			Q	11	: Mechanical and electrical equipment	■					There are facilities that are paused due to breakdown
		Conditions of facilities of Sewerage	Q	12	: Civil structures (such as basins and chambers in WWTP)	■	■	■			Civil structure of many pumping stations have passed their useful lives and are aging.
			Q	13	: Sewer pipe network	■	■	■			The condition of the trunk sewer pipes are relatively good, but the branch sewer pipes are aging.
			Q	14	: Drainage system	■	■				The trunk drainage channels are in place, but the the branch drainage channels that flows into them are insufficient.
			Q	15	: Mechanical and electrical equipment	■	■	■			Equipments at the pumping station exceed the service life and the aging is progressing.
Aspects to be improved mainly by Capacity Development (CD)	Technical aspects	Distribution network management	Q	16	: O&M of the facilities	■	■				There is no O&Mmanual except some.
			Q	17	: Drawings of pipe facilities	■	■	■			Elementary GIS has been introduced, but there is a problem with the amount of information and accuracy.
			Q	18	: Zoning of distribution network	■	■				Eliminate zoning when expanding water supply area ⇒ Reduce water pressure
			Q	19	: Water pressure at customer meter points	■	■				Inappropriate water distribution system (without zonining), half of OHR · GR halt, ¼ inch service connection pipe
		NRW reduction	Q	20	: NRW ratio	■					Evaluated based on the French Project survey result (55%), Effect of reducing water leakage due to low water pressure
			Q	21	: Customer meters	■					Although some have been installed, fee mediation based on meters has not been done
			Q	22	: Bulk meters	■	■				51 places are installed but insufficient
		Water quality control of Water Supply	Q	23	: Water quality parameters tested at purification plants	■	■	■			General items are being tested in the water quality laboratory. In the WASA-F document, it meets the standards.
			Q	24	: Drinkability of tap water	■	■				Contamination of waste water by customer's pump suction
		Sewer pipes network management	Q	25	: Drawings of pipe facilities	■					Both the drawings of the trunk and branch sewer pipes are not made into soft data.
			Q	26	: Condition of sewer pipe and drainage network	■	■				The implementation system of O & M is in place.
			Q	27	: Ownership of machineries for sewer pipe maintenance	■	■				Sewer maintenance equipments are not sufficient, but they are being arranged.
		Water quality control of Sewerage	Q	28	: Compliance of treated water to thestandard	■					At present it does not conform to the standard.
			Q	29	: Periodikal water quality monitoring of industrial wastewater	■					Monitoring is not conducted
	Non-technical aspects	Financial improvement	Q	30	: Cost recovery level	■					Bill collection ratio is low, fixed tariff system, low tariff level
			Q	31	: Collection ratio	■					Collection ratio is 28% for general household
			Q	32	: Budget allocation status	■					It is difficult to secure the budget for repairing the facility, the electricity cost and labor costs are the majority of the budget, the low operating balance ratio, the lack of independence of WASA
		Organizational development	Q	33	: Effective personnel management rules and regulations including incentives	■	■				There are many Vacant Posts. There is no Job Description. (Old draft only)
			Q	34	: Implementation of training	■	■	■			Currently only training staff of BCP 16 or higher (scheduled to expand from 2018 for under 15)
		Public relations	Q	35	: Complaint handling	■	■	■	■		A system to respond to complaints recently has been developed.Temporal site offices for countermeasure for flood control measure in the rainy season (Emergency Camp) are prepared.
			Q	36	: Awareness-raising on NRW reduction, water saving, collection of water charges, etc.	■	■				Several effective residents' awareness-raising activities have been carried out.
Aspects to be improved mainly by Program Approach			Q	37	: Laws and regulations covering the water sector	■	■	■			Regulations of water supply and sewage/drainage are enacted, but Water Act is not established only by Draft.

Source: JICA Mission Team

Figure A8.1.1 Results of the Capacity Assessment of WASA-F

A8.2 Factor Analysis

Issues in the Water Sector (i.e., water supply, sewerage, and drainage sectors) were extracted by a Capacity Assessment of WASA-F. The results are discussed and summarized below.

8.2.1 Results of Capacity Assessment and Extraction of Issues

The following issues were extracted from the results of the capacity assessment of the water supply works implemented in A8.2.

- Low water supply service level – 6-hour water supply, low water pressure, water pollution
- Depletion of water resources
- Decline in groundwater level
- Facility failure
- Non-Revenue Water (NRW)
- Use of groundwater by customers
- WASA is not an autonomous business
- Inefficiency of organization and operation & management
- Vulnerable finances
- Flat-rate tariff system

The following issues were identified from the results of the capacity assessment of the sewerage/drainage works carried out in A6.1.2.

- Frequent occurrence of blocked and overflowing sewers
- High pollution load to water bodies due to insufficient WWTP capacity
- Insufficient stormwater drainage facilities
- Vulnerable finances and insufficient organization/O&M
- Discharge of a high concentration of industrial wastewater to sewers and water bodies
- Discharge of highly concentrated TDS to water bodies through the use of groundwater
- Poor water environment and living environment
- Inadequate environmental administration (that is, both EPA - F and WASA - F)

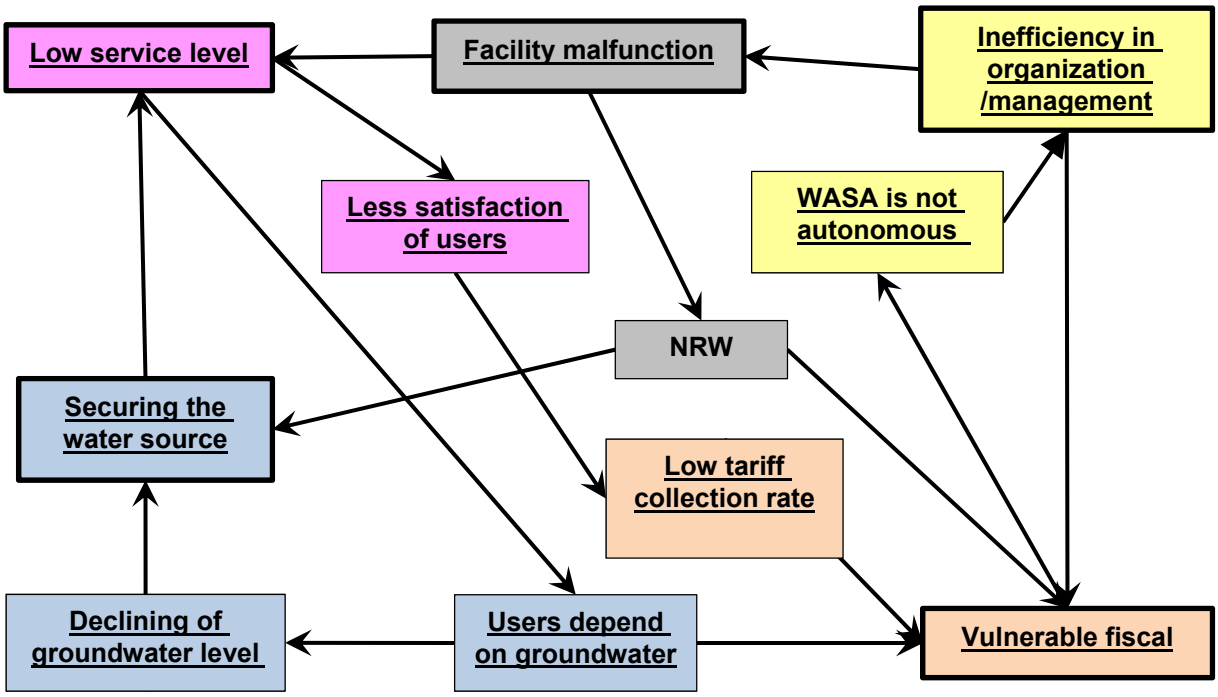
8.2.2 Factor Analysis of Issues

For the purpose of comprehensively and effectively improving the O&M of WASA-F, core issues were examined using a factor analysis method. The results of this analysis were used to formulate a WASA-F O&M improvement plan by which to convert the negative spiral into a positive spiral. **Figure A8.1.2** and **Figure A8.1.3** show the core parts of the relationship diagrams in the water supply works and sewage/drainage works, respectively

The following describes the negative spiral in the water works and the path to conversion into a positive spiral:

- Budget shortfalls result in shortages in O&M expenses and facility malfunctions.
- The facility malfunctions and lack of O&M expenses degrade the water supply service: short water supply time, low water pressure, tap water pollution.
- The low water supply service level worsens the efficiency of bill collection and drives customers away.
- Improving water supply service is expected to increase the efficiency of bill collection and increase revenue by increasing the number of customers.
- Good O&M of facilities and budget are necessary to improve the water supply service level.
- Decreasing the use of groundwater by improving the water supply service can reduce the cost of groundwater pumping and help to conserve the environment.

If the negative spiral in the water supply works can be converted into a positive spiral, the realization of autonomous business through improvement of the currently vulnerable finances becomes feasible. WASA-F could even become an autonomous body.



Issues were color-coded in the same major factors indicated by underline.
Source: JICA Mission Team

Figure A8.1.2 Relationship Diagram Linking the Core Parts of the Water Supply Works

The relationship diagram linking the core parts of the sewerage works and drainage works (**FigureA8.1.3)** shows the following.

The following were confirmed as issues:

- Frequent occurrence of blocked and overflowing sewers
- High pollution load to water environment due to insufficient WWTP capacity
- Insufficient stormwater drainage facilities

The following were confirmed as factors:

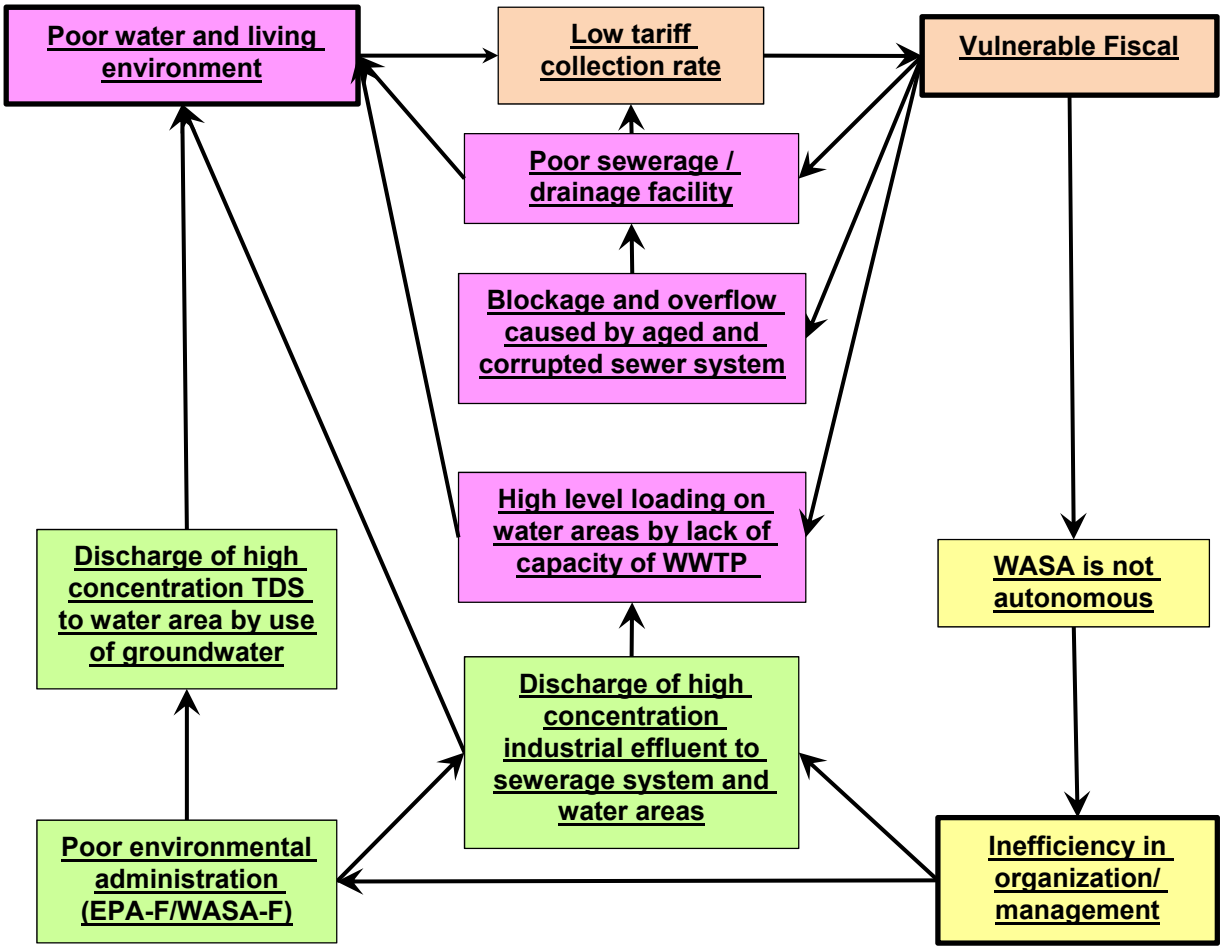
- Vulnerable finances and insufficient organization/O&M
- Inadequate environmental administration (that is, both EPA-F and WASA-F)

These issues and factors result in the following environmental issues:

- Discharge of a high concentration of industrial wastewater to sewers and water bodies
- Discharge of highly concentrated TDS to water bodies through the use of groundwater
- A poor water environment and living environment as a consequence of the foregoing issues and causes

In order to improve the poor living and water environment, it will be necessary to construct facilities such as trunk sewers, pumping stations and WWTPs, rehabilitate aged facilities, cope with industrial

wastewater, and develop stormwater management facilities. WASA-F will also have to improve its fiscal balance by increasing the tariff income as a base and strengthening organization and O&M.



Issues were color-coded in the same major factors indicated by underline.
Source: JICA Mission Team

Figure A8.1.3 Relationship Diagram of the Core Parts of the Sewerage and Drainage Works

A8.3 Issues and Directions of Planning

Water sector issues were extracted by capacity assessment and analyzed by relationship diagrams in both the water supply and sewerage/drainage sectors. From the results of those practices, **Table 8.3.1** summarizes the present conditions for the water sector, and thence the directions for planning.

Table A8.3.1 Present Conditions and Direction of Planning in the Water Sector

Item	Present Conditions	Pointed Out	Direction of Planning
Low Service Level	Intermittent pump operation (2 hours x 3 times a day) reduces the water pressure to inadequate levels and limits the water supply period to only 6 hours per day.	As represented in the common practice identified in Sarfraz Colony, customers install suction pumps on WASA-F's water supply pipes to illegally obtain water and lift the water up to water tanks on their roofs.	Extend water supply hours through appropriate methods and strategies in order to ultimately achieve 24/7 water supply, applying lessons learned from pilot activities.
	Many customers rely on their own groundwater sources in addition to the water supplied by WASA.	According to an interview survey conducted by the Project on the current status of water use in sample households in the Pilot areas, the ratios of groundwater, WASA tap water, and bottled water use were 75%, 24%, and 1%, respectively.	Operations must be continuously improved to provide more efficient and higher-quality services.
Facility Malfunction	Facility use is often suspended or halted due to breakdowns.	As of 2015, nearly half of the OHRs and GRs are non-operational.	Secure budget allocation for the rehabilitation of water distribution facilities.
	The ratio of non-revenue water (NRW) is officially reported to be 33%, but another study has reported a much higher ratio of approximately 50%.	The official NRW value is unclear when NRW is defined as a rate of physical loss or unaccounted-for water versus the total amount billed for.	Conduct a pilot activity to reveal the actual NRW and calculate revenues versus the unit cost of water supply from water bills.
Insufficiency in Organization and Management	Numerous posts are left vacant, causing underemployment against the available labor budget.	Budget deficiency hinders the employment of required personnel without the approval of the provincial government.	Further information needs to be obtained, including details on which posts remain vacant and are affecting work execution.
	On-site workers are quite numerous.	Personnel costs represent a large part of WASA-F's total budget.	On-site workers should be reduced through mechanized management.
	While on-line systems are increasingly made available, they are not much used.	While the GIS, SCADA, and CRC systems are praised, there have been problems in their application to work.	An integrated IT system, namely, a Management Information System (MIS), is proposed.
	No annual training program has been prepared. Human resources are not properly allocated in a systematic way.	Based on a careful review of previous training sessions for the year, an effectual training plan must be prepared to make up for the components lacking.	WASA-F needs to cooperate with the Al Jazari ACADEMY. A training program is prepared with a view to developing the capacity of each staff member and advancing his or her career.
	WASA-F's organizational structure is not structured around the water supply, sewerage, and drainage sectors, that is, the three sectors WASA-F oversees.	WASA-F's current organization structure is categorized from an administrative viewpoint (with an engineering department, services department, etc.).	The separation of the sectors into a water supply department (or section), sewerage department, and drainage department has been proposed.

Item	Present Conditions	Pointed Out	Direction of Planning
Vulnerable Finances	The tariff collection efficiency is quite low, 28%, in water billing. The rate is gradually rising, but no drastic solution has been found.	A reduced service level leads to lower customer satisfaction, which translates into a low tariff collection efficiency.	Services must be improved along with strategic promotional activities.
	An area-based fixed-rate tariff system with low pricing is applied.	Though not practically applied, the existing metered-rate tariff structure sets a much lower price.	While a review of the tariff structures is certainly needed, the priority must go to an improved collection efficiency, which in turn depends upon improved services. Next, the tariff revision is required.
	WASA is not an autonomous body. It is difficult to secure budget for water supply, sewerage, and drainage projects and operations.	Not only development costs, but also most non-development costs such as electricity, repair, and maintenance costs, are subsidies from GOPb.	A tariff review and tariff increase are required under long-term financial planning to position WASA-F as an autonomous body within the time period of the M/P.
Shortage of Water Source	Excessive water pumping is depleting groundwater levels. The potential for new development is low.	Apart from the limited potential, the groundwater is brackish in and around the city and may contain arsenic.	New water source development should be shifted to surface water from irrigation canals. WASA-F is required to negotiate with the Irrigation Department to obtain water rights.
	The irrigation canals must sometimes be closed (no-flow periods) for maintenance.	A typical period of closure for canal maintenance is approximately three weeks.	Some infrastructure must be provided to meet the water needs during the periods of canal closure, including multiple canals and reservoirs.
Poor Water and Living Environment	Laws and regulations are being developed for water supply and sewerage works. However, the enforcement of law and regulation is currently very less.	The Punjab Municipal Water Act drafted in 2014 has not yet been enforced.	The new regulations need to be examined if they are to be implemented as stipulated. It is important to strengthen enforcement power.

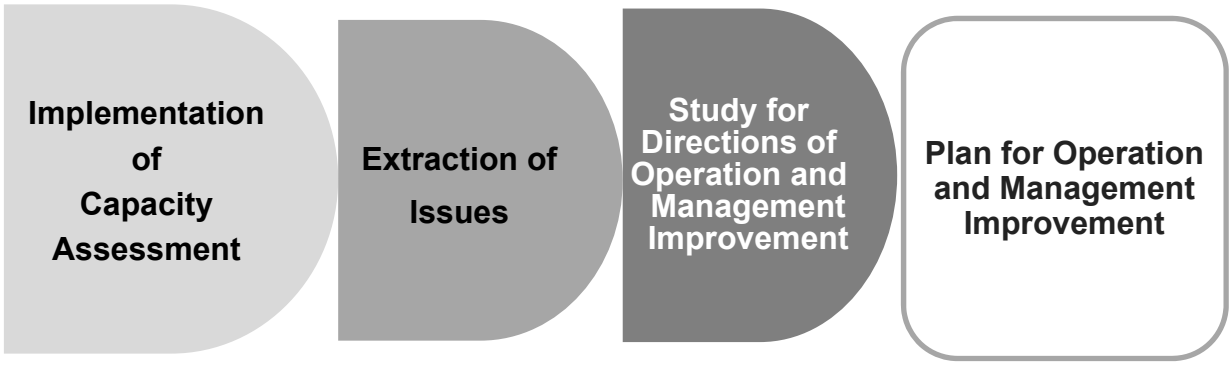
Note: GIS, Geographic Information System; SCADA, Supervisory Control and Data Acquisition System; CRC, Customer Relations Center.
Source: JICA Mission Team

CHAPTER A9 WASA-F OPERATION AND MANAGEMENT IMPROVEMENT PLAN

For the steady implementation of the 20-year M/P, it is essential to improve operation and management capacity of the WASA-F. To ensure this improvement, this Chapter proposes dividing the M/P into four 5-year Mid-term Plans. Moreover, to carry out the 5-year Mid-term Plan, WASA-F has to first review the current Business Plan, and then prepare a New Business Plan (NBP) as a driving force toward the goals of the M/P. In addition, to carry out the NBP effectively, organizational reform and human resources development of WASA-F are also important. This Chapter discusses the methodologies for the WASA-F operation and management improvement in conjunction with NBP, organization reform, and human resources development of WASA-F, and discuss mainly for the first 5 years.

A9.1 Approaches

In promoting the M/P formulated for water supply, sewerage and drainage facilities development, it is necessary to improve the operation and management of WASA-F by improvement of financial condition and service level and by securement of sustainable O&M etc. **Figure A9.1.1** shows a procedure used for the preparation of WASA-F operation and management improvement plan.



Source: JICA Mission Team

Figure A9.1.1 Procedure for the Operation and Management Improvement Plan

a) Capacity related to WASA-F's operation and management is assessed and issues and weaknesses are identified.
b) The factors underlying the identified issues are analyzed to solve the issues. First, the issues and underlying factors are analyzed by a tree diagram. An examination of mutual relationships can reveal if some of the identified issues are caused by the same factors. Hence, a relationship diagram is used as a factor analysis tool to confirm the common factors.
c) Based on the issues extracted and factors analyzed, policies to improve WASA-F operation and management are studied.
d) Finally, taking the policies into account, the plan for WASA-F's operation and management improvement is formulated.

The procedures for a) to c) were discussed in the previous Chapter, and this Chapter mainly discuss the procedure of d); that is, how to prepare the WASA-F's operation and management improvement plan as a driving force to attain the M/P by WASA-F's organizing power. The fundamental idea is that the 20 years M/P is divided into four 5-year Mid-term Plans; in other words, the WASA-F operation and management improvement plan should be reviewed every 5 years to assess the progress towards the goals of the M/P (See **Figure A9.1.2**).

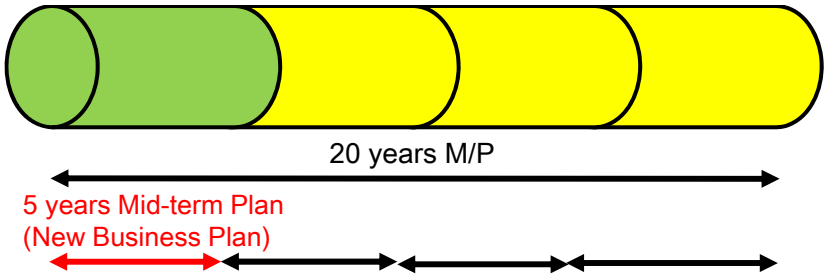


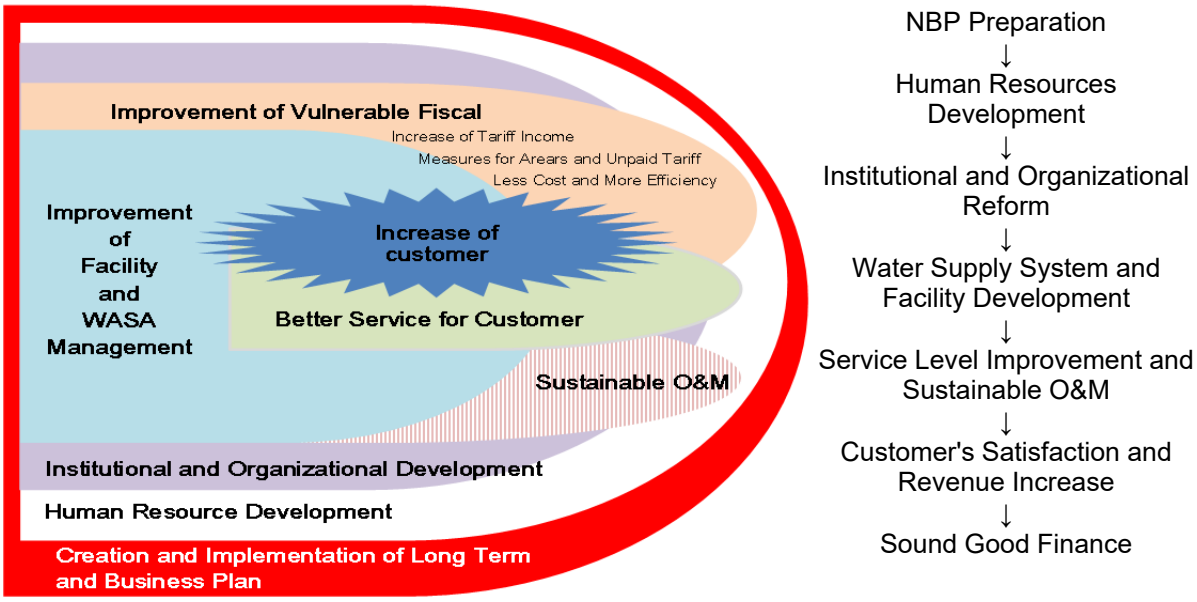
Figure A9.1.2 Relation of M/P and Mid-term Plan

Moreover, to carry out the 5-year Mid-term Plan, WASA-F has to first review the current Business Plan, for six years from FY 2014/15 to FY 2019/20 (October 2013), and then prepare a New Business Plan (NBP) as a driving force toward the goals of the M/P. That is, WASA-F promotes its operation and management improvement plan by carrying out the NBP. Further discussions for the NBP are shown in A9.3.1 Proposal for New Business Plan.

A9.2 Basic Policies

9.2.1 Improvement of Operation and Management in Water Supply Works

Improvement of the operation and management of the water supply works should be first addressed by WASA-F. Vulnerable financial improvement is regarded as a top priority issue, and it will be realized by development of human resources, reform of institution and organization, improvement of function of facilities and P&M, improvement of water supply service level, increase of revenue (increase of bill collection ratio + increase of customers); and all these effort are made and implemented according to business plan as shown in **Figure A9.2.1**.



Source: JICA Mission Team

Figure A9.2.1 Structure Diagram of Improvement of Water Supply Works

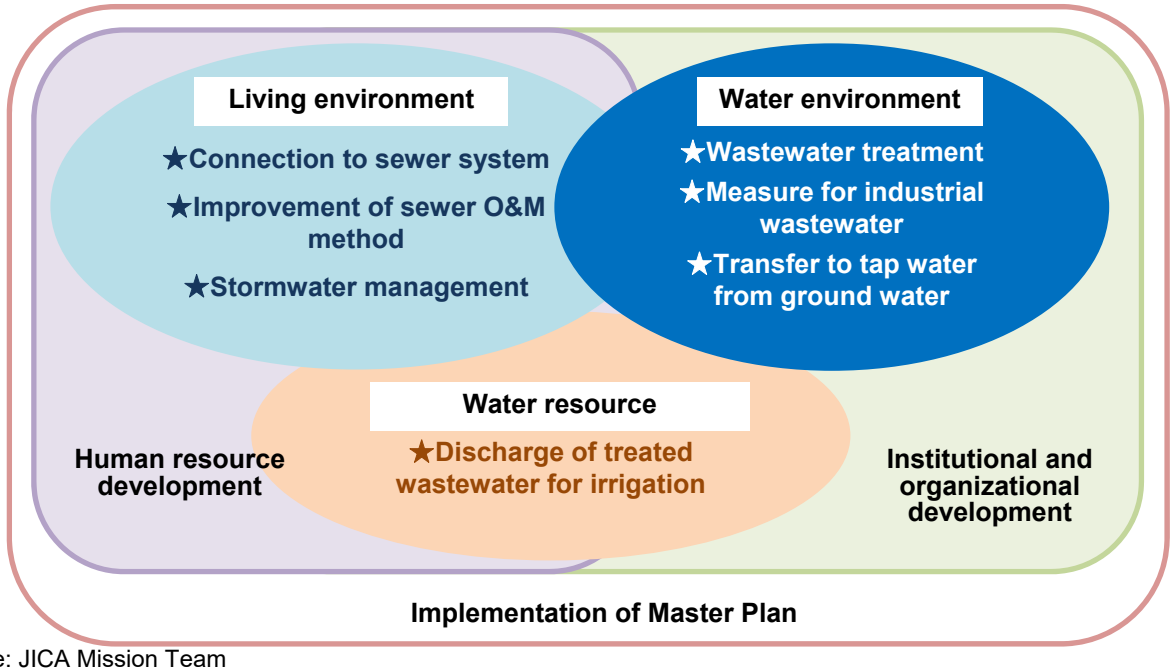
9.2.2 Improvement of Operation and Management in Sewerage and Drainage Works

Improvement of the operation and management of sewerage/drainage works will be carried out with:

- Promoting house connection to sewers,
- Stopping discharge of wastewater to drainage canals,

- Improving cleaning method of sewer pipes,
- Constructing additional sewage treatment plants and trunk sewer/pumping system,
- Dealing with factory wastewater,
- Promoting conversion of water use from underground with high TDS to WASA-F's tap water. for reuse of wastewater such as agricultural use.
- Recycling of water resources as irrigation use of treated wastewater, however, industrial effluent should be regulated and controlled with legal force and ability to get things done.
- Developing organization/institution and human resources.

Figure A9.2.2 illustrates the above measures for improvement of the operation and management of sewerage / drainage works.



Source: JICA Mission Team

Figure A9.2.2 Structural Diagram of Improvement of Sewerage/Drainage Works

A9.3 Methodologies

As a motivating force to attain the M/P, the current Business Plan is first reviewed, and a New Business Plan (NBP) that includes action plans is prepared. To carry out the NBP effectively, organizational reform and human resources development of WASA-F are also essential as the following discussions.

9.3.1 Review of the Current Business Plan

In the current Business Plan, only the main PIs (KPIs) are being checked on an ongoing basis for the promotion of the WASA-F's business. **Table A9.3.1** lists the trends in the KPI figures after the start of the current Business Plan, along with the mid-term goal for 2018 and long-term target value for 2020. Calculation basis for the KPIs sourced from WASA-F is also shown in **Appendix AA9.1**, **Performance Indicators (PIs) prepared by WASA-F**, in the **Supporting Report**.

The KPIs will be used to evaluate the Plan as general indicators. In the NBP, meanwhile, the use of absolute value indicators as outputs of major action plans is proposed, in addition to the KPIs.

Table A9.3.1 KPIs- Target Values and Actual Conditions

Performance Indicators - WASA-F -								
KPM Is Ref.	Indicator	Unit	2013-14	2014-15	2015-16	2016-17 ACTUAL	Mid Term 2018	Long Term 2020
1	Water Coverage	%	50	60		70	70	100
2	Sewerage Coverage	%	72	73		75	85	100
3a	Water production	Lpcd	168	221.3		245	195	258
3b	Water Consumption	Lpcd	117	148.5		169	125	180
3c	Metered Water Consumption (f)	Lpcd	0	0		0	50	100
4	Un-Accounted For Water	%		31.93				
5	Non-Revenue Water	%age		32.90				
8	Pipe Break/Burst	/km/year		0.13				
9	Sewerage Blockages	block/km/yr	1.4	0.129		0.28	1	0.25
10	Replacement of manhole covers and covering of open manholes.	%/Year	9.85	9.85		10.2	1.25	1
11	Pipe leakages.	leaks/km/yr	0.33	2.16		2.16	0.28	0.25
12	Cleaning/desilting of manholes	%	22.15	59		60.86	25	25
13	Cleaning / desiltation of sewers.	%	0.17	57		2.24	3	5
14	Storm Water Drains being used as Sullage carriers.	%	79	79		79	5	0
15	Sewer collapse / Crown Failure.	crown failure /km/yr	0.062	0.069		0.0483	0.45	0.25
16	Unit Operational Cost -water sold(production cost at consumer end)	Rs. Per m3 sold	21.94	14.6		13	Under Study	Under Study
17	Unit Operational Cost -water produced(gross production cost)	Rs. Per m3 prod	15.22	9.84		9.18	Under Study	Under Study
18	Staff/'000 Water & Sewerage connections	ratio	5.44	7.16		6.86	5.2	5
19	WS Staff/'000 Water connections	ratio	7.89	4.59		4.59	6.1	5
20	Sewerage Staff/'000 Sewerage connections	ratio	4.37	3.47		3.6	4.6	5
21	Salary Costs as a proportion of Operating Costs	%	47.1	41.557		47.9	38	30
22	Power/Electricity Costs as a proportion of Operating Costs	%	48.25	39.446		43.94	47.5	45
23	Maintenance Costs as a proportion of Operating Costs	%	4.65	6.684		7.35	14.5	25
24	Contracted-out service costs as a proportion of Operating Costs	%	0	0.164		0.7	4	10
25	Chemically Unfit Water Samples at Tap	%	0	3.58		4.26	0	0
26	Biologically Unfit Water Samples at Tap	%	0	3.25		4.26	0	0
27	Water Quality – Required samples tested	%	0	4.19		100	100	100
28	Chemically Unfit Water Samples at Source	%	0	0		2.04	0	0
29	Biologically Unfit Water Samples at Source	%	0	0		0	0	0
30	Water Quality – Samples having residual chlorine	%	0	100		96.1	More than 95	More than 95
31a	Water Supply Complaints	% of W Cons	1.47	0.83		0.86	1.3	1
31b	Sewerage Complaints	% of S Cons	1.62	1.62		1	1.3	1
31c	Revenue / Billing Complaints	% of B Cons	0.059	0.0059		0.047	1.3	1
32	Wastewater treatment-Primary	%	0	0		0	20	100
33	Wastewater treatment-secondary	%	5.91	5.91		5.91	20	100
34	Average Revenue of Water & Waste Water (Total Revenue / Total Water Sold)	Rs. per cubic meter of water	22.88	14.689		7.25	Under Study	Under Study
35	Collection Period	Months	25.89	112days		57	28	30
36	Billing Efficiency	%	99.92	99.6		99.91	100	100
37	Collection Efficiency (Physical)	%	37.8	27.6		27.23	70	90
38	Collection Efficiency (Financial)	%	51.7	63.91		69.131	75	95
39	Operational cost coverage	ratio	Nil	1.001		0.56	1.05	1.2
	Operational cost coverage with grant					0.95		
40	Working ratio without Tariff Increase	ratio	1.85	1.052		1.78	1.35	1.9
41	Dept service Ratio	% of Oper Rev						

Note 1: The indicators and mid-term and long-term values were taken from the current Business Plan.
2: The value for each year was provided by WASA-F.
Source: JICA Mission Team

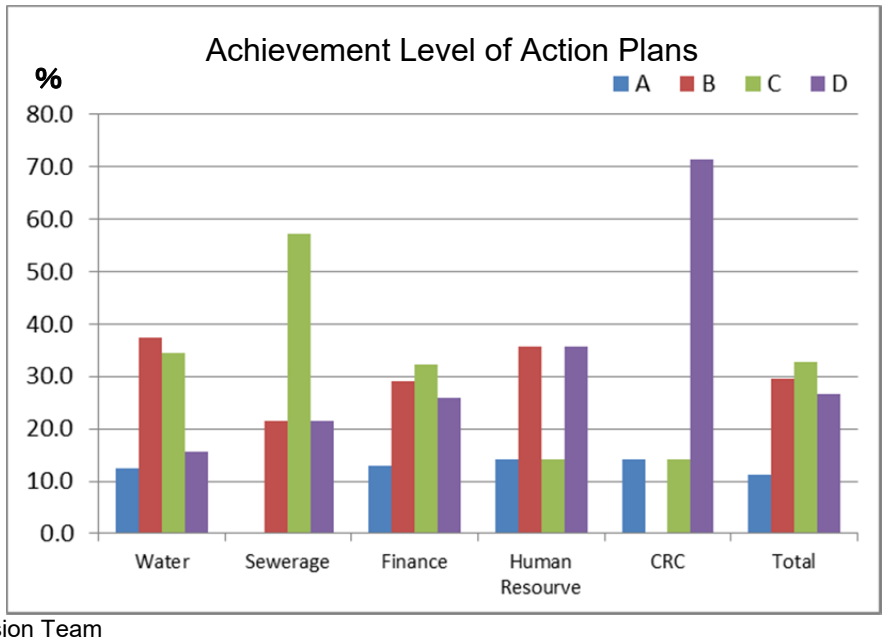
The achievement levels of 98 current action plans under the current Business Plan at 3 years after the start of the plan were evaluated on the following four-point scale:

A: achieved,
B: roughly achieved,
C: partially achieved,
D: not achieved.

Generally speaking, only 11% of the action plans were assessed at level A (achieved) and as many as 27% were assessed at level D (not achieved). The rate of achievement of the action plans is generally low overall. While no level A assessments appeared for sewerage works action plans and many D assessments appeared for action plans of the CRC division, the base populations were too small to merit mention of those action plans here.

Theoretically, the implementation of the action plans should lead to the achievement of the PIs. The PIs, in turn, will become the targeted management indicators. The achievement of the action plans has not been evaluated, however, in the current Business Plan. The method for evaluating the current Business Plan can therefore be seen as lacking.

On the other hand, the implementation of the current Business Plan seems to have been meaningful, given that some of the action plans under the Business Plan itself have achieved certain results. This achievement evaluation was performed through interviews with WASA-F staff based on WASA-F's own evaluation criteria, and is not highly accurate. This evaluation of the action plans under the current Business Plan was established to grasp the approximate progress and related issues.



Source: JICA Mission Team

Figure A9.3.1 Achievement Levels of the Current Business Plan, May 2017

The following list summarizes the status of the current Business Plan and issues faced:

- The progress of the action plans leading to the achievement of the PIs has not been managed.
- The PIs themselves are only slightly representative of the management content of WASA-F.
- No sub-committee is currently held; only the KPIs are checked. (No PI's are checked at present, either.)
- The action plans have a low level of achievement in general.

- Many of the action plans seem to be difficult to realize.
- There are too many action plans to tackle.
- The presented financial prospects have not been achieved.
- The suggested tariff level revision is unrealistic.
- Whether WASA-F considers the current Business Plan to be the foundation of its own management.

The issues faced in the current Business Plan have been summarized based upon the rate of achievement of the 98 action plans and current circumstances. In order to promote M/P effectively, it would be fruitful to create and implement an NBP that reviews the current Business Plan.

9.3.2 Proposal for New Business Plan (NBP)

(1) Framework of the NBP

The NBP states the water vision of WASA-F as an overall goal, e.g.: "Safe, sustainable and satisfactory water supply and sewerage /drainage services are provided." Few or several goals (e.g., water supply services are improved, human resources are developed, etc.) are positioned underneath the water vision. To achieve the goals, WASA-F works out Action Plans and Activities. **Figure A9.3.2** illustrates the structure of the NBP.

The NBP fundamentally is a performance-based evaluation for the targets corresponding to the selected Action Plans. While the current Business Plan evaluates the outputs of the performance indicators (PIs) or key performance indicators (KPIs), the NBP evaluates the outcomes or outputs of the Action Plans. The NBP can be expected to become a force motivating the managerial personnel at WASA-F to strive for day-to-day management toward the achievement of the Action Plans. The better they perform towards those ends, the more remarkable the outcomes of the NBP become.

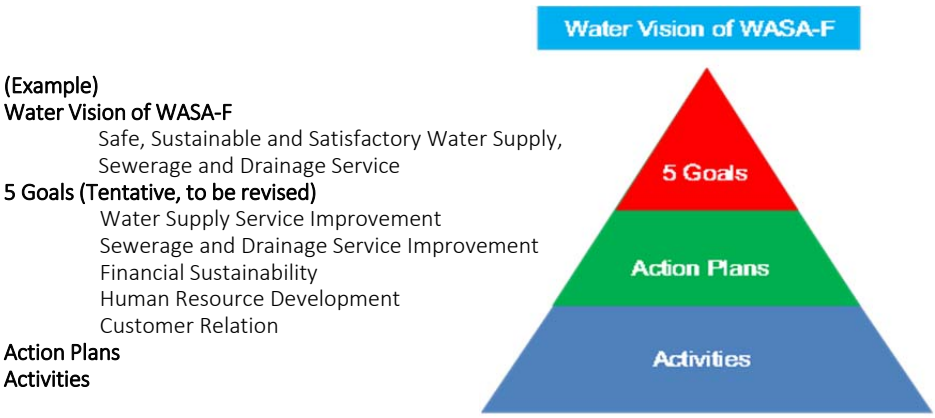


Figure A9.3.2 Structure of New Business Plan

Following is a list of essential processes in the NBP:

- Reviewing the current Business Plan,
- Setting 5 or several goals which should be leading concepts and reviewed / revised every 5 years
- Examining and selecting Action Plans that make it easier to measure the progress and outputs while considering specific Activities for the Action Plans,
- For example, for the improvement of water supply service level (Action Plan), target area(s) is selected (Activates), tasks are decided (Activities), and results are reported (Activities),
- Evaluating the progress and outcomes of the NBP based on the outcomes or aggregated outputs of the Action Plans in the first mid-term (5 years),
- Reviewing the current NBP and preparing the following NBP using the plan-do-check-action

(PDCA) cycle.

In preparing the NBP, it will be necessary to clarify the inputs, outputs, and outcomes of the plan. The examples for the water supply works in **Table A9.3.2** show the Inputs corresponding to action plans, the Outputs of those Inputs, and the Outputs corresponding to the effects of the overall policy.

Table A9.3.2 Inputs, Outputs, and Outcomes of the NBP (Example of Water Supply Works)

Inputs	Outputs	Outcomes
✓ Efforts for revenue increase ✓ Tasks to enlarge the area supplied with water for 12hr or longer (Action Plan: Improvement of water supply service level) ✓ Installation of water meters and transfer to a metered-rate tariff	✓ Increased revenue ✓ Increased area with good water supply service ✓ Increased number of customers ✓ Transfer of groundwater to WASA water	✓ Improved financial condition ✓ Increased customer satisfaction ✓ Improved customer willingness to pay ✓ Ensured fairness ✓ Environmental protection by reducing groundwater use

Source: JICA Mission Team

More detailed table is also presented in **Appendix AA9.2**, **Detailed Input, Output and Outcome of the New Business Plan**, in the **Supporting Report**.

(2) Preparation of Action Plans and Activities

Action Plans should be selected as Inputs to achieve the outcomes targeted under the NBP. In order to evaluate the performance of the Action Plans proposed in the previous section, it will also be necessary to clarify the activities, target value, and evaluation method. An example is shown in **Table A9.3.3**.

Table A9.3.3 Inputs, Evaluation, and Target (Example for Water Supply Works)

INPUT	Evaluation of OUTPUT	Target Values
(Action Plan: Improvement of water supply service level) Activities: ✓ Meeting of SMART WASA ✓ Selection of targeted area ✓ Decide required tasks ✓ Implementation of tasks	✓ Record of meeting ✓ Confirmation of the targeted area and schedule ✓ Confirmation of the work plan and securing of budget ✓ Confirmation of task completion	✓ Until MM/YY targeted areas are selected ✓ Until MM/YY ○○ colony is provided with 24/7 water supply ✓ Number of customers to be increased by ○%

Source: JICA Mission Team

Action plans are considered and categorized from few aspects such as better operation and management and sound financial condition; and, for example, action plans are organized as **Table A9.3.4**.

Table A9.3.4 Examples of Action Plans for New Business Plan

Category	Action Plans (Examples)
1) Efforts for Better Operation & Management	(a) Improvement of water supply service level
	(b) Maintaining and improvement of facility
	(c) Buildup of Management Information System (MIS)
	(d) Higher efficiency of operations and cost reduction
	(e) Living and environmental improvement
	(f) Strengthen of Safety management
2) Measures for Sound Fiscal Condition	(a) Increase of revenue (Collection efficiency, Raise of tariff)
	(b) Meter installation and transition to metered rate tariff system
	(c) Division of water supply and sewerage / drainage accounts
	(d) Transference to accrual accounting system
	(e) Measures to improve customer service

Source: JICA Mission Team

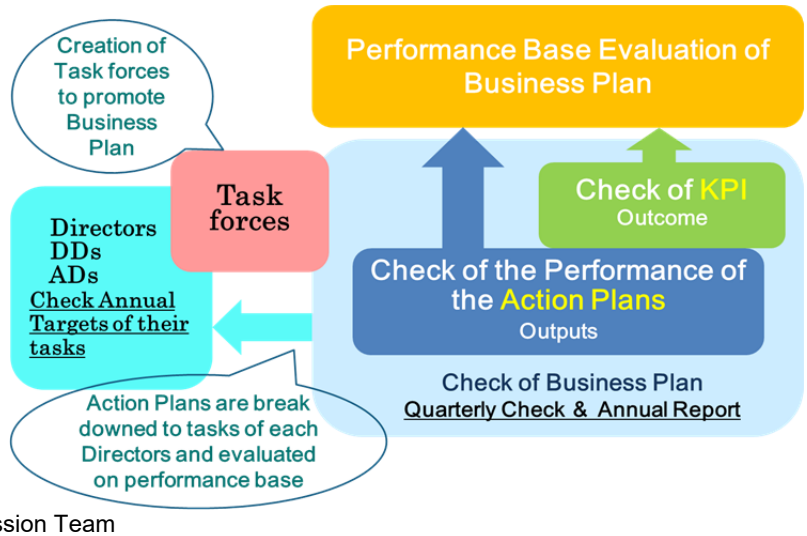
The more details of the Action Plans are also presented in **Appendix AA9.3**, **Proposed Action Plan**, in the **Supporting Report**.

(3) How to Implement the NBP

The NBP is implemented according to the following procedure:

- The NBP will be evaluated based on performance through the steady implementation of action plans and performance management.
- Regarding the outcomes of the action plans, KPIs will be checked every 6 months while the outputs of the action plans themselves are emphasized.
- Implementation items in the action plans will be positioned as business targets of the management staff members. The performance of the management staff members will be evaluated person by person and the targets will be coordinated with personnel management.
- The NBP will be carried out in coordination with task forces such as SMART WASA.
- A quarterly check will be conducted and an Annual Report will be prepared and announced.

Figure A9.3.3 illustrates the above-mentioned method for implementing the NBP.



Source: JICA Mission Team

Figure A9.3.3 Method for Implementing the NBP

1) Implementation structure of the NBP

The implementation structure of the NBP and its Action Plans will be based on the Business Plan Joint Meeting (BPJM). The Action Plans will be implemented by task forces, multiple Directorates, or a single Directorate.

(a) Business Plan Joint Meeting (BPJM)

A BPJM will be held to discuss the following contents regarding NBP implementation.

- The Managing Director (MD) will chair the meeting. The MD and Deputy Managing Directors (DMDs), and Directors, Deputy Directors (DDs), and Assistant Directors (ADs) nominated by the MD will be the members of the BPJM.
- The BPJM will be held once a month. In each monthly meeting the members will confirm the schedule, report the results of the activities, and discuss the issues.
- The minutes on the progress and issues, discusses countermeasures, and reports on performance.

(b) Task forces

Task forces formed across multiple directorates will promote the NBP. Two task forces, namely, SMART WASA and the Revenue Increase Meeting, are in progress, and four other task forces will be studied in the future (see below):

- SMART WASA (In progress)
- Revenue Increase Meeting (In progress)
- Management Information System (MIS) (Further study)
- Sustainable O&M (SOPs) (Further study)
- Cost Reduction and effective O&M (Further study)
- Industrial wastewater management and environmental protection (Further study)

2) Evaluation and intermediate review of the NBP

The NBP will be evaluated and reviewed intermediately. If needed, action plans and their target values under the NBP will be re-established.

- The evaluation of the NBP will be conducted with an emphasis on the performance-based evaluation of the action plans. Targets will be set for each action plan. Each target will be compared with the actual performance, and each action plan will be evaluated by the degree to which it has been achieved.
- The target value is set for 5 years later, and a target value for the final year of the M/P is also mentioned with reference. Target values for each year can also be determined. These target values shall be sufficiently grounded in the action plan activities.
- If the performance of an action plan is unsatisfactory, it will not receive an unfavorable evaluation. Rather, the causes will be identified the solutions on which to focus will be highlighted. If necessary, the annual target value will also be reviewed.
- A mid-term evaluation will be done in the third year. If necessary, the target value for 5 years will be reset.

(4) Road Map to Autonomous Business

Urban Unit considered the organizational reform of WASA-F in its review conducted in 2014. An analysis of WASA's low service levels and poor financial conditions in that review attribute the problems to complex and inefficient decision-making processes within WASA-F. The core solution proposed in the review was to reform WASA into an autonomous body. In a comparison between the "Authority" model and "Company" model, Urban Review recommended the former, adding that "Effective accountability can be achieved by consolidating responsibilities, authorities, and resources at one point." As the first pilot case in 2014, Urban Unit therefore proposed that WASA-F be reformed into an Authority. For the present, however, this proposal has yet to be realized.

Meanwhile, the provincial government does not seem to be considering a reform of WASA into an autonomous body. Considering the current WASA management situation, WASA’s capacity does not seem to satisfy the requirements for being an autonomous body.

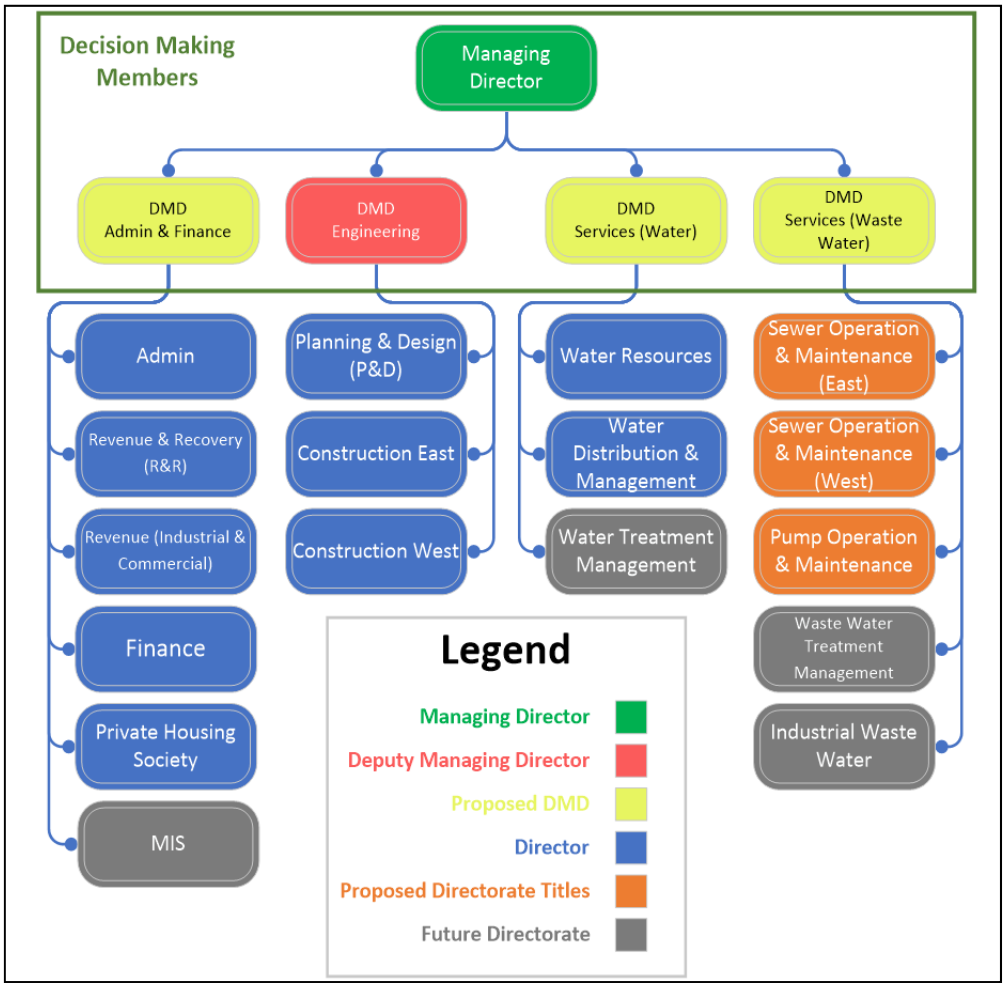
In addition, under the current conditions, WASA-F is beginning to improve its financial performance as progress continues in its pilot activities, etc. Based on the current situation, WASA-F aims to achieve financial and operational improvements based on the proposed NBP and is preparing to operate as an autonomous business. With further progress, WASA-F’s autonomy will be considered and consultations with the provincial government will be held.

9.3.3 Proposals for Organizational Reform

(1) Reform of the whole organization

Figure A9.3.4 proposes a new organization structure of WASA-F improved after the reform. The proposed points are as follows:

- To Make the Managing Director (MD) and Deputy Managing Directors (DMDs) decision-making members.
- To put all directorates under the direction of the DMDs.
- To newly establish DMDs for Administration and Finance, Service (Water), and Service (Wastewater).
- To place each directorate for Administration, Revenue (domestic), Revenue (Industry & Commercial), Finance, Private Housing Society, Citizen Liaison Cell under the Administration and Finance DMD.
- To separate the Service DMD into a Service (Water) DMD and Service (sewerage/drainage) DMD.
- To change the names of the Directorates of the service DMD (sewerage/drainage) in order to clarify the work contents.
- To place the MIS Directorate under the Administration & Finance DMD, Water Treatment Management Directorate under the Service (Water) DMD, Wastewater Treatment Management Directorate and Industrial Wastewater Directorate under the service DMD (sewerage/drainage) at the necessary times.



Source: JICA Mission Team

Figure A9.3.4 Proposed Organization of WASA-F

(2) Organizational enhancement toward 24/7 water supply and the shift to a metered-rate tariff system

1) Organizational enhancement of the Distribution Directorate toward 24/7 water supply

Pilot activities have proven that under some conditions, the water supply time can be extended from 6 hours to 12 hours or longer without drastic reconstruction of the existing facilities. For that reason, WASA-F decided that if water can be supplied for 12 hours or longer without major investment in any areas outside of the pilot activities area, the area with improved water supply will be gradually enlarged. Further, projects targeting 24/7 water supply will be implemented sequentially under the M/P after the Priority Project is complete.

It has been determined, however, that the establishment of improved water supply service will require substantial project costs and labor, particularly for improvements to infrastructures such as the GRs and OHRs and the maintenance of the water distribution network overall. It will also be effective to shift from a flat-rate tariff to metered-rate tariff, starting from the districts supplied with water for 12hr or longer.

The Distribution Directorate is supervising the installation of water meters. In order to implement the project for improved water supply service, WASA-F will need to strengthen the organizational structure and secure the required number of personnel in addition to securing the project cost.

Regarding the staffing of the Distribution Directorate, the number of vacant posts is increasing with dwindling numbers of ADs and SEs versus the budgeted number of posts. Initial steps to address this will be to refill these vacant posts, secure the necessary personnel, and prepare a system for carrying out ordinary work.

The maintenance work for the water distribution pipes for water supply for 12hr or longer and the supervision of the installation of water meters are carried out by one team consisting of one SE and two on-site staff members. This team is to be led by the DD. In the meantime, it is suggested that WASA-F engage an additional 12 employees at the same time to improve the water supply service works in four areas. (See **Table 9.3.5**)

Table A9.3.5 Number of Staff Members in the Distribution Directorate Budgeted, Actual, and Proposed

Designation	Budget	Mar. 2018	Proposed
Director	1	1	1
Deputy Director (DD)	2	2	2
Assistant Director (AD)	4	2	4
Sub-engineer (SE)	8	6	8+4=12
On-site staff	272	140	140+8=148

Source: JICA Mission Team

2) Enhancement of meter reading staffs in Revenue Directorate

The meter-reading work is to be performed by WASA-F personnel. This is thought to be advantageous, as WASA-F has no previous experience in the work of meter reading, an activity that can be useful for both discovering water leaks and communicating with customers.

The Revenue Directorate has eight on-site offices. In addition, a single meter reader can read 1,500 meters per month. Assuming that 250,000 houses in the current water supply area will become households with meters, 166 meter readers will be needed.

This job is expected to be outsourced, yet outsourcers with sufficient know-how in meter reading will be difficult to engage. WASA-F therefore plans to initially use its own personnel to perform the work and then to outsource once the WASA-F personnel themselves gain the know-how. The recruitment of meter readers within the budget capacity is recommended. For the time being, therefore, a team of five meter

readers, including one revenue officer, will be prepared in each office. Going forward, additional staff will be placed in the offices as more meters are installed. **Table A.9.3.6** shows the capacity by budget, the current status, and the proposed staffing.

Table A9.3.6 Number of Staff Members at the Revenue Directorate Actual and Proposed

Designation	Budget	Mar. 2018	Proposed
Director	1	1	1
Deputy Director (DD)	2	2	2
Assistant Director (AD)	4	3	4
Revenue Officer	8	8	8+8=16
On-site staff (regular)	160	122	122+32=154

Source: JICA Mission Team

3) Cooperation of the Distribution and Revenue Directorates

It became clear that the Distribution and Revenue Directorates will have to exchange information and cooperate with each other if they are to cope with the problems to be solved in SMART WASA's activities to install meters and improve the water supply for the extension of daily supply to longer than 12 hours.

Works to expand the service improvement area in the future will be implemented as regular operations rather than SMART WASA activities. To ensure better communication between the staffs of the two Directorates, WASA-F is advised to deploy its teams of five Revenue staff members and three Distribution staff members in the same offices, insofar as possible, to perform their daily work. This can be arranged by considering the locations and sizes of the on-site offices.

9.3.4 Proposal for Human Resource Development

Turning to the human resource development plan for WASA-F, the following knowledge and abilities can be recommended as requirements for the WASA-F staff. Human resources development using SOPs or performed in conjunction with the implementation of the business plan can also be proposed.

(1) Human Resources Required for WASA-F

The human resource development capacities required of WASA staff are listed below. The proposed human resource development satisfies the requirements.

1) Ability to meet the performance requirements based on skills required for WASA-F operations & management

Staff members recruited for each job category are required to satisfy a minimum level of experience and certain qualifications and skills specified in the Job Descriptions and service regulations. Each staff member improves his or her capacity to perform even better.

2) Ability and motivation to promote the operation & management of WASA-F

The operation & management of WASA-F always requires the setting of goals and the performance of daily tasks to achieve them. The ability and motivation to carry out the work are therefore essential.

3) Judgment and mental strength to carry out the operation & management of WASA-F

The sound implementation of operation & management at WASA-F requires not only knowledge and experience, but also the judgment necessary to appropriately apply knowledge and experience. Manager-class officials need to organize their staffs and determine the correct direction. WASA-F must also recognize the purpose of the organization and its own role in the organization when carrying out

O&M. The mental power to support the implementation and judgment of appropriate business must be cultivated.

4) Compliance with laws and regulations

Compliance with laws and regulations is essential to the smooth operation & management of WASA-F in accordance with the principles of social responsibility. All members of the staff need to carry out their work with a thorough knowledge and consciousness of compliance.

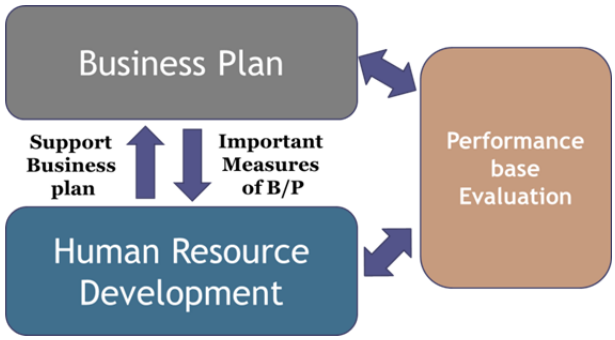
(2) Methodology to Develop Human Resources

The capacity development of human resources for the management staff is mainly built up by the implementation of the WASA-F business plan, the foundation of operation & management at WASA-F. Meanwhile, the capacity development of human resources for on-site personnel is built up by creating and operating standard operation procedures (SOPs) for the purpose of improving and leveling the quality of work.

1) Human resource development utilizing Business Plan

Human resource development is an important element to support business plans. On the other hand, the activities included in the human resource development plan are included in the action plan under the business plan. That is, the synergistic effect of both activities together will improve the work within WASA-F. Further, the business plan and human resource development plan are jointly promoted through performance-based evaluations.

Figure A9.3.5 shows the relation between the business plan and human resource development based on performance-based evaluation. This relation is closely tied to the performance evaluation of the management class staff and facilitates the reformation of their awareness.



Source: JICA Mission Team

Figure A9.3.5 Relationship between the Business Plan and Human Resource Development

Personnel placed below the BPS 15 ranking should understand that their work is related to the realization of the action plan under the business plan. To secure this understanding, personnel from the DD, AD to Sub Engineers should come to fully understand the meaning of their work under the direction of the Director.

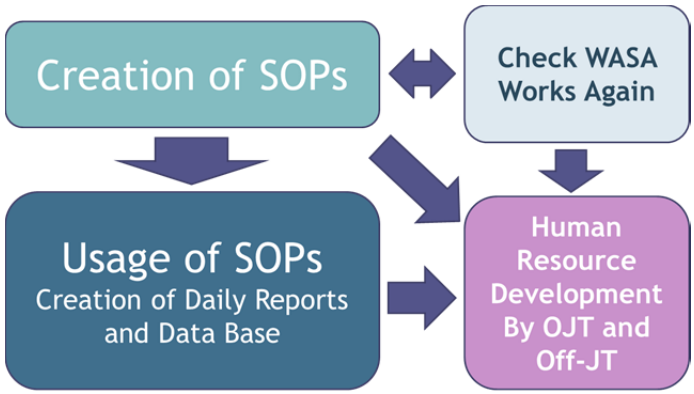
2) Human Resource Development Using Standard Operation Procedures (SOPs)

Looking at the actual circumstances of operation & management at WASA-F, the limited training provided on-site for staff seems to have compromised both the quality and consistency of the work done. A proposed solution to remedy these problems is to create and operate SOPs that until now have been mostly nonexistent. SOPs should also be prepared for all WASA-F works. Before deliberating the actual

use of a newly created SOP, the process of SOP creation should be explored as a human resource development activity.

If the SOPs are created outside of the organization, the process of SOP creation may not lead to reviewed of the work currently being done or contribute to human resource development. The active participation of WASA-F staff in the creation of SOPs in this project will encourage their human resource development. And by reviewing the contents and procedures in the process of creating them, WASA-F staff will improve operation & management in their organization.

Regarding SOP creation and operation, the formation of a cross-organization task force is recommended. Both management staff and on-site staff could participate as task force members.



Source: JICA Mission Team

Figure A9.3.6 Human Resource Development through the Creation and Use of SOPs

(3) Contents of the Human Resource Development Plan

The following five items are listed as the basic policies of the human resource development plan. Each will be explained below.

- Establishment of a Training Plan
- Establishment and use of Job Descriptions
- Performance-based incentives and evaluations
- Creation and implementation of SOPs

1) Establishment a Training Plan

(a) Group training

Group training is effective for improving the abilities of numerous staff. While training must be implemented irrespective of the field, the main staff to target in the technical system are the DD and AD (44 persons) at the management level and Sub-Engineers (57 persons) at the practical level. It will be important to utilize the WASA Academy as the core provider of Group Training. The training contents of WASA Academy are shown in **Table A9.3.7.**

Table A9.3.7 Training contents of Al-Jazari Academy

Course	Module
O&M of tubewells and Pump Facilities	1. O&M of the Water Distribution System
Leakage Detection	1. Basic knowledge on the leakage Prevention System
	2. Leakage detection and repair at the site (OJT)
	3. Installation & operation of equipment at the site (OJT)
O&M of Sewer and Storm Water Drainage	1. Safety control and safety measures for sewerage and drainage
	2. Operation and maintenance of sewer systems
	3. Operation and maintenance of drainage systems
O&M for Electrical and Mechanical Equipment	1. Centrifugal Pumps, Induction Motors, and drainage
	2. Electrical Panels and Instrumentation Equipment
	3. Generators
	4. Chlorination and Filtration Systems
	5. Heavy Machines
	6. Supervisory Control and Data Acquisition (SCADA)
	7. Water Meter Maintenance and Repair
Asset Management	1. Introduction to Asset Management
	2. Creating & Updating the Asset Database in AMIS
	3. Asset Database Analysis
	4. Asset Replacement Plan
	5. Survey & Analysis of Asset Conditions
	6. Use of GIS application in Asset Management
Business Planning	1. Business Plan & Operation of WASAs
	2. Strategy for WSS Service Delivery
	3. Human Capital Development
	4. Financial Management System
	5. Business Plan Implementation

Source: Al Jazari Academy

At present, WASA-F has not carried out any of its own Group Training. Going forward it will be necessary to consider carrying out training to transfer to lower staff members and group training using SOPs.

(b) On-the-Job Training (OJT)

It is difficult and time-consuming to provide group training to the large number staff members currently engaged. On-the-Job Training is therefore an effective alternative. It will be effective to provide OJT by Sub Engineers in utilizing SOPs and OJT utilizing a Training Yard to be installed in the future.

(c) Training for New Recruitment Staff

Many staff members at WASA-F are cease to retire, but new staff members are still recruited. Human resource development for the newly recruited staff is an important task. Training plans specialized for newly recruited staff should be formulated.

Management staff can be effectively trained by attending the Al Jazari Academy. Meanwhile, they should be able to fully understand the SOPs of their work and carry out their work based on the SOPs. It will also be necessary to acquire an understanding of the basics, such as what WASA-F's work should be and compliance with laws and regulations, through the training.

(d) Overseas training

Overseas training broadens a trainee's understanding of and perspectives on sophisticated technologies, in addition to promote the motivation for future work implementation. The candidates selected for overseas training should be positioned at the management level and thoroughly qualified to receive the type of training imparted.

2) Establishment and use of the Job Descriptions

The Job Descriptions (JDs) are extremely important for clarifying not only the work content of each position, but also the O&M duties in each department of the organization. A draft set of JDs was created in WASA-F almost 15 years ago, but it has yet to be authorized. WASA-F must therefore develop content consistent with its current organization and review the content in its entirety.

Another important step will be to put top priority on the work to create the JDs. A JD is a base description for the performance evaluation of each management staff member, as well as a basis for selecting new recruits. JDs will have to be created for a wide range of tasks and ideally should not be created by the administration directorate staff alone. Instead, WASA-F should set up an entity such as a committee with members ranked in or around the DD class in each field. The work to create the JDs is currently underway and approaching completion. At the current rate of progress, therefore, the JDs may be authorized before the release of this report.

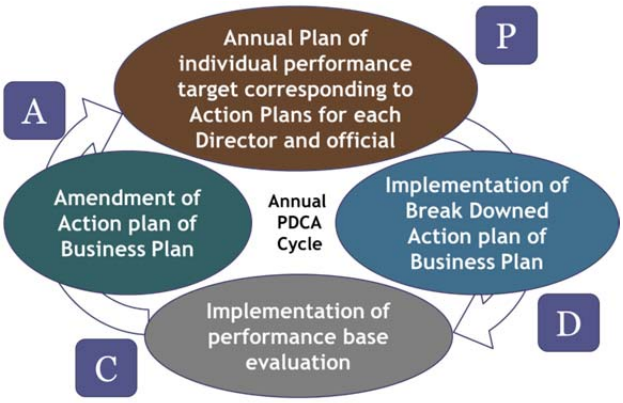
3) Performance-based incentive and evaluation

A Performance-Based Evaluation is necessary to develop the capacity of a management staff member. The evaluation can be implemented based on the current method used for personnel evaluation, with some improvements. In other words, each administration staff member sets goals for his job or duty each year, linking them in some cases to the action plan under the business plan, and is evaluated based on the degree of achievement.

Note, also, that the granting of incentives should also be considered, in addition to the evaluation itself. **Figure A9.3.7** shows the method for determining performance targets and **Figure A9.3.8** shows the method for conducting Performance-Based Evaluations using the PDCA cycle.

Source: JICA Mission Team

Figure A9.3.7 Method for Deciding upon Each Performance Goal



Source: JICA Mission Team

Figure A9.3.8 Method for Deciding upon Each Performance Goal

4) Creation and implementation of SOPs

Human resource development of middle management and on-site personnel is promoted through the creation and use of SOPs. While there are cases where SOPs are created in pilot activities in this project, WASA-F lacks SOPs for carrying out the jobs in all but a few cases in actual operations.

In addition to preparing SOPs for all of its work, WASA-F must also consider the priority of creation and the creation of the SOPs it is to implement. Following are a number of examples of SOPs to be created:

- Creation of SOPs
- House Connection
- O&M of Water Distribution
- O&M of WTP
- O&M of Sewer Pipe System
- O&M of WWTP

The formation and use of a task force will facilitate the creation of SOPs. In implementing SOPs, OJT for the usage and review of the SOPs will be effective in improving the capacity of the staff members.

CHAPTER A10 CONCLUSION AND RECOMMENDATION

Considering current water supply, sewerage, and drainage works by WASA-F, this M/P put forward WASA-F operation and management improvement with proposal preparing new business plan. This Chapter evaluate the plan taking into considerations the recommendations described below.

A10.1 Conclusion

(1) Improvement of Water Supply Business with Execution of New Business Plan (NBP)

In this M/P, especially for the strategies of the WASA – F's water supply business improvement, preparation of a NBP which is an execution program for every five years is proposed. WASA - F is expected to improve their operation based on the New Business Plan gradually shifting to an independent autonomous organization.

Specifically, to improve the operation of WASA - F as a waterworks business entity, the tasks for achieving their objects are as follows.

①	Preparation of new business plan with reviewing of current business plan
	↓
②	Development of human resources to ensure these initiatives is necessary
	↓
③	Development of institutions and organizational development to ensure these improvements is necessary
	↓
④	Improvement of function of facilities and operation/management brings about sustainable O&M
	↓
⑤	Improvement of service level requires improvement of functions of facilities and operation/management
	↓
⑥	Improvement of service level is indispensable for increase of revenue
	↓
⑦	Improvement of vulnerable finance of WASA-F (increase of tariff revenue, cost reduction, efficiency of operation, etc.)

All of the above-mentioned tasks shall be carried out by WASA-F in accordance with the NBP. The NBP includes Action Plans for not only water supply but also sewerage / drainage business improvements. It is important that issues on each step shall be challenged with provisions of what the target of the next step is. Those challenges must be based on WASA-F's strong willingness to improve their management.

(2) Promotion of Sewerage Project for Environmental Improvement

Most of the wastewater is discharged to drainage canals, which causes deterioration of living environment and water environment. Therefore, measures to eliminate wastewater discharge to drainage canals are necessary. It is also necessary to take measures to the discharge of factory wastewater and to improve the living environment by eliminating flooding in the rainy season.

- Construction of sewage treatment plants, pumping stations and interceptors for the purpose of improving living environment and water environment, the discharge of sewage to drainage canals should be reduced.
- Measures for factory wastewater will be started by the formed Task Force.
- The living environment is improved by implementing effective flood countermeasures.
- Organizational/institutional development and human resource development are promoted to ensure efficient operation and management.
- In addition, agricultural reuse of treated wastewater to secure drinking water sources will be promoted.
- These activities are also positioned as New Business Plan.

(3) Environmental and Social Considerations

Groundwater depletion and pollution caused by over pumping for the domestic and industrial purposes degrade the quality of life and human health in Faisalabad. Absence of adequate wastewater treatment plants and sewerage and drainage system seriously damage the city environment.

There exists institutional and legal setup for effective environmental administration in Faisalabad, however, demarcation of the roles and responsibilities of the relevant agencies are not clearly defined. Consequently the environmental protection regulations are ineffective and the sources of pollution continue to release pollutants to the water environment.

The water quality standards for surface water bodies shall be developed and promulgated for effective water environment monitoring.

A10.2 Recommendation

(1) New Business Plan Requirements

The important thing for compiling and implementing a new business plan is to identify the implementation of the action plan as the business goal of the organization; i.e., each DMD and Director's business goal. To achieve this goal, it is necessary to isolate each O&M section from others and to clarify the business goal and cost consciousness of the section, and to reorganize the organization to ensure transparency through the positioning of decision-making staff consisting of MD and DMD.

Meanwhile, for effective service improvement it is necessary to utilize the task force as a cross-functional driving force in the organization. Finally, these efforts will become the necessary preparations for the WASA-F's autonomy.

(2) Operation and Management Requirements

WASA-F is required to maintain the water supply facilities such as intake, water treatment facility, and transmission/distribution facility properly to not only supply the water with excellent water quality and enough volume to the customer without delay, but also always maintain the financial in healthy condition by economical operation. In case of sewerage and drainage facilities, it is also required to maintain house connection pipes, sewer pipes, trunk sewers, pumping stations and treatment plants in good condition and by economical operation.

To realize the above operation, understanding and analysis of the data obtained from the maintenance as well as proper routine operation and maintenance of the facility are required.

- Routine management consists of operation management and maintenance. The objective of operation management is not only to operate the facility or equipment safely and normally, but also to operate efficiently as a whole system. The objective of maintenance is to maintain its function so that it can be operated always in a normal condition.
- The technique to check, maintenance, and repair shall be standardized so that sufficient result may be expected by anyone who carries out. To achieve this, it is required to prepare manuals, and then to work based on them, and to observe them thoroughly.
- If the frequency of maintenance becomes high, the cost will increase, but the frequency of maintenance and probability of abnormal occurrence do not necessarily correspond. In other words, there is proper frequency and contents according to the scale of the facility and characteristic of the system, and maintenance itself cannot always prevent an accident and failure only by maintenance. Therefore, it is necessary to adopt the optimal method according to the actual condition of each facility.
- The maintenance data stored for a long period is useful to know the state of deterioration of

structure, pipes, and equipment, and the tendency of failure and accident, and others. The data is also important as the material for understanding the state of facility and equipment in operation management, preparation of a renewal plan, and the reference material for the maintenance.

(3) Collaboration with Other Donors' Activities

It is important for WASA-F to hold regular donor coordination meeting with JICA, the French government, DANIDA, ADB, WB and others and to collaborate with other programs of those donors for ensured implementation of the M/P projects.

(4) Environmental and Social Considerations

Improvement of the water supply, sewerage and drainage system by WASA-F is urgent for reducing the groundwater pumping and improving the water environment in Faisalabad.

The roles and responsibilities of the relevant agencies must be clearly indicated. The EPA/EPD shall be empowered so that the environmental protection regulations to be strictly complied by the sources of pollution.

Regarding the water quality standards, currently there have been only standards for effluents (NEQS for Municipal and Liquid Industrial Effluents) but no quality standards for surface water bodies.

(5) WASA-F Financial Management Improvement

Following recommendations would be considered by the parties in concern to discuss and take positive and decisive actions to improve WASA-F financial management for the supply of quality services.

WASA-F Modified Cash Accounting system should be replaced by accrual accounting system at the earliest opportunity possible in a bid to provide quality services on an appropriate costing and pricing basis. As regards budget scheme within the Provincial Government, separation of WASA-F account from the Government consolidated account will need to be discussed among the parties in concern so that WASA-F could shift its organizational setup to independently manage and make efforts to financially sustainable on an institutionally autonomous-basis. This institutional transition would also secure governance of WASA-F in its operational as well as financial management. In this light, the establishment of Special Revenue Account for water supply and sewerage/ drainage services will be suggested in a bid to secure financial and operational transparency and accountability (governance) in the agency. Specifically, Special Revenue Account of water supply and sewerage services will independently be established from the government consolidated account.

On the operational side, the enhancement of accounting and financial management sections will be streamlined and reinforced in terms of human capital and equipment will be imperative in the light of well-managed accounting which assures confidence to external financiers and oversighting Provincial government in the case of the entity's borrowings for development projects. In tandem, WASA-F will set up internal audit section to watch financial management, as well as enhancing capacity of performance evaluation of the entity within its own institutional framework (Value for money-Auditing). On the issue of reengineering the entity's revenue structure, the realignment of current asset (recovery of liquidate bad performance asset-account receivables) as well as tariff recovery from customers' payment evasion will profoundly be recommended for reinstalling sound and transparent financial management and financing capacity of the entity. Meanwhile, the needs for enhancing WASA-F IT-based tariff billing and collection system will also be reiterated to WASA-F management in a bid to quickly and efficiently collect service recoveries from users.