Ministry of Municipalities and Public Works, Iraq

Southern Governorates, Iraq

REPORT ON
DATA COLLECTION SURVEY
ON WATER SECTOR IN
SOUTHERN IRAQ

March 2015

JAPAN INTERNATIONAL COOPERATION AGENCY

NJS CONSULTANTS CO., LTD.

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Survey Area showing Governorate Boundaries

DATA COLLECTION SURVEY ON WATER SECTOR IN SOUTHERN IRAQ
INCEPTION REPORT

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Abbreviations

BOD	Biochemical Oxygen Demand
BOT	Build Operation Transfer
EIA	Environmental Impact Assessment
EU	European Union
F/S	Feasibility Study
GDP	Gross Domestic Product
GIS	Geographic Information System
IMF	International Monetary Fund
IQD	Iraqi Dinar
NDP	National Development Plan
JCCME	Japan Cooperation Center For the Middle East
MIS	Management Information System
MMPW	Ministry of Municipalities and Public Work
ODA	Official Development Assistance
O&M	Operation and Maintenance
PPP	Public and Private Partnership
RO	Reverse Osmosis
SCADA	Supervisory Control And Data Acquisition
SOP	Standard Operation Procedure
STP	Sewage Treatment Plant
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
WHO	World Health Organization
WTP	Water Treatment Plant

Chapter 1 Outline of Survey

1.1 Background of Survey

The Republic of Iraq (Iraq) was severely damaged both economically and socially by a long period of conflict and economic restrictions. Iraq has been preceding its reconstruction by support from international societies, and with a focus on upgrading the basic infrastructure, including water and sewerage services.

The southern region, which includes the second largest Iraqi city Basra, has a relatively safe community and more Japanese companies compared to other areas of the country. The importance of ODA related projects of the water sector in this region is expected to increase, supported by highly interested private sectors. However, there are many issues concerning water supply and sewerage services such as the deterioration of the existing facilities, and the efficient development will be required for the projects.

Due to the urgency of the water related issues and development in southern Iraq, the Government is in a haste in the development and is planning projects both ODA related and capital funded. For the international societies including Japan, it will be necessary to apprehend the actual situation as well as the Iraq society demands to provide appropriate support.

1.2 Objectives

This Survey aims to arrange information for planning of water supply and sewerage services, and to enhance the facility management and operating capacities of Iraq. The Survey includes: analysis of governing structure of the Ministry of Municipalities and Public Works, confirmation of related issues in the southern region, and information arrangements for future planning.

1.3 Target Area

The Survey target area for specific project planning is the southern four governorates (Messan, Al -Mutnanna, Dhi-Qar and Basrah), however, the information will be gathered from the whole Iraq country.

1.4 Survey Process

The Survey process is shown in the figure below. Due to security and transportation circumstances, the 1st Site Survey was carried out in Amman, the Hashemite Kingdom of Jordan (Jordan) and 4th Site Survey was carried out in Dubai, the United Arab Emirates (UAE).

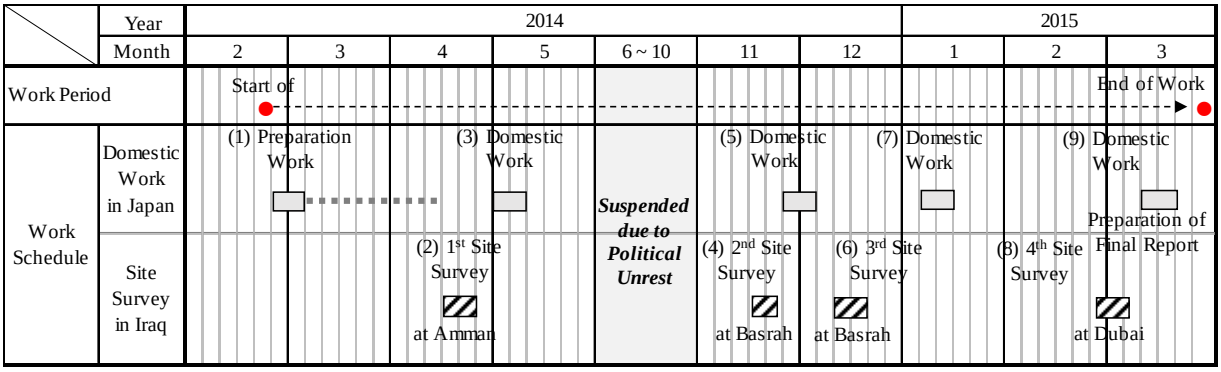


Figure 1.1 Survey Process

Chapter 2 Situation of Water and Sewerage Sector of Iraq

2.1 General Conditions of Iraq

2.1.1 Natural Conditions

(1) Location and Area

The west region of Iraq is a part of the Syrian Desert and borders with the Syrian Arab Republic (Syria) and Jordan (Figure 2.1). The north which borders with the Republic of Turkey (Turkey) is included in the Kurdistan Mountains, the east edge forms the Arabian Gulf, and the south region borders with the State of Kuwait (Kuwait) and the Kingdom of Saudi Arabia (Saudi Arabia), and is included in the Nafud Desert.

According to the National Development Plan 2013-2017 (hereinafter "NDP, 2013-2017"), the actual area of Iraq is 441,839 km^2. The southern four governorates composing the Survey area (Messan, Al-Mutnanna,, Dhi-Qar and Basrah) cover 65,195 km^2, 15% of the county area.

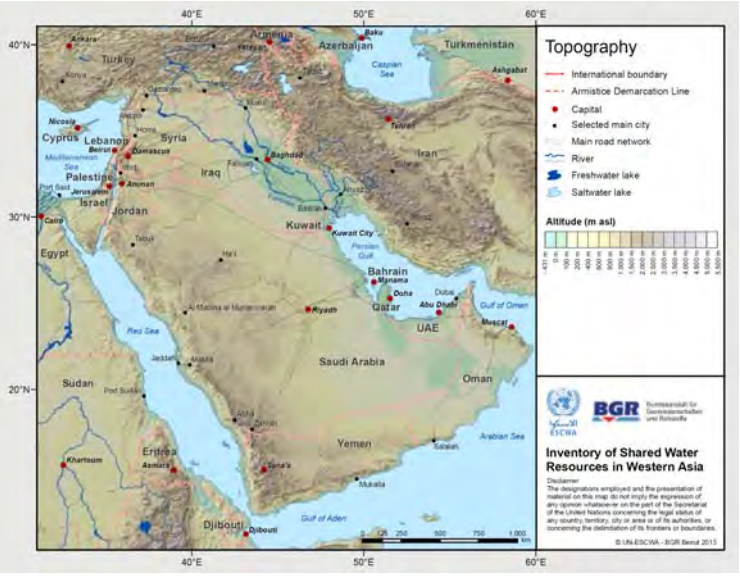
Figure 2.1 Location of Iraq and Survey Area

(2) Natural Conditions

1) Topography

The topography of Iraq is classified into three types. The southern region of Euphrates River is composed of a gentle sloping plateau of an altitude of 1,000 meters, the Syrian Desert and the Nefud Desert (Figure 2.2). The Mesopotamian Plain extends around the Tigris and Euphrates Rivers, and the altitude of the region east of the Tigris River rises to form the Zagros Mountains.

Within the southern four governorates, Al-Muthanna and Basrah are located in the slopes between Saudi Arabia plateau and the Euphrates River. Basrah, Dhi-Qar and Messan are located in the Mesopotamia Plain and some parts of Messan also spread to the Zagros Mountains.

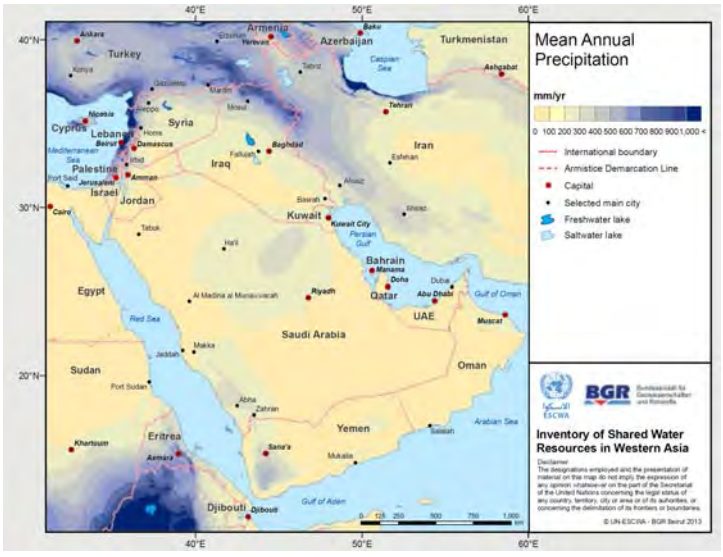


Source: UN-ESCWA-BGR 2013

Figure 2.2 Topography of Iraq

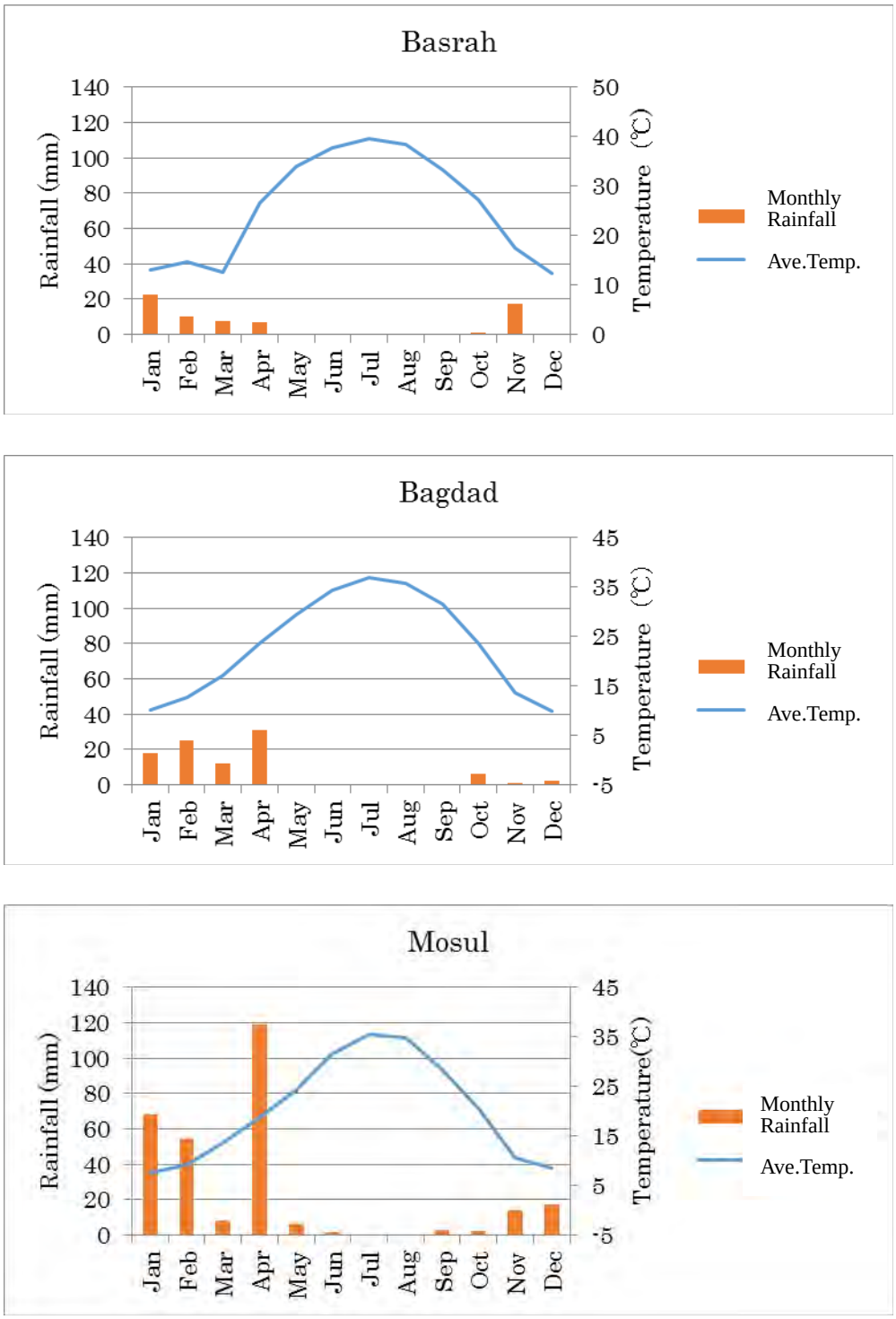
2) Meteorology

The meteorology of Iraq is classified as desert climate and therefore has very small rainfall (Figure 2.3). The temperature and rainfall annual data (2011) of Basrah, Bagdad and Mosul are shown in Figure 2.4. The average annual temperature is respectively; Basrah (south) 25.6℃, Bagdad (central) 25.6℃ and Mosul (north) 20.3℃. The average annual rainfall is; Basrah 65.3mm, Bagdad 96mm and Mosul 294.7mm. The southern region has higher temperature and smaller rainfall than the north.



Source：UN-ESCWA-BGR 2013

Figure 2.3 Annual Rainfall of Iraq

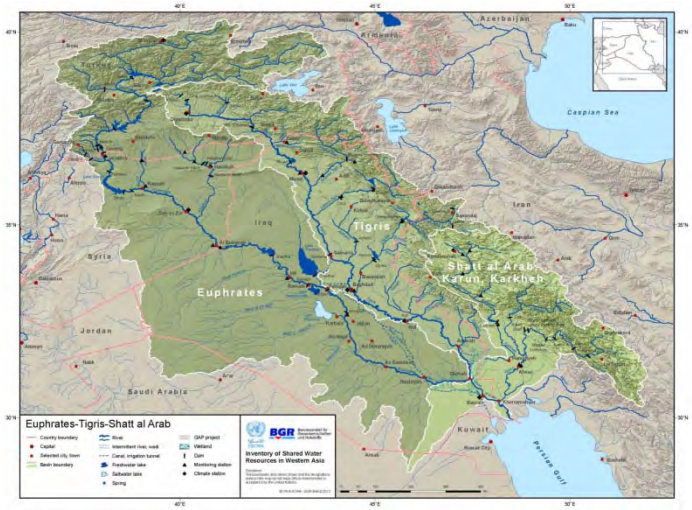


Source: http://cosit.gov.iq/en/component/content/category/79-aas2013-en

Figure 2.4 Temperature and Rainfall of Basrah, Bagdad, Mosul, 2011

3) Limnology and Water Supply

The water supply system of Iraq is supported by the usage of irrigation and dams of the Tigris and Euphrates Rivers (Figure 2.5).



Source：UN-ESCWA-BGR 2013

Figure 2.5 Basin of Euphrates, Tigris and Shatt al Arab Rivers

42.2% of Iraq is located in the basin area of Euphrates River and 59.9% is of the Tigris river. According to the "Basic Research and Analysis of the Republic of Iraq (2003, JICA)", 90% of the inflow of the Euphrates sources are of the upper basin countries, while 50% of the Tigris is within Iraq (Table 2.1).

Table 2.1 Basic Information of Euphrates and Tigris Rivers

Country	[1] Area of Whole Country (km^2)	All Basin Area of Euphrates			All Basin Area of Tigris		
		[2] Basin Area (km^2)	%	% of Basin Area in Country ([2]/[1])	[3] Basin Area (km^2)	%	% of Basin Area in Country ([3]/[1])
Iran	1,745,150	-	-	-	55,047	17.96	3.2
Iraq	438,317	208,972	42.42	47.7	183,686	59.94	41.9
Saudi Arabia	2,149,690	13,068	2.65	0.6	-	-	-
Syria	185,180	127,004	25.78	68.6	884	0.29	0.5
Turkey	783,560	143,484	29.12	18.3	66,856	21.81	8.5
Jordan	89,324	132	0.03	0.1	-	-	-
Total	-	492,660	100	-	306,473	100	-

Source: UN-ESCWA, 2013

The Japan Cooperation Center for the Middle East (hereinafter "JCCME") carried out a survey, "Water and Sewage Sectors in Iraq: Sector Report, Feb 2013" (hereinafter "JCCME, 2013". In this survey, the Ministry of Water Resources reported that the Iraq's freshwater sources depend heavily on the Tigris and Euphrates Rivers. According to the reports, the available water resources (surface water and ground water) of the year 2012 are 54.2 billion m^3/year (Table 2.2).

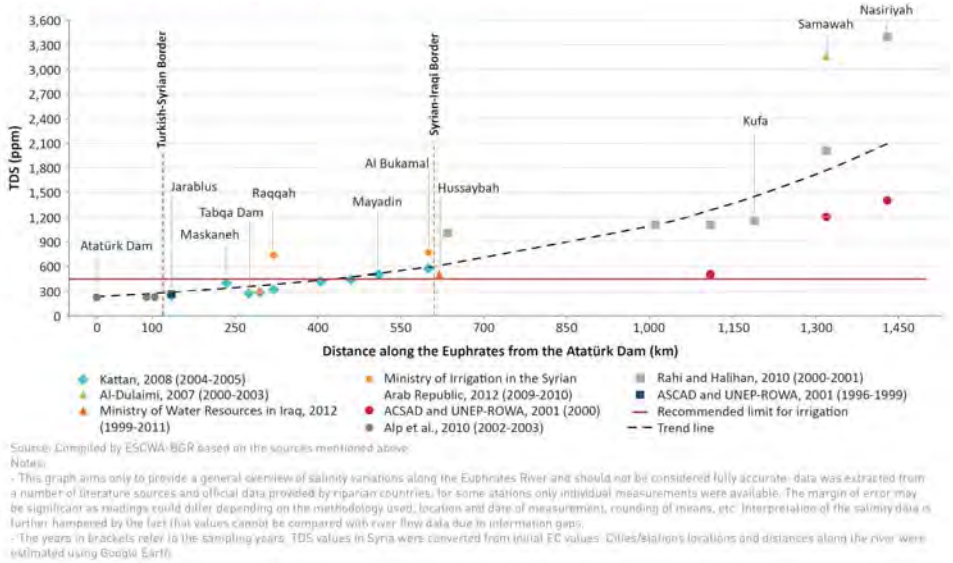
Table 2.2 Water Resource Data (2010)

Category	Cubic Meters/Year	Cubic Meters Per Capita
Surface Water	50,045,000,000	1,528
Ground Water	4,228,000,000	140

Source: JCCME, 2013

Figure 2.6 shows the relation of measured TDS as an index of the salinities and the distance from the Ataturk dam toward the downstream direction, investigated in the Euphrates River since 1996 (UN-ESCWA (2013). Both the TDS and salinity has risen in the downstream regions.

TDS (Total Dissolved Solid) is a dissolved substance, and when it exists in tap water, the main components are salts and organic matters such as calcium, magnesium, silicic acid, sodium and potassium. In the Japanese water quality guidelines reported by specialists in 1992, the evaporation residues value is 500mg/L to provide water without taste problems, and the target value for "tasty water" is 30 – 200mg/L (http://www.mhlw.go.jp/topics/ bukyoku/kenkou/suido/kijun/dl/k48.pdf). According to the WHO Guideline and USEPA Drinking Water Standards, TDS is listed as an "item which may cause consumer complaints" and the value is targeted as 1,000mg/L, but it is not mentioned in the EU standards (http://www.mhlw.go.jp/shingi/2002/11/s1108-5g.html).
The TDS is not a singular substance and the value does not necessary indicate direct influence to human health, but it may cause issues for the taste of drinking water or limescale for supply pipes, boilers and other equipment.



Source: UN-ESCWA BGR 2013

Figure 2.6 TDS Variations along the Euphrates River from Ataturk Dam

As shown in Figure 2.7, the TDS concentration has raised largely after the completion of Al-Hadithi dam (1978) and Partow dam (2001).
The details will be described in the later chapters, but the downstream areas in the southern region are affected by the seawater retroact and the TDS (salts) concentration of groundwater is high. Therefore, the TDS of the river water rises when the volume of low-salinity water of the Euphrates and Tigris Rivers decrease. The rise of TDS concentration is assumed to have been caused as a result of the river water intake amount increase due to the construction of the dams.

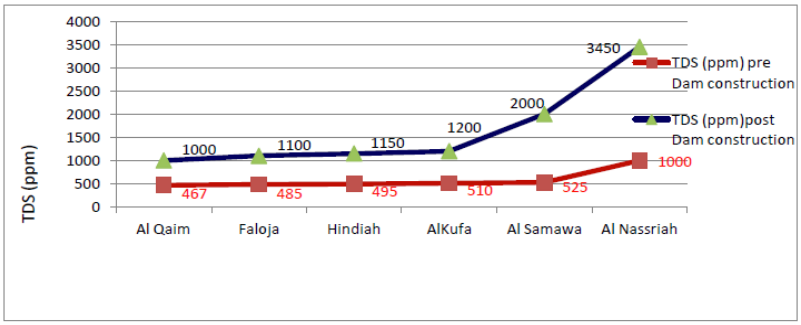


Figure 6.3: The change in TDS along part of Euphrates river stretch within Iraq; numbers extracted from Al-Hadithi (1978) and Partow (2001).

Source: EMPORAL AND SPATIAL CHANGES IN WATER QUALITY OF THE EUPHRATES RIVER – IRAQ"

Figure 2.7 Euphrates River TDS Value of Before/After Dam Construction

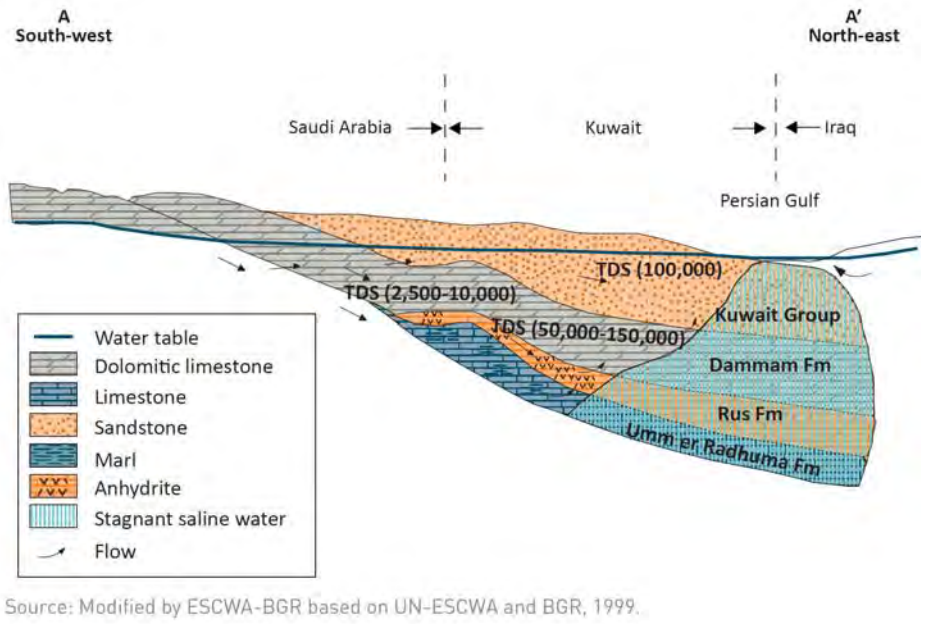
4) Geology and Ground Water Quality

The salinity rise of the ground water in Basrah is particularly high, according to UN-ESCWA (2013). Figure 2.9 shows the stratum surface layer distribution within Saudi Arabia, Kuwait and Iraq, the A-A' sections and the ground water salinity.

As the seawater invades the aquifer, the salinity concentration of groundwater is raising in Basrah. It is to say that the salinity concentration is low at the pressure supply side, and high at the downstream seaside areas. As a result, the salinity concentration is not an issue on the left bank of Euphrates River, but in the right bank downstream areas (Basrah, Kuwait), the groundwater salinity concentration rate is a high 10g/L (1.0%) as shown in Figure 2.10.

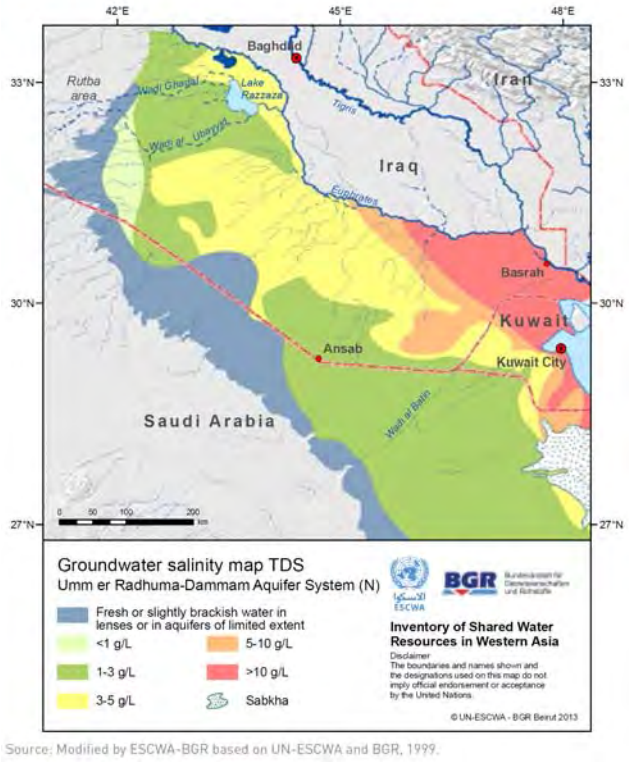
Source: UN-ESCWA BGR 2013

Figure 2.8 Aquifer System of the Right Bank of Euphrates



Source: UN-ESCWA BGR 2013

Figure 2.9 Geological Features, Aquifer A-A' Cross-section of Basrah (Kuwait) Region



Source: UN-ESCWA BGR 2013

Figure 2.10 Salinity Concentration Map of Euphrates River Right Bank

2.1.2 Socio-economics of Iraq

(1) Economy

1) Structure of Industry and Productions

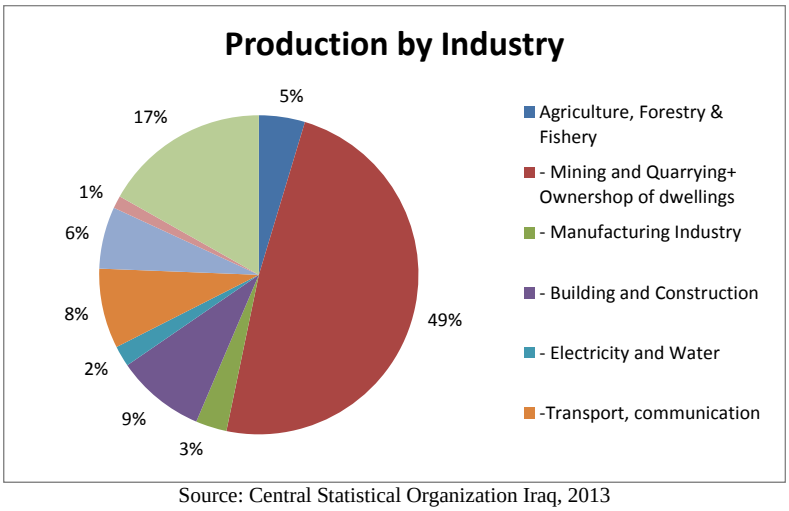
Table 2.3 shows the industry breakdown by production for 2012. According to the data, agriculture, forestry, and fishery produce 5% of GDP, the service sector produces 40% while the mining and manufacturing industry produces 55%. The oil industry is mostly included in mining industry. In this table, the ownership of dwelling is categorized into the service sector, however, when it is added with the mining, the total production of the two industries becomes 49% of GDP shown as Figure 2.11. This figure shows how the economy of Iraq relies on oil industry. It does not include the export of crude oil and production of oil related services. If all oil related services are included, the production of oil and oil related industry occupy 54% of GDP, according to an IMF report. This means that the non-oil industry only produces 46% of GDP, and the economic structure of Iraq heavily relies on oil industry.

Table 2.3 Production per Industry (Breakdown) in 2012

Unit: Trillion Iraq Dinar

Industry	Production	%
(1) Agriculture, Forestry & Fishery	13,140	5%
(2) Industry		55%
- Mining and Quarrying	120,081	43%
- Manufacturing Industry	8,882	3%
- Building and Construction	25,327	9%
(3) Services		40%
- Electricity and Water	5,924	2%
-Transport, communication	22,768	8%
- Ownership of dwellings	16,597	6%
- Wholesale and Retail Trade, Hotels	17,685	6%
- Banking and insurance	3,584	1%
- Social and personal services	47,360	17%
Total	281,347	100%

Source: Central Statistical Organization Iraq, 2013



Source: Central Statistical Organization Iraq, 2013

Figure 2.11 Production per Industry in 2012

Table 2.4 shows the socio-economic trends of Iraq, according the IMF report, and shows how the economy heavily relies on the production and the export of crude oil. Oil reserves of Iraq are estimated as 143 billion barrels, in the top class level after Saudi Arabia, Venezuela and Iran. Export of crude oil is contributing to the growth of economy and GDP per capita. The GDP per capital has been growing from 1,300 USD in 2003 to 6,300 USD in 2012. Figure 2.12 shows that the GDP per capita is expected to increase to 9,000 USD in 2018.

2) Foreign Exchange and International Trade Surplus

Inflation is declining from 6% in 2010 to 3.3% at the end of 2011, since the export of crude oil and oil price have been increasing but the price of food has dropped.

The currency Iraq Dinar has weakened due to the instable political situations, the increasing debt of State Own Enterprise (hereinafter "SOE"), and the monetary policy of the central bank for increasing foreign currency deposits. The amount of reserve funds by the central bank has increased from 61 billion USD as of the end of 2011 to 70 billion USD as of the end of 2012. This amount is equivalent to a 9-month import amount or 33% of GDP. Based on said increases, the Iraq Reconstruction Fund has increased from 16.5 billion USD to 180 billion USD. This amount is equivalent to 8.5% of GDP.

The trade balance also has been maintaining a surplus of 5% in 2011 and 4% in 2012, supported by increasing export of crude oil. The macro-economic situation of Iraq is expected to be fairly well according to these statistic data.

3) Labor Market and Poverty

More than half of the laborers work for the government or the SOE related oil production and export fields. The unemployed rate was 11% in 2011. However the actual situation is more serious. The Iraq War created numerous refugees and caused a rapid outflow of the labor population (especially skilled workers) due to the post-war economy control. Training/educational institutes are not improving, which is a cause of the shortage of skilled workers and huge unemployment among the younger generation. The population of under the age of 15 occupies 41% of the total population. Lack of teachers and educational facilities, along with the weakness of education system, could not provide sufficient education and training to the younger generation. In addition, the government policy including education policy is not smoothly implemented because of the weak capability.

The poverty gap has been growing. The poverty ratio was 22.9% in 2008, however, the actual situation is worse. 40% of the people live in rural areas with underdeveloped housing, education and social services. According to UNDP, the Human Development Index of Iraq is 131st, the lowest in the world.

4) Direct Foreign Investment and Industry Development

The direct foreign investment, especially investment to non-oil related industry, is small and not growing due to slow policy implementation, weak approving capability of the government, instable law

enforcement, instable regulation and problems of peace and order. These situations make it difficult for the government to attempt to enhance the economy by benefiting from direct foreign investment.

Table 2.4 Economy Trends

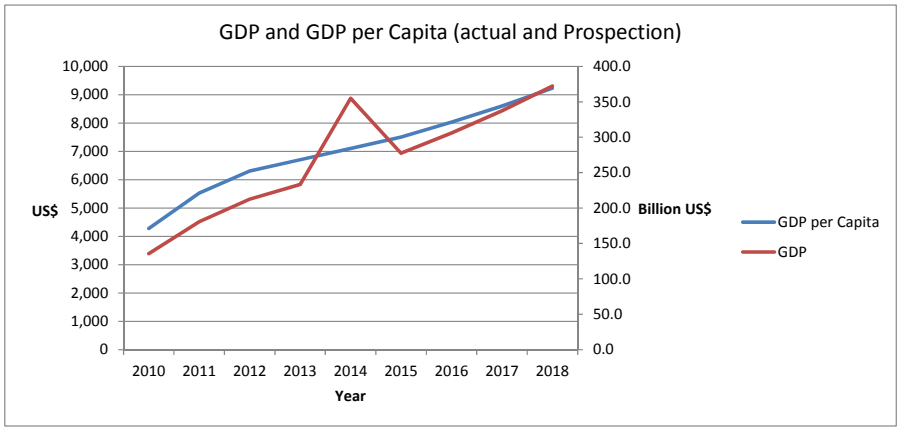
		2010	2011	2012	2013	2014	2015	2016	2017	2018
(1)Economic Growth and prices		Actual	Actual	Projection	Projection	Projection	Projection	Projection	Projection	Projection
Real GDP (percentage change)	%	5.9	8.6	8.4	9.0	9.0	8.3	9.0	8.4	8.3
Non-oil real GDP（percentage change)	%	9.7	5.7	6.3	6.0	6.0	6.0	6.0	6.0	6.0
GDP per Capita	US$	4,278	5,529	6,305	6,708	7,106	7,501	8,036	8,601	9,229
GDP	Billion US$	135.5	180.6	212.5	233.3	354.9	277.4	306.1	337.3	372.4
Oil Production	mbpd	2.38	2.65	2.95	3.33	3.74	4.15	4.66	6.16	5.70
Oil Exports	mbpd	1.91	2.17	2.42	2.70	3.05	3.45	3.85	4.30	4.75
Inflation (consumer price: percentage change)	End of perio	3.3	6.0	3.6	5.0	5.5	5.5	5.5	5.5	5.5
Inflation (consumer price: percentage change)	Average	2.4	5.6	6.1	4.3	5.5	5.5	5.5	5.5	5.5
Consumer Price Inflation	End of perio	3.3	7.0	4.2	5.0	5.0	5.0	5.0	5.0	5.0
Gross domestic investment (% of GDP)	%	21.4	19.3	20.3	21.1	21.5	23.4	24.2	25.1	24.1
Of which public	%	15.2	13.0	13.5	14.7	14.6	16.0	16.3	16.6	16.7
Gross domestic consumption（% of GDP）	%	77.9	66.9	70.8	73.2	73.7	72.1	71.7	71.1	72.1
Of which public	%	25.2	21.7	21.3	21.6	21.2	21.1	20.7	20.4	20.0
Gross national savings (% of GDP）	%	24.4	31.8	27.3	24.9	24.3	27.3	28.5	29.2	28.2
Of which public	%	10.8	17.7	18.1	17.1	17.4	19.5	20.5	20.9	20.9
Saving - Investment Balance	%	3.0	12.5	7.0	3.8	2.9	4.0	4.5	4.1	4.2
Government revenue and grant（% of GDP）	%	46.4	49.5	48.2	46.4	45.7	45.5	44.8	44.6	44.1
Government oil revenue	%	40.0	46.0	44.6	44.4	43.6	43.4	42.5	42.2	41.7
Government non-oil revenue	%	3.5	2.5	4.1	2.0	2.1	2.2	2.3	2.4	2.4
Grant	%	2.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Expenditure (% of GDP)	%	50.7	44.6	44.1	44.8	43.5	42.5	41.2	40.9	40.3
Current	%	35.5	31.6	30.6	30.1	28.9	26.6	24.9	24.3	23.6
Capital	%	15.2	13.0	13.5	14.7	14.6	16.0	16.3	16.6	16.7
Primary balance	%	-3.8	5.6	4.5	2.3	2.8	3.5	4.1	4.1	4.0
Overall fiscal balance (including grants)	%	-4.3	4.9	4.1	1.6	2.2	3.0	3.6	3.7	3.8
Non-oil primary fiscal balance (% of non-oil GDP)	%	-76.0	-84.6	-73.1	-73.6	-69.1	-68.3	-64.9	-62.7	-60.2
Non-oil related tax revenue（% of GDP）	%	1.8	1.9	2.3	2.0	2.1	2.1	2.2	2.2	2.3
Development Fund of Iraq	Billion US$	7.4	16.5	18.1	18.9	21.9	27.8	37.4	48.4	61.2
Total government debt	Billion US$	70.8	73.4	74.1	40.4	36.6	33.1	30.1	27.2	24.3
external debt	Billion US$	60.9	61.0	60.2	27.8	25.5	23.5	22.1	20.7	19.3

Note :
mbpd: million barrel per day

		2010	2011	2012	2013	2014	2015	2016	2017	2018
(2) Budget of Central Government		Actual	Actual	Nominal	Projection	Projection	Projection	Projection	Projection	Projection
Revenue and grants	Trillions ID	73.6	104.6	119.4	126.1	135.8	147.3	159.9	175.4	191.6
Revenue	Trillions ID	68.9	102.4	119.4	126.1	135.8	147.3	159.9	175.4	191.6
Crude oil export revenue	Trillions ID	59.9	93.4	109.4	1117.9	126.7	137.0	148.0	162.3	176.9
Grant	Trillions ID	4.7	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Expenditures	Trillions ID	80.3	94.3	109.4	121.8	129.3	137.6	147.0	161.0	175.0
Current expenditures	Trillions ID	56.2	66.8	75.8	81.8	85.9	85.9	89.0	95.7	102.7
Salary and pension	Trillions ID	28.9	33.9	34.9	41.0	44.7	48.7	53.7	59.2	65.4
Salary	Trillions ID	22.6	27.0	28.5	32.9	46.0	39.2	43.2	47.6	52.6
Pension	Trillions ID	6.3	6.9	6.4	8.0	8.8	9.5	10.5	11.6	12.8
Goods and services	Trillions ID	11.0	12.0	17.5	17.6	18.1	19.1	19.8	20.6	21.4
Transfers	Trillions ID	12.5	14.7	16.6	15.2	14.6	14.0	13.5	14.1	14.8
Social safety net	Trillions ID	6.3	8.0	6.7	6.7	6.8	7.3	7.9	8.6	9.3
Payments and transfers to SOEs	Trillions ID	3.3	3.8	2.9	2.5	2.5	2.5	2.5	2.5	2.5
Other payments and transfers	Trillions ID	2.9	2.9	7.1	6.0	5.3	4.2	3.1	3.0	3.0
Interest payments	Trillions ID	0.8	1.6	1.0	1.9	1.8	1.7	1.7	1.6	0.8
War reparations	Trillions ID	3.0	4.6	5.5	5.9	6.3	2.1	0.0	0.0	0.0
Contingency	Trillions ID	0.1	0	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Investment expenditures	Trillions ID	24.1	27.4	33.6	40.0	43.3	51.7	58.0	65.3	72.4
Balance (including grants)	Trillions ID	-6.8	10.3	10.1	4.3	6.5	9.6	12.9	14.4	16.5
Balance (excluding grants)	Trillions ID	-11.4	8.2	10.1	4.3	6.5	9.6	12.9	14.4	16.5

Note：ID:Iraq Dinar

Source: IMF Report 2013



Source: IMF Report 2013

Figure 2.12 GDP Trend and GDP per Capita

(2) Budget execution of the Government

1) Revenue and Expenditure

Annual revenue of the government in 2011 was 1,064 trillion IQD. Although equivalent to 49.5% of GDP, it should also be considered that the oil related revenue is 46% of GDP. Almost all of the government annual revenue comes from oil related sales of SOP and oil related tax. The income from foreign assistants is only 1% of GDP, which indicates that revenue from non-oil related tax is only 2.5%.

The annual expenditure of the government is 31.6% against GDP for operational budget. The capital budget, including infrastructure development of water supply and sewerage sector, is 13% to GDP (40% of the total expenditure). However, the government has many works planned to reconstruct the damage sustained by war including house rebuilding, goods/food distribution infrastructure repair and war refugee resettlement. These issues require a large budget and prioritization decision making is difficult.

2) Budget Execution

Table 2.5 and 2.6 shows the government budget and execution. The budget has been increasing 30% annually and 75% is spend for operational activity while 25% is spend for capital investment, however, the execution ratio has been dropping particularly on capital budget. The execution ratio of Basrah is the worst and is only 8% in 2011.

According to “Iraq Budget Execution, 2013” by UN Iraq Joint Analysis Unit:

- Local constructors often submit insufficient financial proposals. Because of their weak cost estimation capability, the cost estimation is too low to gain any profit.
- Weak evaluation capability of the government for selecting sufficient constructors. For example, they do not review and accept significantly low financial proposals (such as less than 25% of the standard cost). There are no procedures or systems to reject said irregular proposals on the government’s side.
- There is no cost adjustment or disbursement adjustment mechanism when the government side requests to change the specification and/or design. (If this situation emerges, the

constructor must bear the excess cost, even if changing the specification and/or design is not their responsibility.)

- Unclear bidding process and evaluation criteria, and numerous defects of the bidding system, such as requiring long time for bidding procedure, and no rules of punishment or punishing criteria for the failure of the constructor.

Low budget execution signifies delay or suspension of infrastructure development projects. Interview surveys of this Project also confirm issues of delay including sudden suspend/cancel during the construction by the constructor. These are the major reasons for low budget execution.

The budget for 2014 has not been approved officially by the end of 2014, for the emerging conflict with ISIS（Islamic State of Iraq and Syria）and government changes. Presently, the budget being executed as a tentative provisional budget until it is officially approved.

Table 2.5 Budget Execution by Ministry during 2009 to 2011

Iraqi Budget Execution Rates, from 2009 to 2011 IQD Billion

	2009			2010			2011		
Ministries	Budget	Execute	Rate %	Budget	Execute	Rate %	Budget	Execute	Rate %
Oil	3,729	560	15%	4,754	2,043	43%	9,345	3,016	32%
Electricity	4,001	3,267	82%	6,890	6,795	99%	4,951	1,262	25%
Municipalities and Public Works	1,118	753	67%	2,341	2,167	93%	2,089	982	47%
Water Resources	864	798	92%	1,290	993	77%	1,594	835	52%
Housing & Construction	759	736	97%	960	713	74%	1,043	687	66%
Health	4,133	3,406	82%	5,759	4,167	72%	5,722	3,358	59%
Youth and Sports	244	145	59%	646	486	75%	876	455	52%
Industry and Minerals	1,530	1,102	72%	664	261	39%	682	275	40%
Education	4,820	4,705	98%	5,544	4,667	84%	7,583	5,794	76%
Foreign Affairs	375	339	90%	442	351	79%	838	319	38%
Communication	359	288	80%	316	196	62%	263	43	16%
Higher Education & Scientific Researc	2,049	1,918	94%	2,548	2,171	85%	2,574	2,148	83%
Transportation	629	370	59%	627	305	49%	555	346	62%
Agriculture	670	297	44%	761	505	66%	1,133	263	23%
Defense	4,862	4,385	90%	5,733	4,997	87%	6,839	4,806	70%
Interior	6,469	5,879	91%	7,188	5,951	83%	7,386	5,626	76%
Culture	150	108	72%	202	161	80%	324	140	43%
Finance	12,394	7,688	62%	14,034	10,938	78%	15,493	13,500	87%
Planning and Development Cooperatio	182	118	65%	294	164	56%	240	59	25%
Science and Technology	127	113	89%	142	109	77%	143	136	95%
Commerce	4,343	4,282	99%	4,786	4,218	88%	4,636	4,897	106%
Labor & Social Affairs	995	201	20%	271	116	43%	1,033	587	57%
Justice	313	279	89%	542	436	80%	461	390	85%
Environment	52	28	54%	95	41	43%	68	48	71%
Migration and displacement	66	76	115%	228	211	93%	228	330	145%
Human Rights	18	13	72%	30	23	77%	25	19	76%
KRG	8,283	8,284	100%	10,608	10,559	100%	11,169	11,686	105%
sub total	63,534	50,138	79%	77,695	63,744	82%	87,293	62,007	71%
Others	5,631	5,453	97%	6,962	6,390	92%	9,369	14,861	159%
Total	69,165	55,591	80%	84,657	70,134	83%	96,662	76,868	80%

Source: Iraqi Budget Execution, Report from UN Iraq Joint Analysis Unit, 2014

Table 2.6 Governorate Budget Execution Rate in 2011

Governorate	Budget Execution Rate of 2011
ANBAR	100%
KRG	100%
SALAH AL DIN	84%
NAJAF	78%
MUTHANNA	76%
THI QAR	71%
WASSIT	65%
QADISIYA	61%
KERBLA	57%
BAGHDAD	48%
MISSAN	47%
BABIL	41%
KIRKUK	37%
DIYALA	34%
NINEWA	24%
BASRAH	8%

Source: Iraqi Budget Execution, Report from UN Iraq Joint Analysis Unit, 2014

(3) Population

Table 2.7 shows statistic data and population projection by the Ministry of Planning. The population was assumed to increase 3% annually from 1997, however, the value had been changed to 2.6% after 2009 based on the census in 2009.

Table 2.8 shows the average family size. 7.1 persons per family in urban areas, and 10 persons in rural areas, an average of 7.7 persons were presented by the census of 1997. These figures drop to 6.3 persons per family in urban areas, 7.8 persons in rural areas and an average of 6.7 persons by the census of 2009.

Table 2.9 shows the population projection for the recent 4 years by the Central Statistical Organization of Iraq. 2.6% annual increase ratio for both urban and rural areas are expected, which has been adjusted to 2.9% for urban areas and 1.9% for rural areas after 2013.

The population of Iraq was 32 million in 2010 and is expected to increase to 50 million in 2030. The young generation under age 20 occupied 70% of the total population in 2010 and the population growth are relatively high. The population inflow to the urban areas and rapid urbanization is requiring more infrastructure development in the urban areas.

Table 2.7 Annual Population

Year	male	female	Total	Increasing
2000	12,047	12,039	24,086	3.0%
2001	12,424	12,389	24,813	3.0%
2002	12,814	12,751	25,565	3.0%
2003	13,216	13,124	26,340	3.0%
2004	13,629	13,510	27,139	3.0%
2005	14,055	13,908	27,963	3.0%
2006	14,493	14,317	28,810	3.0%
2007	14,943	14,739	29,682	3.0%
2008	16,058	15,837	31,895	7.5%
2009*	15,910	15,754	31,664	-0.7%
2010**	16,561	15,929	32,490	2.6%
2011**	16,985	16,353	33,338	2.6%
2012**	17,420	16,788	34,208	2.6%

*Census

**projection

Source: Central Statistical Organization Iraq, 2013

Table 2.8 Number of Households and Average Family Size

1997			2009			Indicators
Urban	Rural	Total	Urban	Rural	Total	
1,518,697	621,797	2,140,494	3,435,043	1,375,512	4,810,555	Total housing units
1,798,153	696,154	2,494,307	3,440,700	1,255,565	4,696,265	Total households
12,850,589	6,231,977	19,082,566	21,844,413	9,820,053	31,664,466	Total population
7.1	10	7.7	6.3	7.8	6.7	Ave. Size of Household

Source: Central Statistical Organization Iraq, 2013

Table 2.9 Population of Governorates (2009-2012)

Population

Governorate	2009			2010			2011			2012		
	Urban	Rural	total	Urban	Rural	total	Urban	Rural	total	Urban	Rural	total
Ninevah	1,888,497	1,218,451	3,106,948	1,938,167	1,249,778	3,187,945	1,988,872	1,282,502	3,271,374	2,047,324	1,306,551	3,353,875
Kirkuk	950,140	375,713	1,325,853	974,992	385,450	1,360,442	1,000,369	395,615	1,395,984	1,029,643	403,104	1,432,747
Diala	657,355	713,680	1,371,035	674,600	731,992	1,406,592	692,206	751,125	1,443,330	712,508	765,176	1,477,684
Al-Anbar	718,583	764,776	1,483,359	737,463	784,366	1,521,829	756,737	804,836	1,561,574	778,959	819,863	1,598,822
Baghdad	5,842,318	860,220	6,702,538	5,995,812	882,227	6,878,039	6,152,511	905,225	7,057,736	6,333,179	922,100	7,255,278
Babylon	816,036	913,630	1,729,666	837,505	937,034	1,774,539	859,420	961,489	1,820,909	884,684	979,440	1,864,124
Kerbela	673,724	339,530	1,013,254	691,395	348,245	1,039,640	709,437	357,350	1,066,787	730,243	364,038	1,094,281
Wasit	666,191	483,888	1,150,079	683,692	496,295	1,179,987	701,558	509,258	1,210,817	722,158	518,777	1,240,935
Salah AL-Deen	591,398	746,388	1,337,786	606,922	765,532	1,372,453	622,770	785,533	1,408,303	641,045	800,221	1,441,266
Al-Najaf	867,940	353,288	1,221,228	890,739	362,346	1,253,084	914,014	371,810	1,285,823	940,849	378,758	1,319,608
Al-Qadisiya	608,325	469,289	1,077,614	624,274	481,330	1,105,604	640,557	493,910	1,134,467	659,336	503,149	1,162,485
Al-Muthanna	298,779	384,347	683,126	306,610	394,209	700,818	314,605	404,512	719,117	323,825	412,079	735,905
Thi Qar	1,097,436	646,962	1,744,398	1,126,231	663,558	1,789,789	1,155,629	680,897	1,836,526	1,189,529	693,630	1,883,160
Maysan	668,118	254,772	922,890	685,670	261,312	946,981	703,588	268,144	971,732	724,248	273,162	997,410
Basrah	1,923,109	482,325	2,405,434	1,973,636	494,692	2,468,328	2,025,218	507,613	2,532,831	2,084,689	517,101	2,601,790
15 governorates Total	18,267,949	9,007,259	27,275,208	18,747,706	9,238,365	27,986,071	19,237,492	9,479,820	28,717,311	19,802,220	9,657,150	29,459,370
Kurdistan Region :												
Erbil	1,274,090	257,991	1,532,081	1,307,618	264,536	1,572,154	1,341,844	271,379	1,613,223	1,381,297	276,387	1,657,684
Duhouk	786,599	285,725	1,072,324	807,178	293,008	1,100,187	828,192	300,621	1,128,813	852,432	306,201	1,158,633
AL-Sulaimaniya	1,515,775	269,078	1,784,853	1,555,578	275,982	1,831,560	1,596,214	283,195	1,879,409	1,643,068	288,492	1,931,561
Total of K.R	3,576,464	812,794	4,389,258	3,670,375	833,526	4,503,901	3,766,250	855,195	4,621,446	3,876,797	871,081	4,747,878
Iraq Grand total	21,844,413	9,820,053	31,664,466	22,418,081	10,071,891	32,489,972	23,003,742	10,335,015	33,338,757	23,679,017	10,528,231	34,207,248

Source: Central Statistical Organization Iraq, 2013

(4) Infrastructure

1) Electricity

The electricity supply situation of Iraq (except the Kurds) from 2002 to 2011 is shown in the below table. The generation amount repeats to increase and decrease from 2002 to 2005, but has been increasing since 2005. The population has also increased; therefore the consumption amount per person has not changed largely since 2002.

Table 2.10 Electricity Supply Condition in Iraq (except Kurds)

Year	Total Generation (MWh/year)	Import (MWh/ year)	Total Sales (MWh/ year)	Supply Population (people)	Amount per Person (MWh/ year)
2002	34,670,328	–	29,451,553	22,207,864	1.33
2003	25,363,612	–	18,368,365	22,873,589	0.8
2004	30,266,719	–	25,802,572	24,031,907	1.07
2005	28,811,546	1,922,594	18,351,590	24,266,172	0.76
2006	32,137,809	2,688,426	24,833,423	24,993,115	0.99
2007	33,283,350	2,196,184	24,863,030	26,246,043	0.95
2008	36,780,524	2,973,027	29,742,670	27,025,383	1.1
2009	46,064,647	5,603,882	37,052,425	27,295,574	1.36
2010	48,908,179	6,722,050	38,625,151	28,102,135	1.37
2011	53,902,571	7,233,094	41,113,889	33,338,757	1.23

Source: Central Statistical Organization Iraq

The electricity demand planning is shown in the below table. The electricity production in 2012 was 6,148MW, and it is planned to increase to 25,000MW in 2017 by enhancing generating capacities and increasing import amount.

Table 2.11 Electricity Demand Planning of Iraq

Year	2012	2013	2014	2015	2016	2017
Demand（MW）	14,020	15,183	16,298	17,494	18,628	19,823

Source: NDP,2013-2017

2) Transportation (Roads, Bridges)

Road conditions were good before 2003, but have been destroyed by the war and both the efficiency and capacity has dropped. The existing road length is estimated as 48,000km and future construction plans are shown in the below.

Table 2.12 Road Construction Plans for Iraq

Item	unit	2012	2013	2014	2015	2016	2017	Total
Highway	km		116	40	282	248	600	1,286
Main road	km	75	93	146	291	161	175	941

Item	unit	2012	2013	2014	2015	2016	2017	Total
Major street	km	485	807	775	541	788	1108	4,504
Secondary street	km	115	246	104	273	225	185	1,148
Concrete bridge	no.	8	25	20	16	11	13	93
Grade separation	no.		8	6	7	4	4	29
Steel bridge	no.	-	-	-	-	-	2	2

Source: NDP,2013-2017

3) Railways

Both the number of passengers and carriage of railways had decreased after 1998, but changed to increase since 2007. Plans have been made to replace outdated equipment and disabled signals, to make double lines and to combine systems for modernization. The plans for facility improvement and the numbers of passengers/carriage are shown in Table 2.13.

Table 2.13 Railway Improvement Plans for Iraq

Year	Extension between cities (km)		Extension of main/secondary roads (km)		Passengers (mil persons)		Carriage (mil tons)	
	Increase	Accumulation	Increase	Accumulation	Increase	Accumulation	Increase	Accumulation
2012	---	1931	---	2915	---	1	---	4
2013	---	1931	369	3284	0.5	1.5	1	5
2014	---	1931	200	3484	1	2.5	1	6
2015	400	2331	1400	4884	4.2	6.7	38	44
2016	1000	3331	2400	7284	23	29.7	58	102
2017	1500	4831	3375	10659	35	64.7	233	335

Source: NDP, 2013-2017

2.1.3 Laws and Regulations Related to Environmental Protection

Laws and regulations related to environmental protection are as follows.

(1) Law No.27/2009

Iraq central government has prepared the Federal Law No.27/2009, which is the basic law for environmental conservation. The federal law prescribes as following provisions.

- The law regulates to establish an Environmental Protection Council/Office to monitor the activities of environmental conservation in the country.
- The law regulates the EIA system for projects which will impact the environmental and social conditions. EIA report shall include following contents.
  - Predictions of negative and/or positive impact to surrounding environment conditions.
  - Mitigation methods to reduce the impacts to meet rules and regulations of the national and local government for environmental conservation.
  - Preliminary countermeasure for environmental conservation.

- Possibility of alternative technology to reduce environmental burden and save energy.
- Consideration of 3R（Reduce, Reuse and Recycle）activities.

- Preparation of environmental conservation management plan for air quality, soil, biodiversity and hazardous waste treatment.

This Law applies EIA for infrastructure implementation works such as water supply/sewerage facilities

(2) Regulation of Environmental Conservation

1) Water Quality Conservation

Water Quality Conservation Law of Rivers and Public Water Area (No.25/1967)

This federal law prescribes related regulations regarding water discharge to public water areas and sewerage systems. Article 7 prohibits the discharge of polluted waste water to public water area. Article 8 and 9 prescribes the conservation mechanism of water pollution by discharge of polluted waste water. Article 10 prohibits illegal dumping of solid and liquid waste, i.e. dead body of animals, dung and rotten materials to public water areas. The law also prescribes the national water quality standard and the effluent water quality standard.

Law of Water Resources Conservation (No.2/2001)

This federal law prescribes regulations of general water utilization including environmental water resource conservation, and the law provides the regulations of water resource development. The central government recognizes water as a fundamental matter for economic and social development. The law describes 1) prohibition of waste water discharge to public water areas and 2) recycle utilization of waste water. Article 5 prescribes that EPID has authority to regulate the effluent water quality standard of public water areas, sewerage system and rainfall water.

(3) Laws for Biodiversity

1) Law of Forest and Seedbed (No.30/2009)

This federal law prohibits cutting trees to protect water resources. The intentions of the law are preservation of biodiversity and green land which serves cultivation of water resources. Article 9 prohibits cutting trees by private companies without technical and legal compensation.

2) Law for Wild Animals and Birds (No.17/2010)

This federal law prescribes preservation of wild animals in Iraq. The law regulates hunting rules, however there is no description about the trade of wild animals from country to country.

(4) Laws for Social Consideration

1) Ownership of the Land

Article 23 of the Iraqi Constitution prescribes that the owner of the land has a right of buying and selling his property. Expropriation of land can be accepted only in a case of public profit.

2) Buying and selling of land

Law of Buying and Selling of land (No.12/1981)

The law prescribes the right of landowners regarding buying and selling land for public works. Article 1 prescribes rules and regulations of public compensation in expropriation. Article 2 prescribes rules and regulations in cases of buying and selling agricultural area, non-agricultural area and orchard area. Article 4-8 prescribes rules and regulations regarding agreed buying based on the assessment and compensation system by Land Assessment Committee. Article 9-21 prescribes the details of judicial buying by central government institutions which has a legal right of possession. Article 22-28 prescribes the procedure of transfer from government to government.

Article 29-30 prescribes about compensation, i.e. exchange of same value lands, and cash payment depending on assessed price. Article 31-32 prescribes compensation for residential area, industrial area, business area and construction area by the market price depending on field inspection.

3) Law of Historical and Cultural Heritage (No.55/2002)

This federal law prescribes historical/cultural tangible and intangible property. The law regulates contact methods between the people and related institutions when historical/cultural heritage is discovered. The regulation shall be applied to several construction works which may invade historical and cultural protection area.

(5) Laws of International Treaty

1) Ratification of Basel Treaty (No.3/2009)

The federal low prescribes “Basel Convention on the Control of Trans Boundary Movements of Hazardous Wastes and their Disposal”, usually known as the Basel Convention, is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent the transfer of hazardous waste from the developed to the less developed countries (LDCs). However, it does not address the movement of radioactive waste. The Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure environmentally sound management as closely as possible to the source of generation, and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate.

The Convention was opened for signature on 22 March 1989, and was enforced on 5 May 1992. As of February 2014, 180 states and the European Union have ratified to the Convention.

2) Ratification of the Kyoto Protocol (No.7/2008)

The Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC) is an international treaty which sets binding obligations on industrialized countries to reduce emissions of greenhouse gases. The UNFCCC is an environmental treaty with the goal of preventing dangerous anthropogenic (i.e., human-induced) interference of the climate system. According to the UNFCC website, the Protocol "recognizes that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity", and places heavier burdens on developed nations under the principle of "common but differentiated responsibilities". There are 192 parties to the convention: 191 states (including all the UN members except Andorra, Canada, South Sudan and the United States) and the European Union. The Protocol was adopted by Parties to the UNFCCC in 1997, and enforced in 2005.

3) Ratification of the Protection of the World Cultural and Natural Heritage (No.12/2008)

The United Nations Educational, Scientific and Cultural Organization (UNESCO) seeks to encourage the identification, protection and preservation of cultural and natural heritage around the world which are considered to be of outstanding value to humanity. This is embodied in an international treaty called the Convention concerning the Protection of the World Cultural and Natural Heritage, adopted by UNESCO in 1972.

4) Ratification of Biodiversity (1992) (No.31/2008)

The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA or the Treaty) stands as a tool of governance of plant resources that is, "the genetic material of plant origin with effective or potential value for food and agriculture" designed to respond at a global level to the objectives of economic solidarity and environmental sustainability. At first glance it could seem to be a matter between governments and farmers: in fact the Treaty, after stating in the Preamble that the contracting parties are convinced of the special nature of plant genetic resources, goes on to recognize that these resources are 'the raw material indispensable for crop genetic improvement, whether by means of farmers' selection, classical plant breeding or modern biotechnologies', affirming that 'the past, present and future contributions of farmers in all regions of the world, particularly those in centers of origin and diversity, in conserving, improving and making available these resources, is the basis of Farmers' Rights'

2.1.4 Water Quality and Environmental Standards

(1) Environmental Water Quality Standard

As mentioned in the above, Law No.25/1967 regulates the water quality and environmental standards for the public water areas. These values are shown in Table 2.14, along with the standards of WHO, USEPA, EU and Japan.

The Iraqi standards features are that it includes BOD and COD as environmental measurement items, and the standard values differ between the water areas. WHO, USEPA, EU and Japan standards all have

different values, and that of Iraq also have several item which regulate standard which do not match its counterparts.

Table 2.14 Water Quality and Environmental Standards of Iraq (Law No.25/1967)

No.	Parameter	Unit	Public water area				WHO	USEPA	EU	Japan
			A-1	A-2	A-3	A-4	Guideline value	Drinking water value	Directive	Water Standard etc.
1	Color	-	Normal	Normal	Normal	Normal	15 (true color units)	15 (color units)	Acceptable to consumers and no abnormal change	5 degrees (Property)
2	Temperature	deg C	-	-	-	-				
3	Suspended Solid (SS)	mg/L	-	-	-	-				
4	pH	-	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	-	-（C）	6.5～8.5(C)	6.5～9.5	5.8～8.6(Property), approx. 7.5(Satisfy)
5	Dissolved Oxygen (DO)	mg/L	> 5.0	> 5.0	> 5.0	-				
6	BOD_5	mg/L	< 5.0	< 3.0	< 3.0	-				
7	COD (Cr_2O_7 method)	mg/L	0.02	-	-	-				
8	Cyanide (CN^-)	mg/L	0.02	0.02	0.02	0.02	0.07	0.2 (as free cyanide)	0.05	0.01(Health)
9	Fluoride (F^-)	mg/L	0.2	0.2	0.2	0.2	1.5	4.0、2.0(C)	1.5	0.8(Health)
10	Free Chlorine	mg/L	Trace	Trace	Trace	Trace				
11	Chloride (Cl^-)	mg/L	200	200	200	200	250(C)	250(C)	250	200(Property)
12	Phenol	mg/L	0.005	0.005	0.005	0.005				
13	Sulfate (SO_4^{2-})	mg/L	200	200	200	200	250(C)	250(C)	250	
14	Nitrate (NO_3^-)	mg/L	15	15	15	50	50(urgent))	10 (as nitrate nitrogen)	50	10 (as nitrate nitrogen / nitrite nitrogen) (Health), 0.05 (as nitrite nitrogen), (Monitor, P)
15	Phosphate (PO_4^-)	mg/L	0.4	0.4	0.4	0.4				
16	Ammonium (NH_4^+)	mg/L	1	1	1	1	1.5(C)		0.5	
17	DDT	mg/L	nil	nil	nil	nil	0.002			
18	Lead	mg/L	0.05	0.05	0.05	0.05	0.01	0.015（AL)	0.01	0.05(Health)from Apr. 2003,0.01
19	Arsenic	mg/L	0.05	0.05	0.05	0.05	0.01 (P)	0.05	0.01	0.01(Health)
20	Copper	mg/L	0.05	0.05	0.05	0.05	2 (P)、1(C)	1.3（AL）、1.0(C)	2	1(Property)
21	Nickel	mg/L	0.1	0.1	0.1	0.1	0.02 (P)		0.02	0.01(Monitor, P)
22	Selenium	mg/L	0.01	0.01	0.01	0.01	0.01	0.05	0.01	0.01(Health)
23	Mercury	mg/L	0.001	0.001	0.001	0.001	0.001	0.002 (as inorganic	0.001	0.0005(Health)

No.	Parameter	Unit	Public water area				WHO	USEPA	EU	Japan
			A-1	A-2	A-3	A-4	Guideline value	Drinking water value	Directive	Water Standard etc.
								mercury)		
24	Cadmium	mg/L	0.005	0.005	0.005	0.005	0.003	0.005	0.005	0.01(Health)
25	Zinc	mg/L	0.5	0.5	0.5	0.5	3(C)	5(C)		1(Property)
26	Chromium	mg/L	0.05	0.05	0.05	0.05	0.05 (P)	0.1	0.05	0.05 (as hexavalent chromium)(Health)
27	Aluminum	mg/L	0.1	0.1	0.1	-	0.2(C)	0.05～0.2（C)	0.2	0.2(Satisfy)
28	Barium	mg/L	1	1	1	1	0.7	2		
29	Boron	mg/L	1	1	1	1	0.5 (P)		1	1(Monitor)
30	Cobalt	mg/L	0.05	0.05	0.05	0.05				
31	Iron	mg/L	0.3	0.3	0.3	0.5	0.3(C)	0.3(C)	0.2	0.3(Property)
32	Manganese	mg/L	0.1	0.1	0.1	0.1	0.5 (P)、0.1(C)	0.05(C)	0.05	0.05(Property), 0.01(Satisfy)
33	Silver	mg/L	0.01	0.01	0.01	0.01	U	0.01(C)		

Water area
A-1:River (include branch stream)
A-2:Stream, channel
A-3:Lake, pond
A-4:Spring, well, groundwater

(Notation)
P = Provisional value due to lack of information regarding health effects
U = Concentration in drinking water does not affect human health
NAD = Sufficient data not available to regulate guideline
C = Complaints may occur from users
TT = Reduction measure target for water treatment technology
AL = Level requiring measures by water business enterprises
MRDL =Maximum residual disinfectant level
Health=Standards related to human health
Property=Standard property for water service
Satisfy=Standard for water quality satisfaction
Monitor=Monitoring standards

(2) Efulluent Water Quality Standard

Law No.25/1967 also prescribes the effluent water quality standard shown in Table 2.15. The table shows the options of Japan and EU standard.

Table 2.15 Efulluent Water Quality Standard (Law No.25/1967)

No.	Parameter	unit	Iraq (No.25/1967)	Japan (No.79/1958, 2003 revised)	EU (91/271/EEC)
1	color	-	-	-	
2	temperature	deg C	< 35.0	-	
3	Suspended Solid (SS)	mg/L	60.0	< 40.0	< 35.0[5)] or < 60.0[5)]
4	pH	-	6.0 – 9.5	5.8 – 8.6	
5	Dissolved Oxygen (DO)	mg/L	-	-	
6	BOD_5	mg/L	< 40.0	< 10.0[2)] or < 15.0[2)]	< 25.0
7	COD (Cr_2O_7 method)	mg/L	< 100.0	-	< 125.0
8	Cyanide (CN^-)	mg/L	0.05	-	
9	Fluoride (F^-)	mg/L	5.0	-	
10	Free Chlorine	mg/L	Trace	-	
11	Chloride (Cl^-)	mg/L	< 1 %[1)], < 600.0[1)]	-	
12	Phenol	mg/L	0.01 – 0.05	-	
13	Sulfate (SO_4^{2-})	mg/L	< 1 %, 400.0, < 200.0	-	
14	Nitrate (NO_3^-)	mg/L	50.0	< 10.0[3)] or < 20.0[3)]	< 15.0[6)] or < 10.0[6)]

No.	Parameter	unit	Iraq (No.25/1967)	Japan (No.79/1958, 2003 revised)	EU (91/271/EEC)
15	Phosphate (PO_4^-)	mg/L	3.0	< 0.5[4] or <1.0[4] or < 3.0[4]	< 2.0[7]or < 1.0[7]
16	Ammonium (NH_4^+)	mg/L	-	-	
17	DDT	mg/L	nil	-	
18	Lead	mg/L	0.1	-	
19	Arsenic	mg/L	0.05	-	
20	Copper	mg/L	0.2	-	
21	Nickel	mg/L	0.2	-	
22	Selenium	mg/L	0.05	-	
23	Mercury	mg/L	0.005	-	
24	Cadmium	mg/L	0.01	-	
25	Zinc	mg/L	2.0	-	
26	Chromium	mg/L	0.1	-	
27	Aluminum	mg/L	5.0	-	
28	Barium	mg/L	4.0	-	
29	Boron	mg/L	1.0	-	
30	Cobalt	mg/L	0.5	-	
31	Iron	mg/L	2.0	-	
32	Manganese	mg/L	0.5	-	
33	Silver	mg/L	0.05	-	
34	Total hydrocarbons and its compounds	mg/L	8)	-	
35	Sulfide (S^{2-})	mg/L	-	-	
36	Ammonia	mg/L	-	-	
37	Ammonia gas	mg/L	-	-	
38	Sulfur Dioxide	mg/L	-	-	
39	Petroleum Alcohol	mg/L	-	-	
40	Calcium Carbonate	mg/L	-	-	
41	Organic Solvent	mg/L	-	-	
42	Benzene	mg/L	-	-	
43	Chlorobenzene	mg/L	-	-	
44	TNT	mg/L	-	-	
45	Bromine	mg/L	-	-	
46	Total Coliform	MNP/100mL		< 3,000.0	

Remark:

1) Chloride (Cl^-) : a) In case of discharge water amount is less than 0.1% of public water amount, Chloride concentration is applied higher (more 1%)、b) In case of discharge water amount is higher than 0.1% of public water amount, Chloride concentration shall be less than 600 mg/L.
2) Depends on treatment system
3) Depends on treatment system（T-N）
4) Depends on treatment system（T-P）
5) SS－35mg/L is applied for over than 10,000 peoples, SS-60mg/L is applied for 2,000-10,000 peoples.
6) T-N-15 mg/L is applied for over than 10,000 peoples, T-N-15mg/L is applied for 2,000-10,000 peoples.
7) T-P-2.0 mg/L is applied for over than 10,000 peoples, T-P 1.0mg/L is applied for 2,000-10,000 peoples.
8) Total hydrocarbons and its compounds are used for effluent water quality to A-1 and A-2 public water area, A-1 and A-2 is classified by Law (No.25/1967) a) In case discharge water amount is less than 0.1% of public water amount, the standard value is 10mg/L, b) In case discharge water amount is less than 0.2% of public water amount, the standard value is 5mg/L, c) In case discharge water amount is less than 0.3% of public water amount, the standard value is 3mg/L.

Source: JICA Study Team

(3) Drinking Water Quality Standard

Law No.417/1974 prescribes the Drinking Water Quality Standard shown in Table 2.16.

Table 2.16 Drinking Water Quality Standard（No.417/1974）

Parameter	Unit	Iraqi Standard (Law #417 1974)	WHO Guideline	Japan Water Standards
TDS	mg/L	500-1,500	Less than 1,000	Less than 500
K	mg/L	250	-	-
Na	mg/L	200	Less than 200	Less than 200
Ca	mg/L	75-200	-	Less than 300
Mg	mg/L	50-150	-	(total)
Cl	mg/L	200-250	Less than 250	Less than 200
HCO_3	mg/L	125/200	-	-
T.H.	mg/L	100-500	-	Less than 300
pH		6.5-8.2	6.5-8.5	5.8-8.6

Source: JCCME, 2013

2.2 Current Status of Water Supply and Sewerage Sector

2.2.1 Water and Sewerage Demand

(1) Water Supply

Water supply, service population, per capita water supply, and service coverage are shown in Table 2.17. In this table, the water volume necessary to serve 100 % coverage is shown as water demand. The national average of service coverage is 78 %. However, the coverage is lower in the southern four governorates except Messan.

Table 2.17 Water Demand

Location Governorates	Water Supply (m^3/day)	Service Population (persons)	Per capita Water Supply（Lpcd）	Service Coverage (%)	Water Demand (m^3/day)
Dahuk/central	97,520	248,137	393	79%	123,000
Dahuk/periphery	170,000	601,420	283	93%	184,000
Nineveh	685,011	2,147,475	319	76%	897,000
Sulaimaniya/central	192,247	707,404	272	96%	200,000
Sulaimaniya/periphery	218,893	763,302	287	72%	304,000
Kirkuk	621,195	1,138,911	545	86%	724,000
Irbil/central	320,680	695,958	461	95%	338,000
Irbil/periphery	223,675	570,400	392	54%	414,000
Diala	355,015	695,164	511	51%	701,000
AL-Anbar	478,236	1,187,382	403	80%	598,000
Baghdad/municipality	1,520,326	5,159,991	295	100%	1,520,000
Baghdad/periphery	400,000	993,186	403	64%	624,000
Babil	475,557	1,202,937	395	69%	685,000
Kerbala	377,811	925,093	408	91%	417,000
Waset	323,000	934,537	346	81%	398,000
Salahuddin	160,611	711,718	226	53%	303,000
AL-Najaf	455,234	1,048,884	434	86%	531,000
Qadisiya	216,503	793,018	273	73%	295,000
AL-Muthana	211,530	470,845	449	69%	308,000
Dhi-Qar	434,985	1,267,451	343	73%	599,000
Messan	413,057	759,775	544	82%	502,000
Basrah	763,172	1,638,386	466	68%	1,122,000

Location Governorates	Water Supply (m^3/day)	Service Population (persons)	Per capita Water Supply (Lpcd)	Service Coverage (%)	Water Demand (m^3/day)
Total	9,114,258	24,661,374	370	78%	11,787,000

Source: Environmental Survey in Iraq 2010 (UNICEF,2011):

(2) Sewerage

Sewerage demand is shown in Table 2.18. The generated sewage is connected to central sewage treatment plants and small treatment plants. Since almost all supplied water is discharged to sewerage, the sewerage demand can be calculated by the water demand and the discharge rate. By using the water demand shown in Table 2.17, the average discharge rate is calculated as 77%.

The national average of coverage is 23%, mostly due to the high value of Bagdad municipality, while many governorates are still zero (0) %. The coverage of Messan is in the higher rank as 40 %, though Dhi-Qar is average and Basrah is lower than average. Al-Muthanna is very low at only 1%.

Table 2.18 Sewerage Demand

Governorate	Service Population *1 (Person)	Coverage (%)	Demand*2 (m^3/day)
Dahuk	0	0.0	0
Nineveh	112,521	4.0	15,150
Sulaimaniya	1,147,800	63.7	0
Kirkuk	26,536	2.0	1,284
Irbil	0	0.0	0
Diala	0	0.0	0
AL-Anbar	35,649	2.4	47,006
Baghdad/municipality	4,231,193	82.0	1,200,000
Baghdad/periphery	0	0.0	0
Babil	60,628	3.5	12,000
Kerbala	288,763	28.3	67,000
Waset	0	0.0	0
Salahuddin	241,552	18.0	27,000
AL-Najaf	159,170	13.0	25,100
Qadisiya	118,719	11.0	40,405
AL-Muthana	6,847	1.0	10,000
Dhi-Qar	349,249	20.0	98,100
Messan	369,530	40.0	70,000
Basrah	313,230	13.0	70,000
Total	7,461,386	23.8	1,683,045

Source: Environmental Survey in Iraq 2010 (UNICEF,2011):

Note: *1) Connected to sanitary or combined sewer, *2) Sewage connected to central treatment plant and small treatment plant

2.2.2 Current Status of Water Supply and Sewerage Facilities

(1) Water Supply

1) Water Treatment Plant

Table 2.19 shows the types and production of water treatment plant in each governorate. 66 % of the production is related to water treatment plants, although many complexes are used in Basrah, Dhi-Qar, and Messan.

Table 2.19 Types and Production of Water Treatment Plant in Each Governorate

(Production: m^3/day)

Governorate		Water Treatment Plant	Complex	Well	Desalination*1)	Solar*2)	Total
Dahuk/central	No.	3	0	1	0	0	4
	Production	101,520	0	0	0	0	101,520
Dahuk/periphery	No.	2	3	479	0	0	484
	Production	840,000	690	105,300	0	0	189,990
Nineveh	No.	33	90	15	0	10	148
	Production	1,019,927	106,739	14,880	0	138	1,141,684
Sulaimaniya /central	No.	3	0	0	0	0	3
	Production	216,000	0	0	0	0	216,000
Sulaimaniya /periphery	No.	51	5	1	0	0	57
	Production	201,933	2,500	14,860	0	0	219,293
Kirkuk	No.	16	98	104	11	19	248
	Production	396,248	144,153	95,798	238	1,022	637,459
Irbil/central	No.	3	0	425	0	0	428
	Production	182,680	0	138,000	0	0	320,680
Irbil/periphery	No.	8	0	968	0	0	976
	Production	42,000	0	186,240	0	0	228,240
Diala	No.	25	176	0	1	34	236
	Production	344,809	49,602	0	8	49	394,468
AL-Anbar	No.	21	366	0	2	19	408
	Production	277,200	280,000	0	700	236	558,136
Baghdad /municipality	No.	9	36	0	0	0	45
	Production	2,314,924	218,936	0	0	0	2,533,860
Baghdad /periphery	No.	10	180	0	0	20	210
	Production	280,000	200,000	0	0	30	480,030
Babil	No.	18	272	0	1	22	313
	Production	245,280	230,277	0	0	402	475,959
Kerbala	No.	7	120	0	2	16	145
	Production	327,560	145,412	0	1,100	308	474,380
Waset	No.	21	202	19	19	24	285
	Production	183,200	200,826	416	416	408	385,266
Salahuddin	No.	19	171	6	0	22	218
	Production	162,005	67,440	16,000	0	620	246,065
AL-Najaf	No.	13	116	1	2	0	132
	Production	366,050	128,960	250	390	0	495,650
Qadisiya	No.	15	195	0	0	21	231

Governorate		Water Treatment Plant	Complex	Well	Desalination*1)	Solar*2)	Total
	Production	216,900	92,240	0	0	250	309,390
Al-Muthanna	No.	4	54	3	13	28	102
	Production	161,410	48,480	1,390	5,568	250	217,098
Dhi-Qar	No.	15	160	0	48	0	223
	Production	285,736	326,920	0	2,634	0	615,290
Messan	No.	13	252	0	12	22	299
	Production	72,000	434,988	0	2,160	800	509,948
Basrah	No.	12	300	0	49	22	383
	Production	240,300	625,742	0	720	1,200	867,962
Total	No.	321	2796	2022	160	279	5578
	Production	7,721,682	3,303,905	573,134	13,934	5,713	11,618,368

Source: Environmental Survey in Iraq 2010 (UNICEF,2011)

Note: *1) Desalination is RO unit with capacity of 10 – 50 m^3/hr
*2) Solar is small RO unit with capacity of 1 m^3/hr
Both of these two kind of plant is difficult to operation and maintenance, they are not in use currently.

2) Network

Table 2.20 shows the service population and service coverage for the urban and rural areas of each governorate. The national average service coverage is 86 % in urban areas and 62 % in rural areas, although the coverage is lower in the southern four governorates except Messan.

Table 2.20 Service Population and Service Coverage for Urban and Rural for Each Governorate

Governorate	Service Population (person)			Service Coverage (%)		
	Urban	Rural	Total	Urban	Rural	Total
Dahuk/central	238,766	9,371	248,137	80	65	79.3
Dahuk/periphery	399,097	202,323	601,420	94	90	92.6
Nineveh	1,426,798	720,677	2,147,475	80	70	76.3
Sulaimaniya/central	678,299	29,105	707,404	100	50	96.0
Sulaimaniya/periphery	635,395	127,907	763,302	75	60	71.6
Kirkuk	951,022	187,889	1,138,911	100	50	85.8
Irbil/central	695,958	0	695,958	95	0	87.5
Irbil/periphery	532,000	38,400	570,400	55	43	76.3
Diala	223,962	471,202	695,164	34	66	50.6
AL-Anbar	590,497	596,885	1,187,382	82	78	79.9
Baghdad/municipality	5,159,991	0	515,991	100	0	100.0
Baghdad/periphery	528,183	465,003	993,186	75	55	64.1
Babil	654,365	548,572	1,202,937	80	60	69.4
Kerbala	652,814	272,279	925,093	96	80	90.7
Waset	600,588	333,949	934,537	90	69	81.2
Salahuddin	427,290	284,428	711,718	72	38	53.0
AL-Najaf	783,581	265,303	1,048,884	90	75	85.7
Qadisiya	487,980	305,038	793,018	80	65	73.5
AL-Muthana	240,080	230,765	470,845	80	60	68.8
Dhi-Qar	878,817	388,634	1,267,451	80	60	72.6
Messan	568,696	191,079	759,775	85	75	82.2
Basrah	1,348,956	289,430	1,638,386	70	60	68.0
Total	18,703,135	5,958,239	24,661,374	86.1	62.1	78.7

Source: Environmental Survey in Iraq 2010 (UNICEF,2011)

Comment: Figures in this table is connection, the service level is very low from satisfaction

(2) Sewerage

1) Sewage treatment Plant (STP)

Numbers and the planned capacity for central STP and small STP are shown in Table 2.21. 21 central STPs and 29 small STPs are constructed, and the total capacity is 1,350 thousand m^3/day, (1,280 thousand m3/day for central STPs and 70 thousand m^3/day for small STPs), and this is only 12 % of the total water production (11,610 thousand m3/day as shown in Table 2.19).

Among the STPs, several do not have a sufficient capacity such as the STP of Bagdad, as the sewage in flow is 1,200,000m^3/day (Table 2.18) against its capacity of 680,000m^3/day,

Table 2.21 Number and Planned Capacity of Sewage Treatment Plant

Governorate	Central Sewage Treatment Plant		Small Treatment Plant	
	Nos	Planned Capacity (m^3 /day)	Nos	Planned Capacity (m^3 /day)
Dahuk	0	0	0	0
Nineveh	0	0	7	23,000
Sulaimaniya	0	0	0	0
Kirkuk	0	0	9	8,180
Irbil	0	0	1	200
Diala	0	0	0	0
AL-Anbar	3	73,600	0	0
Baghdad/municipality	3	680,000	0	0
Baghdad/periphery	0	0	0	0
Babil	1	12,000	1	0
Kerbala	1	50,000	2	25,000
Waset	0	0	0	0
Salahuddin	4	48,500	0	0
AL-Najaf	1	35,000	2	200
Qadisiya	2	15,750	3	814
AL-Muthana	0	0	1	5,000
Dhi-Qar	3	35,000	3	10,100
Messan	2	45,000	0	0
Basrah	1	286,000	0	0
Total	21	1,280,850	29	72,494

Source: Environmental Survey in Iraq 2010 (UNICEF,2011)

2) Network

Service coverage for each type of sewer is shown in Table 2.22. Five (5) governorates, including the high-coverage governorates of over 40 %, has combines sewer, while the others use separated sewer system.

Table 2.22 Service Coverage for Type of Sewer

Governorate	Service Population (Person)	Coverage (%)	Type		
			Sanitary Sewer	Rain Sewer	Combined Sewer
Dahuk	0	0.0	0.0	36.4	0.0
Nineveh	112,521	4.0	4.0	39.0	0.0
Sulaimaniya	1,147,800	63.7	0.0	0.0	26.6
Kirkuk	26,536	2.0	0.0	28.0	2.0
Irbil	0	0.0	0.0	20.0	0.0
Diala	0	0.0	0.0	20.0	0.0
AL-Anbar	35,649	2.4	13.0	50.0	0.0
Baghdad/municipality	4,231,193	82.0	20.0	20.0	60.0
Baghdad/periphery	0	0.0	0.0	15.0	0.0
Babil	60,628	3.5	3.5	20.0	0.0
Kerbala	288,763	28.3	29.0	56.0	0.0
Waset	0	0.0	0.0	55.0	0.0
Salahuddin	241,552	18.0	23.0	35.0	0.0
AL-Najaf	159,170	13.0	13.0	25.0	0.0
Qadisiya	118,719	11.0	30.0	39.0	0.0
AL-Muthana	6,847	1.0	1.0	20.0	0.0
Dhi-Qar	349,249	20.0	48.0	42.0	10.0
Messan	369,530	40.0	40.0	40.0	45.0
Basrah	313,230	13.0	13.0	13.0	0.0
Total	7,461,386	23.8	12.5	30.2	7.6

Source: Environmental Survey in Iraq 2010 (UNICEF,2011)

3) Pump Station

Numbers of the four types of pump stations are shown in Table 2.23. Of the total 891 pump stations, 458 are for rain water discharge. There are more sanitary pump stations than combined stations because the separate system coverage is higher. Bagdad has the most pumping stations in number while Basrah is the second, though the coverage is low. A submersible pump station is a small-sized submersible pump applied pump station which is usually not equipped with grit chamber, and applied in only Bagdad.

Table 2.23 Number of Pump Station for Types

Governorate	Rain Water Discharge	Sanitary Wastewater	Combined Sewage	Submersible Type	Total
Dahuk	0	0	0	0	0
Nineveh	6	5	0	0	11
Sulaimaniya	0	0	0	0	0
Kirkuk	3	0	1	0	4
Irbil	0	0	0	0	0
Diala	16	1	1	0	18
AL-Anbar	25	4	0	0	29
Baghdad/municipality	34	41	72	104	251
Baghdad/periphery	26	0	0	0	26

Governorate	Rain Water Discharge	Sanitary Wastewater	Combined Sewage	Submersible Type	Total
Babil	25	12	0	0	37
Kerbala	15	5	0	0	20
Waset	80	0	0	0	80
Salahuddin	11	19	0	0	30
AL-Najaf	8	4	0	0	12
Qadisiya	19	25	0	0	44
AL-Muthana	39	1	4	0	44
Dhi-Qar	53	0	7	0	60
Messan	8	14	31	0	53
Basrah	90	82	0	0	172
Total	458	213	116	104	891

Source: Environmental Survey in Iraq 2010 (UNICEF,2011)

2.2.3 Current Status of Water Supply and Sewerage Facility Operation

(1) Water Supply

1) Operation Status

The capacity, production and operation ratio of water treatment plants are shown in Table 2.24. The national average of the operation ratio is 76.6 %, which is relatively high considering the annual fluctuation. Regarding the southern four governorates, the operation ratio is over 75 % for all four governorates.

Table 2.24 Capacity, Production and Operation Ratio of Water Treatment Plant

Governorate	Intake (m^3 /day)	Capacity (m^3 /day)	Production (m^3 /day)	Operation Ratio(%)
Dahuk / central	168,400	254,400	101,520	39.9
Dahuk/ periphery	90,000	96,000	84,000	87.5
Nineveh	1,121,920	955,387	1,019,927	106.8
Sulaimaniya/ central	216,000	316,800	216,000	68.2
Sulaimaniya/ periphe	205,801	220,000	201,933	91.8
Kirkuk	575,062	558,096	396,248	71.0
Irbil / central	228,360	243,760	182,680	74.9
Irbil /periphery	50,000	110,200	42,000	38.1
Diala	561,860	561,860	344,809	61.4
AL-Anbar	291,060	400,840	2,314,924	69.2
Baghdad/municipalit	2,430,689	2,986,849	2,314,924	77.5
Baghdad / periphery	35,000	35,000	280,000	80.0
Babil	289,808	306,600	245,280	80.0
Kerbala	342,982	341,280	327,560	96.0
Waset	250,000	219,840	183,200	83.3
Salahuddin	172,013	351,880	162,005	46.0
AL-Najaf	438,910	530,400	366,050	69.0
Qadisiya	299,000	350,000	216,900	62.0
AL-Muthana	195,360	177,050	161,410	91.2
Dhi-Qar	314,310	346,016	285,736	82.6
Messan	88,000	80,000	72,000	90.0
Basrah	293,700	320,400	240,300	75.0

Governorate	Intake (m^3 /day)	Capacity (m^3 /day)	Production (m^3 /day)	Operation Ratio(%)
Total	8,973,235	10,077,658	7,721,682	76.6

Source: Environmental Survey in Iraq 2010 (UNICEF,2011)

2) Leakage

Water production, leakage volume and leakage rate are shown in Table 2.25. The national average of leakage rate is 24 %, and governorates with higher production tend to have higher leakage rate, such as Bagdad. The leakage of Basrah is a low 10 %, but 30 % was obtained through the Project survey as described in Chapter 3.

Water meter installation is necessary to obtain the accurate leakage rate, although the average current installation ratio is very low.

Table 2.25 Leakage in Network

Governorate	Production (m^3/day)	Leakage Volume (m^3/day)	Leakage Rate (%)
Dahuk/central	101,520	32,000	31.5
Dahuk/periphery	189,990	20,000	10.5
Nineveh	1,141,684	456,673	40.0
Sulaimaniya/central	216,000	23,753	11.0
Sulaimaniya/periphery	219,293	4,467	2.0
Kirkuk	637,459	63,108	9.9
Irbil/central	320,680	57,672	18.0
Irbil/periphery	228,240	14,860	6.5
Diala	394,468	39,446	10.0
AL-Anbar	558,136	79,664	14.3
Baghdad/municipality	2,533,860	1,013,551	40.0
Baghdad/periphery	480,030	135,000	28.1
Babil	475,959	56,151	11.8
Kerbala	474,380	95,469	20.1
Waset	385,266	17,285	4.5
Salahuddin	246,065	68,834	28.0
AL-Najaf	495,650	95,494	19.3
Qadisiya	309,390	92,817	30.0
AL-Muthana	217,098	67,570	31.1
Dhi-Qar	615,290	177,671	28.9
Messan	509,948	96,891	19.0
Basrah	867,962	104,069	12.0
Total	11,618,368	2,812,445	24.2

Source: Environmental Survey in Iraq 2010 (UNICEF,2011)

A number of staffs are shown in Table 2.26. Totally 46,000 persons are working in the water directorate of governorate levels and 75 % are regular employees. By job types, there are 12,600 technician, which is 12 % of all staffs.

Table 2.26 Number of Staffs in Water Directorate in Governorate

Governorate	Engineer	Work supervision	Technician	Administrative	Unskilled labor	Driver	Other	Total			
								Proper	Contract	Daily	Total
Dahuk/central	34	356	76	45	190	31	0	485	247	0	732
Dahuk/periphery	79	44	1,005	98	605	99	39	1,195	774	0	1,969
Nineveh	123	1,330	182	131	338	156	174	1,862	0	572	2,434
Sulaimaniya/central	78	325	373	122	171	73	130	1,213	59	0	1,272
Sulaimaniya/periphery	80	0	358	428	1,740	109	0	2,145	570	0	2,715
Kirkuk	70	0	138	149	415	115	529	1,205	0	211	1,416
Irbil/central	51	9	63	204	419	39	424	784	425	0	1,209
Irbil/periphery	105	12	115	357	180	205	3,478	3,532	920	0	4,452
Diala	68	0	1,152	114	35	174	462	1,558	187	260	2,005
AL-Anbar	95	0	175	201	0	83	1,652	1,423	36	717	2,206
Baghdad/municipality	230	0	1,747	674	1,510	79	29	3,453	133	683	4,269
Baghdad/periphery	92	0	1,004	306	0	131	364	1,361	0	536	1,897
Babil	99	0	2,379	116	112	165	130	1,793	0	1,208	3,001
Kerbala	94	0	1,002	267	0	0	728	1,574	517	0	2,091
Waset	66	0	434	101	0	149	1,100	1,254	266	238	1,758
Salahuddin	51	0	76	78	862	92	0	1,031	0	128	1,159
AL-Najaf	97	0	142	104	642	127	352	1,351	34	79	1,464
Qadisiya	67	0	137	242	607	101	781	1,285	457	193	1,935
AL-Muthana	44	0	591	102	0	97	131	863	39	63	965
Dhi-Qar	89	0	1,045	265	0	88	952	1,928	0	511	2,439
Messan	42	0	177	148	1,073	120	0	1,234	132	194	1,560
Basrah	86	0	188	293	0	95	2,568	1,968	150	1,112	3,230
Total	1,840	2,076	12,559	4,545	8,899	2,328	13,931	34,497	4,946	6,735	46,178

Source: Environmental Survey in Iraq 2010 (UNICEF,2011)

(2) Sewerage

Planned capacity, actual inflow and operation ratio of STPs are shown in Table 2.27. The national average of central STP operation ratio is an over-high 115.7 %, because the operation ratio in Baghdad/municipality and Qadisiya exceeds 100 %. Although several governorates are below 25 % such as AL-Anbar, Salahuddin, and Basrah, the majority show high operation ratio, as over 70 %.

Table 2.27 Planned Capacity, Actual Inflow and Operation Ratio of STP

Governorate	Central STP			Small STP		
	Planned Capacity (m^3 /day)	Actual Inflow (m^3 /day)	Operation Ratio	Planned Capacity (m^3 /day)	Actual Inflow (m^3 /day)	Operation Ratio
Dahuk	0	0	0.0	0	0	0.0
Nineveh	0	0	0.0	23,000	15,150	65.9
Sulaimaniya	0	0	0.0	0	0	0.0
Kirkuk	0	0	0.0	8,180	46	0.6
Irbil	0	0	0.0	200	150	75.0
Diala	0	0	0.0	0	0	0.0
AL-Anbar	73,600	6,624	9.0	0	0	0.0
Baghdad/municipality	680,000	1,200,000	176.5	0	0	0.0
Baghdad/periphery	0	0	0.0	0	0	0.0

Governorate	Central STP			Small STP		
	Planned Capacity (m^3 /day)	Actual Inflow (m^3 /day)	Operation Ratio	Planned Capacity (m^3 /day)	Actual Inflow (m^3 /day)	Operation Ratio
Babil	12,000	12,000	100.0	0	0	0.0
Kerbala	50,000	48,000	96.0	25,000	25,000	100.0
Waset	0	0	0.0	0	0	0.0
Salahuddin	48,500	11,000	22.7	0	0	0.0
AL-Najaf	35,000	25,000	71.4	200	100	50.0
Qadisiya	15,750	39,705	252.1	814	700	86.0
AL-Muthana	0	0	0.0	5,000	5,000	100.0
Dhi-Qar	35,000	25,000	71.4	10,100	3,500	34.7
Messan	45,000	45,000	100.0	0	0	0.0
Basrah	286,000	70,000	24.5	0	0	0.0
Total	1,280,850	1,482,329	115.7	72,494	49,646	68.5

Source: Environmental Survey in Iraq 2010 (UNICEF,2011)

The staff numbers of the sewerage directorate are shown in Table 2.28. Total number of staff is 12,600, and 91 % are regular employees. By job types, “un-skilled labor” and “others” occupy the largest portion and the ratio is around 20 %, respectively.

Table 2.28 Staff Number of Sewerage Directorate in Governorate

Governorate	Engineer	Work supervision	Technician	Administrative	Unskilled labor	Driver	Other	Total			
								Proper	Contract	Daily	Total
Dahuk	5	0	0	3	7	14	0	25	4	0	29
Nineveh	54	22	71	96	124	65	184	598	2	16	616
Sulaimaniya	35	5	5	15	33	44	1	89	49	0	138
Kirkuk	43	0	66	51	0	65	218	440	0	3	443
Irbil	35	2	25	46	64	21	5	157	41	0	198
Diala	57	0	319	71	72	63	0	513	0	69	582
AL-Anbar	93	76	436	163	127	65	11	906	0	65	971
Baghdad/municipality	114	5	186	95	0	16	0	402	14	0	416
Baghdad/periphery	55	0	240	80	0	63	143	541	0	40	581
Babil	108	0	299	325	234	63	0	869	0	160	1,029
Kerbala	93	0	65	117	342	91	227	883	0	52	935
Waset	66	554	85	93	0	74	49	754	0	167	921
Salahuddin	53	56	149	56	282	48	0	599	0	45	644
AL-Najaf	68	0	80	41	66	70	267	552	0	40	592
Qadisiya	53	0	45	64	285	75	131	603	0	50	653
AL-Muthana	31	90	19	59	164	39	34	420	0	16	436
Dhi-Qar	55	0	85	129	0	102	912	1,179	0	104	1,283
Messan	27	0	53	55	623	56	71	834	0	81	915
Basrah	56	10	114	120	211	244	439	1,125	0	69	1,194
Total	1,101	820	2,342	1,679	2,634	1,308	2,692	11,489	110	977	12,576

Source: Environmental Survey in Iraq 2010 (UNICEF,2011)

2.2.4 Development Policy

In the National Development Plan (NDP) 2013-2017, national development plans of Iraq are as follows.

(1) Water Sector

During the 1970s and 1980s, the country witnessed a development in the service delivery field, especially water services, which reached 95% urban residents and 75% rural areas.

The results of the 2011 Multiple Indicator Cluster Survey indicated a gran difference in access to drinking water sources between urban and rural governorates. Drinking water is available to about 89% of residents, for 97% whom live in urban areas and for 76% of the rural areas. Also, 65% of households use public water networks as the main source of drinking water, and said public network provides 25% of users with less than two hours of water service per day.

A vision of National Development Plan 2013-2017 is "Guaranteeing all people's access to portable water" and the plan set five goals for nation-wide development (Table 2.29).

Table 2.29 Goals for Water and Sanitation in National Development Plan 2013-2017

Goal	Description of Goal / Means to Achieve Goal
First Goal Increasing Water Coverage and Reducing Waste	Increase the rate of people provided with the service in governorates (expect Baghdad) from 82% in 2011 to 98% in 2017 Means to Achieve Goal: 1. Expedite completion of projects being executed – currently 30 projects 2. Establish new projects – 83 projects 3. Invite international renowned companies to execute water projects
Second Goal Reduce the difference between rural and urban	Reduce the number of residents without access to safe drinking water to 2% in urban areas and 15% in rural areas Means to Achieve Goal: 1. Give priority to the rehabilitation of existing water projects 2. Establish water desalination projects in governorates that suffer from high levels of salinity, especially the southern governorates 3. Intensify programs that provide drinking water to villages and rural areas
Third Goal Providing High Quality Water at a Rate of 350 liters per Capita a Day	Means to Achieve Goal: 1. Complete ongoing projects and launch proposed new projects throughout the duration of the plan 2. Reduce waste in networks through the establishment of transportation and distribution networks and replacing those that are no longer usable
Fourth Goal Promoting the Private Sector's Contribution to Water Services	Means to Achieve Goal: 1. Launch projects to produce water through the build-operate transfer method 2. Provide consultation services 3. Apply to private sector: Maintenance of water networks, quality control and revenue collection
Fifth Goal Rationalizing water use	Means to Achieve Goal: 1. Raise the consumer awareness about rationalization, especially for human use 2. Provide water consumption meters for all housing units 3. Reduce subsidies for drinking water services and base tariffs on consumption

Source: NDP, 2013-2017

(2) Sanitation Sector

Results of the Cluster Survey conducted by the Central Organization for Statistics in 2011 indicate that around 96% of residents in Iraq use improved sanitation means: 99% in urban areas and 90% in rural

areas. However, this percentage decreases when considering a sanitation system linked to a sewage pumping network. In the latter case, 4% of residents use these systems in rural areas and 33% in urban areas. The 2011 Knowledge Network Survey showed dissatisfaction with the still prevailing sanitation services in Iraq, with 59% of households describing these facilities as bad or very bad.

This percentage increases in rural areas and reaches 85%, especially in central and southern Iraq. About 1/3 of Iraqi households have access to public sanitation services and 66% of these households are based in urban areas, mainly Sulaymaniya and Baghdad. On the national level, more than half, as 53% of households categorized as having a high per capita spending rate have access to the public network, compared to 9% of households categorized as having a low per capita spending rate. Households with no access to the public network tend to use septic tanks, and covered sewage holes.

It should be noted that 83% of wastewater is not subjected to sufficient treatment, which leads to very dangerous environmental problems that puts the health of citizens at risk and form an obstacle to achieving sustainable development.

Table 2.30 Development Plans for Sanitation Sector

Item	Outline
Vision	Realize sustainable sanitary environment to meet the MDG (Millennium Development Goals)
Goal 1	Improve the ratio of sewage service coverage to 95% for Bagdad, and 53% for other governorates by year 2017.
Goal 2	Improve the waste disposal situation of rivers.

Source: NDP, 2013-2017

2.3 Legislation and Organizations of Water Supply and Sewerage Sector

2.3.1 Organization for Construction and O&M

According to the survey of JCCME (2013), there are number of Iraqi government institutions and bodies involved in water supply and sewerage sectors. This includes headquarters of central government entities in Baghdad, branches of these central government entities at the provincial (governorate) level and provincial (governorate) governments themselves. Outlines of each institution are summarized below.

(1) Central Government HQs

1) Ministry of Municipalities and Public Works (MMPW)

MMPW is the government body responsible for restoring and improving the municipal services such as Water supply, Sewage treatment, and local administration in all provinces except Baghdad.

MMPW is tasked with strategizing, budgeting and implementing centrally funded projects and the most important entity in Iraq's water and sewage sectors.

2) Ministry of Water Resources (MoWR)

MoWR is responsible for handling all of Iraq's water issues and managing the development and exploitation of surface and groundwater. MoWR main duties are related to water storage, construction of

dams and irrigation facilities, flood control and groundwater resources management.
MoWR is of secondary importance to the MMPW, primarily because water and sewage projects are executed through the latter, and not the former. The MoWR is relevant to the water and sewage sectors because it makes strategic decisions about Iraq's waterways that have a direct impact on the feasibility of specific water projects.

3) Ministry of Planning (MoP)

MoP is responsible mainly for conducting research, studies, and developing plans that achieve the goal of economic and human development in Iraq. MoP also provides statistical data and information necessary needed by state agencies and establishing a national database comprehensive.
MoP is relevant to the water and sewage sectors as its statistical wing COSIT (Central Organization for Statistics and Information Technology) undertakes studies on water and sewage issues that in turn help to direct the strategic decisions of the MMPW.

4) Ministry of Environment (MoE)

MoE is responsible for the oversight of policy, planning, regulation and enforcement of controls on matters that affect Iraq's environment, public health, biodiversity and cultural and natural heritage. MoE formulates the national strategies for environmental protection, drafting and reviewing legislation related to environmental matters and sets the national pollutants norms and standards.
MoE plays a role in conducting environmental studies of Iraq's waterways, and has the ability to advise on a project if it feels the project could negatively impact Iraq's environment.

5) Ministry of Health (MoH)

MoH task is to provide health and medical services to every Iraqi citizen during normal and emergency circumstances in the country. The ministry also administrates the affairs of health and medical cadres in Iraq. It has a responsibility to provide best requirements of curative and health preventive security to all individuals of society.
MoH plays a role similar to the MoE in assessing environmental impacts of projects involving Iraq's waterways. Specifically, the MoH looks at the health impact of given projects on Iraq's citizenry.

6) The Prime Minister's Office (PMO)

While in theory the PMO should not be directly involved in project implementation, anecdotally, the office will order the implementation of a specific project by decree, essentially overriding the MMPW. (According to the interview with district level official in survey of JCCME (2013))

MoWR decision-making has a direct impact on drinking water projects implemented by the MMPW and the provincial governments. However, some decisions taken by the MoWR work counter to the strategic planning of the provincial governments, and/or the MMPW.
For example, a case when the MMPW plans to draw river water from a source nearby the consumer can

be considered. MMPW thinks that if the water source is at a distant location, the water supply may be cut off if the supply routes should be destroyed by war. But when the MoWR restricts the water intake to avoid seawater retrospect or to prevent salination, this can cause strategic differences between the two authorities.

(2) Central Government Branches at the Provincial (Governorate) Level

a) Directorate of Water (DoW)

Every governorate has a DoW office in its provincial capital. The DoW is the provincial level arm of the Water Directorate of MMPW. The provincial directorates are also responsible for operating water supply system in the province.

b) Directorate of Sewerage (DoS)

Every governorate has a DoS office in its provincial capital. The DoS is the provincial level arm of the Sewerage Directorate of MMPW. The provincial directorates are also responsible for operating sewerage system in the province.

Central government HQs has its branch office in each province. As regards MoWR, Iraq's governorates typically have a provincial level director general for the MoWR located in each provincial capital.

(3) Provincial Government

a) Office of the Governor

The governor's office is in charge of strategic planning for the water and sewage sectors, and also for making the final decision on the issuing of tenders.

b) Provincial Council (PC)

They are the highest legislative and supervisory authority within the administrative boundaries of Governorates. Decentralization entitled them to draft and issue local legislation. They are subject to the control of the parliament.

The PC works with the governor's office to come up with specific projects that are then tendered. The PC will typically have significant input in making recommendations to the governor's office on awarding tenders. The PC also plays an oversight role, ensuring that the projects are completed on time and at budget.

c) Committee for Reconstruction and Development (CRD)

The CRD is a sub-unit of the PC. In many provinces the CRD is essentially delegated the role of oversight and tender recommendations by the PC.

Since the Provincial Government controls a budgetary stream totally separate from that of the MMPW, on a practical level, a company implementing a water or sewage project will primarily interface with the MMPW and relevant provincial directorate if they are implementing a project via the MMPW's budget, or,

they will primarily interface with the office of the governor and the provincial council if they are implementing a project using the provincial government's budget stream.

2.3.2 Water Tariff

The Head Quarter of MMPW decides the water tariff as shown Table 2.31. This water rate for domestic customers is adapted nationwide, including the capital city (Bagdad), central and southern Iraq.
For business users, the charge is 90 Iraq Dinar per cubic meters. For charge of flat rate, the nominal consumption volume depending on the area of the building and category of business is decided, and water charges are calculated using 90 Iraq Dinar per cubic meters.
For governments and institutional users, the charge is 60 Iraq Dinar per cubic meters. For charge of flat rate, the nominal consumption volume depending on size of the pipe is decided, and water charges are calculated using 60 Iraq Dinar per cubic meters.
Charge rate of sewerage is the double of the water tariff.
The water and sewerage tariffs are charged combined, although very few customers pay for reasons such as the water contains salt and not sufficient for drinking, or the tariff is not charged according to the actual consumption volume. The Water Directory has acknowledged these problems and does not place strict punishments, such as disconnection, against users who do not pay the water bill.
Currently, a construction of a new facility which can remove the salt in the water is planned and it is expected to solve the problem of low tariff collection efficiency, after enabling sufficient water supply to the customers.

Table 2.31 Water Rate Adapted for Central and South Iraq

(Unit: IQD/m^3)

Water Tariff Table			ID	US$
Domestic Customer	House up to 100 square meters			
		First 30 cubic meters	6.0	0.0050
		30-60 Cubic meters	15.0	0.0125
		60-90 Cubic Meters	22.5	0.0187
		Flat Rate	1,305.0	1.0875
	House more than 100 square meters			
		First 30 cubic meters	6.0	0.0050
		30-60 Cubic meters	15.0	0.0125
		60-90 Cubic Meters	22.5	0.0187
		More than 90 cubic meters	60.0	0.0500
		Flat Rate	3,105.0	2.6000

Note: 1US$=1,200ID
Source: JICA Study Team

2.3.3 Organizational structure and functions of Water Directorate

(1) Organizational Structure and functions
Figure 2.13 shows the organization of MMPW. The Minister controls Directorates of General on Urban Planning, Municipalities, Water and Sewerage.

Major activities of General Directorate of Water are:

- Formulate national water supply and facility development plans, check, evaluate, approve and adjust project plans among each Directorate in the prefectures, and budget allocation.
- Technical support for construction projects and facility operations by Directorate in the prefectures, and execution of the budget.
- Technical support for water quality control by Directorate in the prefectures.
- Administrative work including accounting and human resources management
- Customer service work including decision of water rate.

Major activities of General Directorate of Sewerage are:

- Formulate national sewerage and rain storm drainage facility development plans, check, evaluate, approve and adjust project plans among each Directorate in the prefectures, and budget allocation.
- Technical support for construction project and facility operation by Directorate in the prefectures, and execution of the budget.
- Technical support for water quality control by Directorate in the prefectures.
- Administrative work including accounting and human resources management
- Customer service work including decision of water rate.

(Source: http://mmpw.gov.iq/PageViewer.aspx?id=26)

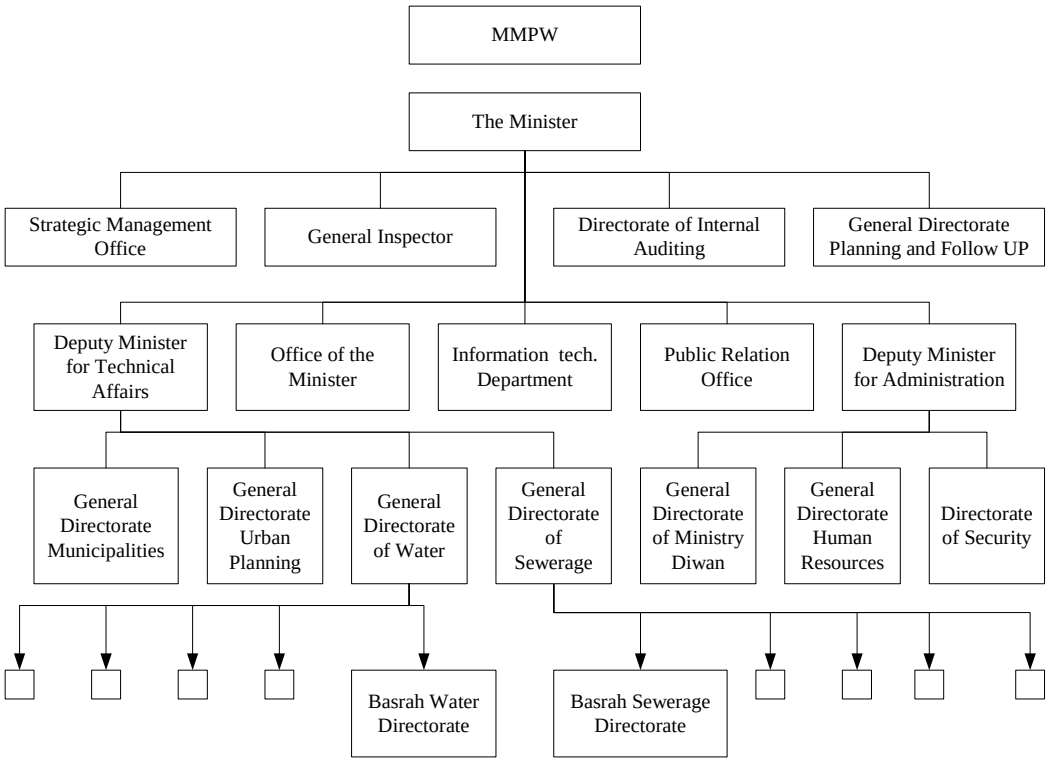


Figure 2.13 Organizational chart of MMPW

Source: JICA Study Team

Note: Approximately 300 staffs in general directorate of water and 200 in general directorate of sewerage.

(2) Project Implementation

1) Planning

The Branch office of MMPW (Water Directorate or Sewerage Directorate) formulates plans for large-scale construction projects of the water supply and sewerage system, and submits the plans to the head office of MMPW. The Head Office of MMPW and Ministry of Planning check the plan and then submit it to Ministry of Finance for budgeting. After Ministry of Finance approves the budget, Water Directorate and Sewerage Directorate implement the construction project.

The Water Directorate or Sewerage Directorate also formulate other construction projects of the water supply and sewerage system for governor of the prefecture, and submit to the governor office for approval. The Governor submits the plan to Ministry of Planning and Ministry of Finance for approval of budget. If Ministry of Finance approves the budget, the Water Directorate or Sewerage Directorate implements the plan of construction project for the governor.

2) Operation

The Water Directorate and Sewerage Directorate operate the water supply and sewerage system. The operational staff is dispatched to each facility to operate the facility, manage the office, produce and distributing water, and treat sewerage.

For operate water supply sewerage services, the Water Directorate and Sewerage Directorate are required to coordinate with Ministry of Health and Ministry of Environment and Water Resources. Water Directorate and Sewerage Directorate have the responsibility of constructing facilities; however, Ministry of Health has the responsibility for the quality of water and causes of water-related diseases. For this responsibility, Ministry of Health involves the Water Directorate and Sewerage Directorate in the operational work, and the Water Directorate and Sewerage Directorate sometimes require negotiation for the capacity of the facility regarding water quality. Water Directorate and Sewerage Directorate require approval from Ministry of Environment and Water Resources for volume of intake, volume and quality of discharged treated water from sewerage.

(3) Finance

1) Capital Budget

Prioritized projects such as national projects are handled by MMPW. Construction projects for facilities for the capital city or large cities which target large benefits and require large budget which exceed the budget for provincial government are categorized as a national project. The head quarter of MMPW checks the plan and allocates capital budget from the budget frame of MMPW. ODA projects are included in this category.

Capital budget for other construction projects are executed from budget frame of Governorate (Prefecture). These projects do not target a large population, do not require a large budget, and are possible to manage in the budget frame of Governorate. The Office of Governor adjusts the allocation of

the budget with other projects in the Governorate.

2) Operational budget

The principle to allocate the operational budget is; MMPW allocates the operational budget for operation of facility construction as a national project, and Governorate allocates the operational budget for operation of facility construction as a Governorate project. However, it is possible to adjust between these two operational budgets, if necessary. The budget for water supply and sewerage sector was requested but it has not been collected yet.

3) Revenue from water tariff

The Tariff Collection Unit of Water Directorate calculates and collects the water tariff. The Income unit of Sewerage Directorate calculates sewerage charges based on water charges. The calculated two billing information is sent to the branch office of Ministry of Finance. However, the Water Directorate and Sewerage Directorate are not adapting to the concept of financial independency. MMPW does not adapt the concept of subsidiary for fulfill shortage of revenue from water and sewerage tariff collection. Therefore, the revenue from collection of water tariff and sewerage charges is not included directly in the budget of MMPW. Also, MMPW does not adapt the concept of cost recovery nor sets any targets for cost recovery.

2.4 Other Circumstances of the Water Sector

2.4.1 Preparation / Procedure of EIA

The general flow of EIA procedure is shown in Figure 2.14. The project implementation body shall submit the project plan to Authority for Environmental Approval, and the authority will do site inspection and categorizes the class of the project. The authority will also indicate details (term of reference) of EIA to the implementation body according to the categorized class. The project categorized Class A and Class B shall be prepared and submit draft EIA report to the authority by the implementation body. The authority will suggest additional items, if necessary. The implementation body shall submit final EIA report to get the approval from the authority. A period of procedure time is not fixed, though the authority suggests that total procedure needs several months.

The Class categories are as follows.

Class A: Project which shall cause serious impact on the environment.

Class B: Project which may cause impact on the environment

Class C: Project which shall cause small impact on the environment, and project which that the environmental contamination can be suppressed to a minimum.

In general, sewage treatment plant is categorized to class A, RO plant for water treatment plant is Class B. conventional water treatment plant and pipe installation are class C.

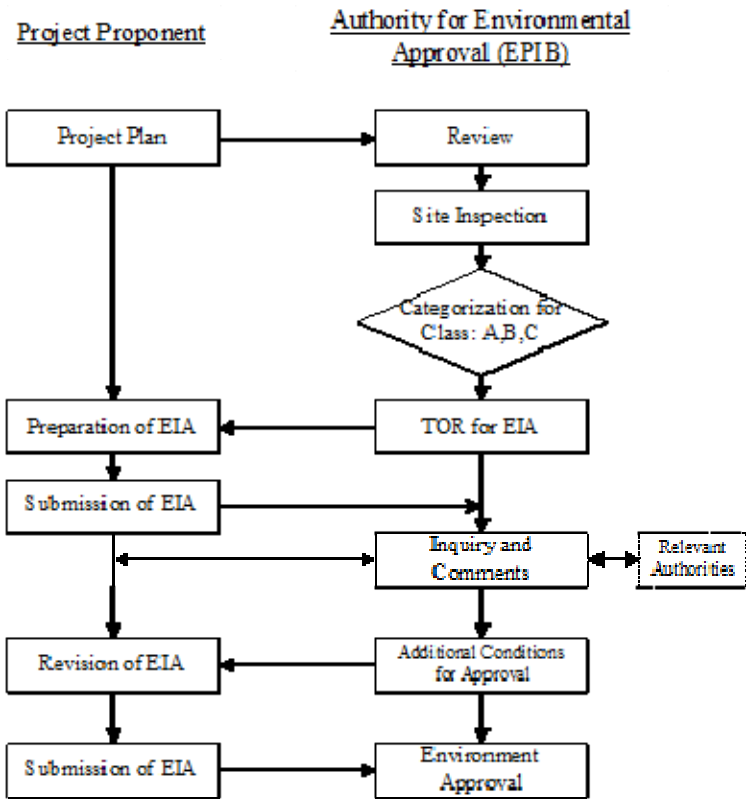


Figure 2.14 The General Flow of EIA Procedure

2.4.2 Electricity Supply Situation

The electricity supply in 2011 for each governorate is shown in the following table. The amount required for water supply/sewage business is included in the "Government", and the electricity supply ratio for the "Government" of the four southern governorates are all above the national average 24% (Basrah 27%, Dhi-Qar 30%, Messan 35%, Al-Muthanna 49%).

Priority power supply is given for water and sewage treatment plant as "a critical line". Governor requests to directorate of Ministry of Energy to supply power when power shortage happens, however, they cannot supply power if the reason is an accident.

Table 2.32 Electricity Supply per Governorate (except Kurds) (2011)

(Mega Watt hour)

Governorate		Illegal use		Industry		Agriculture		Government		Business		Domestic		Total
		%		%		%		%		%		%		
Al Risafa		0.5	7,952	13	223,190	3	54,697	20	346,496	21	361,171	43	746,427	1,739,933
Al Karkh	Baghdad	0.4	12,224	16	487,877	4	122,676	29	857,161	7	194,823	43	1,284,733	2,959,494
Al Sader		1.2	23,320	1	21,799	0	6,729	13	253,515	6	109,273	79	1,540,836	1,942,014
	Ninevah	0	260	29	802,933	3	73,800	22	607,483	3	82,563	44	1,246,152	2,813,191
	kirkuk	0.6	12,550	24	465,631	2	43,769	37	723,976	9	183,627	27	521,538	1,951,091
North	Salah Al-Deen	0.2	4,636	76	1,739,765	1	24,637	10	234,433	1	20,136	12	265,408	2,289,015
	Babil	1	8,179	10	107,141	2	23,261	16	171,295	4	37,695	68	727,230	1,074,801

Governorate		Illegal use		Industry		Agriculture		Government		Business		Domestic		Total
		%		%		%		%		%		%		
Middle Euphrates	Kerbela	1.2	11,605	16	153,872	2	23,394	33	311,066	8	73,341	40	376,697	949,975
	ALNajaf	1	4,552	18	158,460	2	17,523	15	131,661	9	76,247	55	480,726	869,169
	ALQadisiya	0.4	3,263	6	42,801	4	28,725	26	190,029	4	26,447	61	451,083	742,348
	ALAnbar	1.3	9,629	22	162,360	3	21,773	14	105,671	3	25,536	56	411,476	736,445
Middle	Diala	3.3	24,296	5	34,409	5	34,726	18	129,662	3	24,205	66	479,059	726,357
	Wasit	5.3	41,873	5	39,771	15	114,125	12	91,953	4	35,097	59	463,092	785,911
	Basrah	0.3	10,668	38	1197485	0	5,966	27	843,554	3	106,488	31	984,803	3,148,964
	Dhi-Qarr	0.1	786	31	482,785	1	12,408	30	469,970	3	43,142	35	545,617	1,554,708
South	Messan	0.3	2,448	12	81,179	2	14,430	35	246,144	4	29,350	47	326,030	699,581
	Al-Muthanna	0.1	1,127	16	119,849	4	27,118	49	365,614	2	16,885	29	221,775	752,368
Total		0.7	179,368	25	6,321,307	2	649,757	24	6,079,683	6	1,446,026	43	11,072,682	25,735,365

Source: Central Statistical Organization Iraq

2.4.3 Entry Situation of the Private Sector

"Promoting the Private Sector's Contribution to Water Services" is the fourth goal of the water supply sector in NDP 2013-2017. To start a water business by BOT (build-operate-transfer) is an objective, and the following points are also focused.

- Consulting services for environment impact, technical, financial/economical FS implementation and planning/designing
- O&M for water pipes
- Total water quality control (from intake to user)
- Enhance the tariff collection

The JCCME reports the status of partnerships with private sector entities as below.
The partnerships with both domestic and foreign private sector entities in water supply and sewage fields in Iraq are limited by the country's financial structure. The only exception is the small-scale treatment facility operation in areas which the Iraqi citizens do not have access to water supply. The foreign entitles which are working in the water sector are shown in Table 2.34.

Table 2.33 Private Entitles Working in the Water Sector

Company	Country	Province
Master Water	Lebanon	Baghdad
Metito	UAE	Anbar
F&B	Lebanon	Anbar
Drake and Scull	UK	Karbala
CGC	China	Maysan
Concord	Jordan	Al-Muthanna
CNEEC	China	Babil
Genzouba Company Ltd	China	Babil
Intash	Turkey	Salahaddin

Company	Country	Province
Alcom	Turkey	Salahaddin
ICG	Iran	Tamim
Dow Chemicals Kuwait	Kuwait	Basra
Hill International	USA	Baghdad
Pell Frischman	UK	Anbar
Ho Hup	Malaysia	Baghdad
Passavant Roediger	UAE	Karbala
Shriram EPC	India	Basra
Mokul	India	Basra

Source: JCCME 2013

2.4.4 Other Donors

According to the Open Aid Data website, ODA projects for the Iraqi water supply and sewage sector since 2000 amounts to 2,562 million USD. The major countries and records are shown in Figure 2.15 and Table 2.36. The donation from the United States of America during 2005-2006 is an outstanding amount of over 2,000 million USD. Japan and IDA (International Development Association) follows.

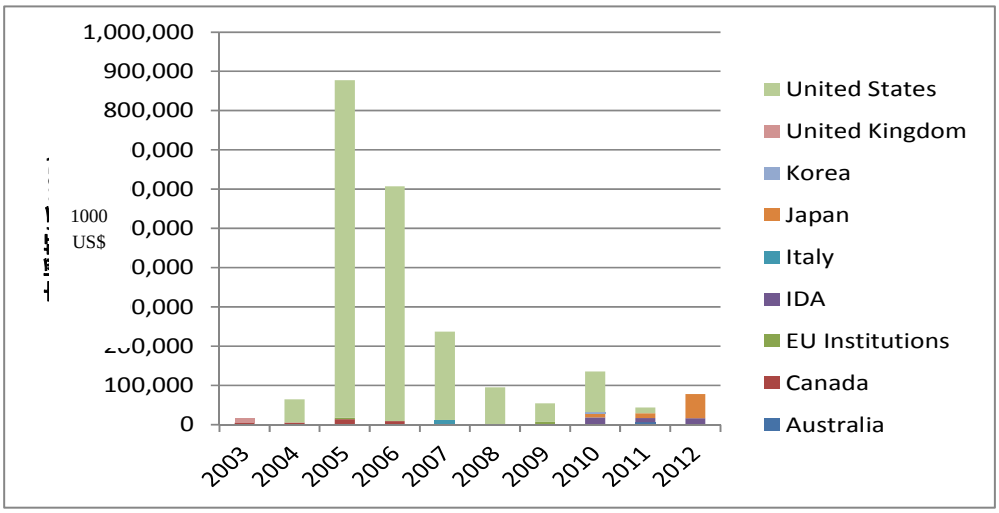


Figure 2.15 ODA Donation from Major Countries to Iraq Water Sector

Table 2.34 ODA Donation from Major Countries to Iraq Water Sector

(Thousand USD)

Nation	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Australia	0	0	0	0	0	0	0	0	6,109	0	6,109
Canada	4,571	4,996	14,030	8,904	0	0	0	0	0	0	32,501
EU Institutions	0	0	3,515	0	0	0	6,465	0	0	0	9,980
IDA	0	0	0	0	0	0	0	18,162	10,755	16,156	45,073
Italy	0	0	0	0	11,745	0	0	0	0	0	11,745
Japan	0	0	0	0	0	0	0	10,383	12,224	61,425	84,031
Korea	0	0	0	0	0	0	0	2,820	0	0	2,820

Nation	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
United Kingdom	11,161	0	0	0	0	0	0	0	0	0	11,161
United States	0	59,000	860,068	598,082	225,191	94,947	47,952	103,771	14,541	0	2,003,552
Total	15,732	63,996	877,613	606,986	236,936	94,947	54,417	135,136	43,629	77,581	2,206,973

Source: http://www.openaiddata.org/recipient_country/543/2012/

Both of World Bank [IDA] and United States are one of the largest donor to water & sanitation sector, and according to "*Addressing the shortfall, Development Initiatives/Water Aid* (2012)", their policy/strategy and recent activity of assistance in water and sanitation sector are summarized below.

World Bank [IDA]

World Bank strategy documents stress the importance in the provision of urban water supply which has been prioritized due to the rapid urbanization taking place in many IDA countries. The World Bank indicates that sanitation and hygiene promotion components in the overall IDA portfolio are likely to increase due to assessments of previous project now showing positive results and, therefore, creating demand for such projects to be replicated.

Past record of bilateral ODA commitments to water & sanitation compared to other sectors, and regional share are shown in following figures.

Total amount of ODA commitment to water and sanitation sector ranged 500~1,000 Mil US$ in recent years and it focuses on South and Central Asia and Sub-Saharan Africa regions.

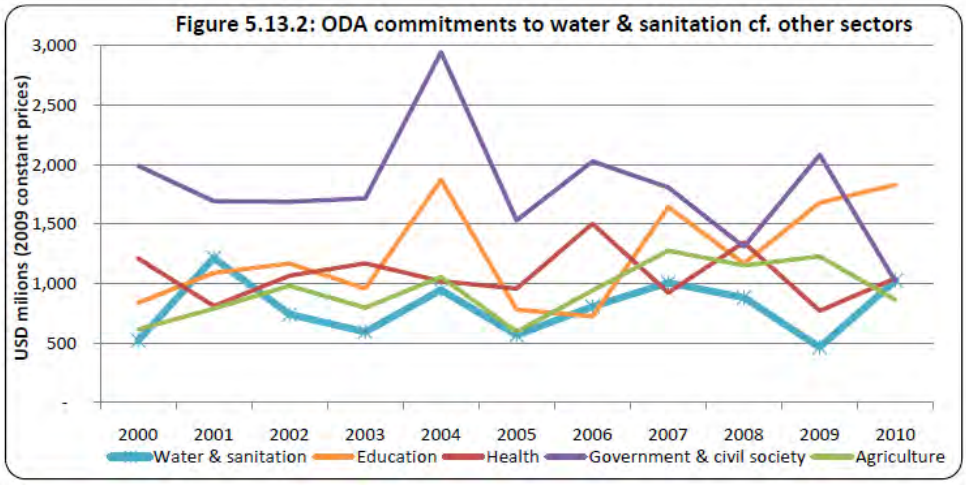


Figure 2.16 ODA Commitments to Water and Sanitation Sector by World Bank

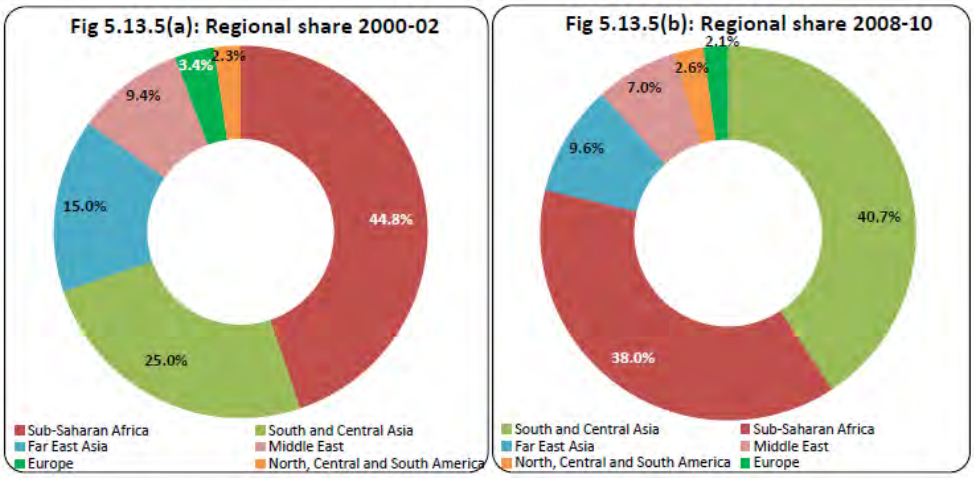


Figure 2.17 Regional Share of Water and Sanitation Sector by World Bank

The World Bank projects related to Iraqi water supply and sewage, according to the World Bank website, is as below.

Table 2.35 Water Sector Projects Supported by World Bank

Project Name	Period
Iraq - IQ-EMERGENCY WATER SUPPLY PROJECT : P094650 - Implementation Status Results Report : Sequence 07	January 15, 2012
Iraq - IQ-EMERGENCY COMMUNITY INFRASTRUCTURE REHAB ADDITIONAL FINANCING : P109296 - Implementation Status Results Report : Sequence 04	September 26, 2011
Iraq - Iraq Emergency Community Infrastructure Rehabilitation Project : P087881 - Implementation Status Results Report : Sequence 11	December 23, 2012
Iraq - IQ-TF EMERG. WATER, SANITATION : P087910 - Implementation Status Results Report : Sequence 16	June 27, 2011
Iraq - IQ-TF EMERG. BAGHDAD WATER SUPPLY : P087912 - Implementation Status Results Report : Sequence 18	January 3, 2012

United States [USAID]

As regards United States, *the Senator Paul Simon Water for the Poor Act of 2005* (Public Law 109-121) makes the provision of safe water, and sanitation and hygiene services in developing countries a component of United States foreign assistance. The goal for individuals and countries to have reliable and sustainable access to an acceptable quantity and quality of water to meet human, livelihood, ecosystem and production needs while reducing the risks of extreme hydrological events to people, the environment and economies.

Past record of bilateral ODA commitments to water & sanitation compared to other sectors, and regional share are shown in following figures.

Total amount of ODA commitment to water and sanitation sector ranged 500~1000 Mil US$ in recent years and it focuses on Sub-Saharan Africa and Middle East and North Africa regions.

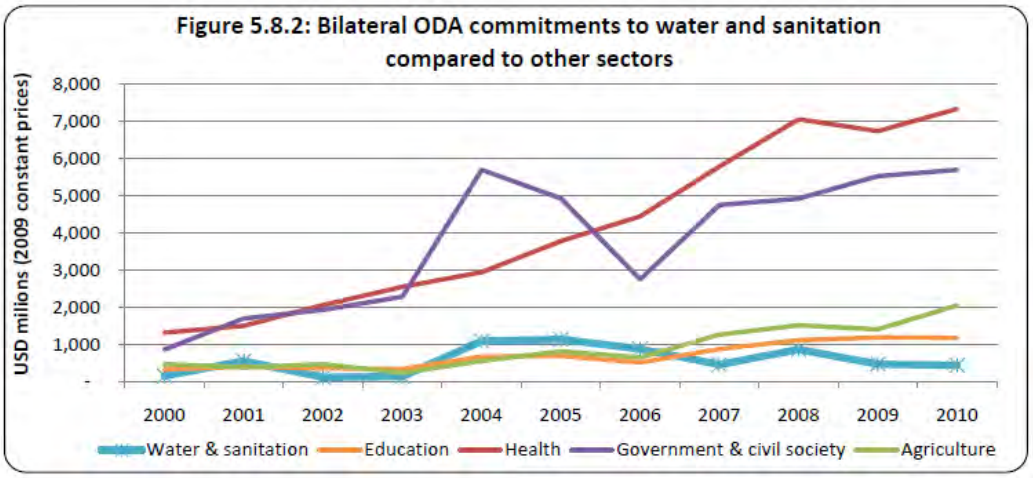


Figure 2.18 ODA Commitments to Water and Sanitation Sector by United States

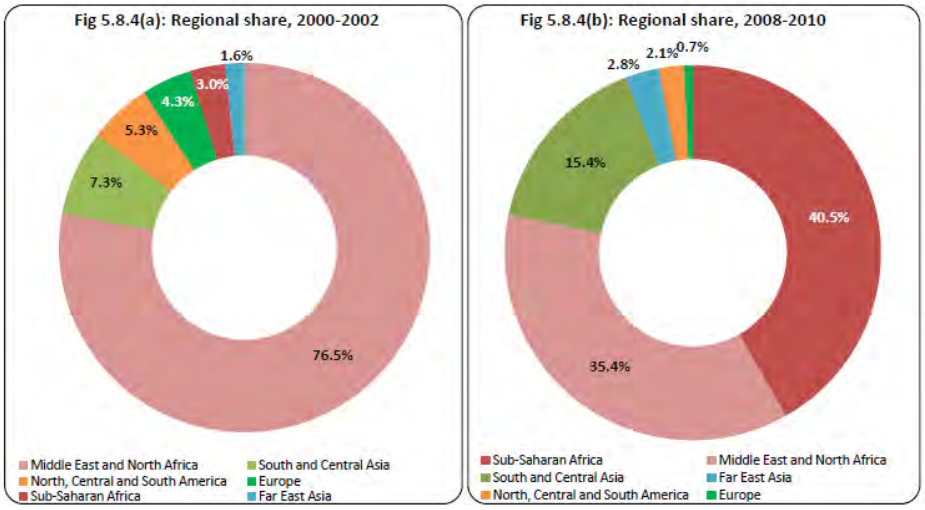
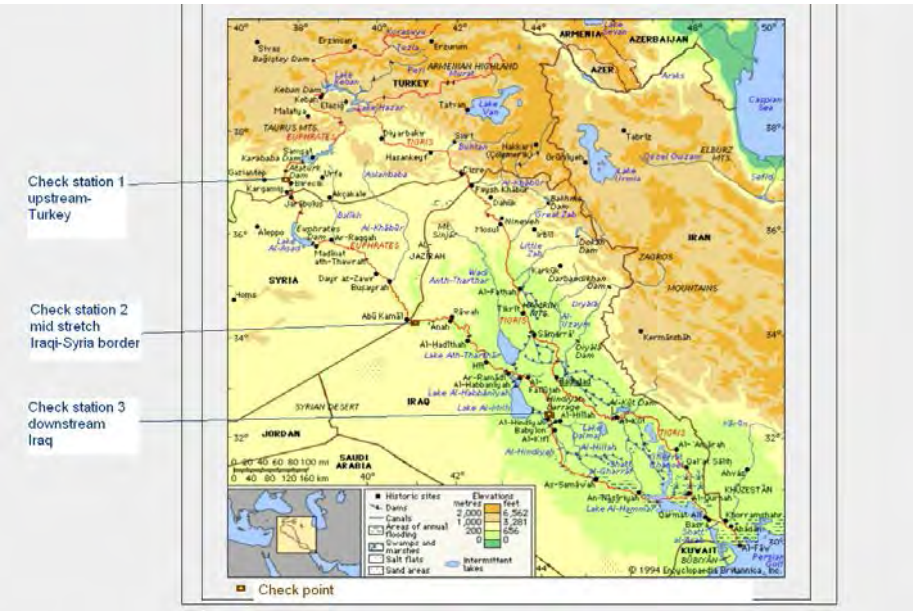


Figure 2.19 Regional Share of Water and Sanitation Sector by United States

2.4.5 Environmental Impact

There are few documents that provide information about water quality of the rivers such as organic pollutant. The information based on the document "TEMPORAL AND SPATIAL CHANGES IN WATER QUALITY OF THE EUPHRATES RIVER – IRAQ", which is a limited information resource, is shown below,

(1) Location of survey



Source: "TEMPORAL AND SPATIAL CHANGES IN WATER QUALITY OF THE EUPHRATES RIVER – IRAQ"

Figure 2.20 Location of Water Quality Survey

(2) Survey Result

The water quality survey was conducted at Station 2 and 3 in 2009-2010. The data of the Station 1 refers to the result of the survey conducted in 2002 -2003. The water quality analysis was implemented by a team consisting of three ministries, the Environment, Water Resources and Municipalities and Public Works.

Station 1 is located at the upstream of the Euphrates River in Turkey. The average water temperature is 16-18℃ and its rainfall reaches 460mm -800mm annually. 500 samples were taken for the survey at 13 locations in Station 1.

Station 2 is at the middle of the Euphrates River, which is near the Iraqi-Syrian border. The average water temperature is 24-26℃ and its rainfall reaches 150mm -200mm annually. 200 samples were taken for the survey at 7 locations in Station 2. Station 3 is located at the downstream of the Euphrates River, 500km away from the Iraqi-Syrian border. 600 samples were taken for the survey at 39 locations in Station 3.

The average of water quality survey for each Station is shown in Table 2.37, Figure 2.17 and 2.18. Figure 2.17 shows the measurement values outreaching 100, which are electrical conductivity, TDS, Alkalinity and Hardness. Said 3 values except Alkalinity are interrelated and increase as it goes toward the downstream. As for the values of Station 3, even though TDS exceeds the Japanese quality standard for drinking water, the other values meet the standard, nonetheless, the values are relatively high.

Figure 2.18 shows DO, BOD, Turbidity, TSS, Mg, K, NH_3-N, NO_3-N and PO_4-P.

DO is the value which decreases when used for biodegradation when pollutant flows into the river. Ammonia and Phosphorus are the indication values of pollution induced by human activity since they are largely included in human waste. In addition, BOD is applied as a comprehensive indication value of organic pollutant. According to the survey result, the DO decreases as it goes toward the downstream

while the values of BOD, NH_3-N, NO_3-N, PO_4-P increase. Therefore, it can be considered that pollution induced by human waste gets worse as it nears the downstream. The indication values of Station 2 still meet the standard although the values are not negligible. However, DO and SO_4 of Station 3 exceeds the standards shown in Table 2.37. In addition, BOD, NH_3-N, NO_3-N and PO_4-P of Station 3 could also exceed the standard although the survey for the indication values has not been conducted.

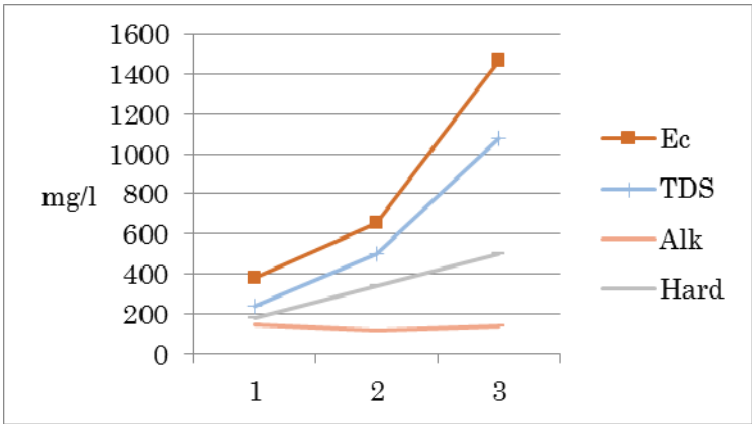


Figure 2.21 Result of Water Quality Survey (1)

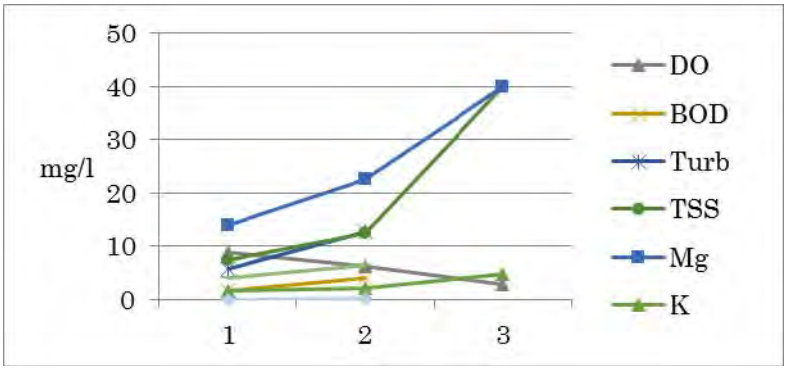


Figure 2.22 Result of Water Quality Survey (2)

Table 2.36 Result of Water Quality Survey

Items	Station		
	No.1	No.2	No.3
pH	8	8	8.15
Ec	378.5	654	1466
DO(mg/l)	8.73	6.19	2.8
BOD(mg/l)	1.54	4.01	
Turb(mg/l)	5.65	12.7	
TSS(mg/l)	7.5	12.5	40
TDS(mg/l)	237	500	1082
Alk(mg/l)	144	120.9	135
Hard(mg/l)	180	341.7	502
Ca(mg/l)	50	85	143

Items	Station		
	No.1	No.2	No.3
Mg(mg/l)	14	22.7	40
K(mg/l)	1.5	2.13	4.7
Na(mg/l)	8.3		111
Cl(mg/l)	21		149
F(mg/l)	0.2		
SO_4(mg/l)	26	170	378
NH_3-N(mg/l)	0.36		
NO_3-N(mg/l)	3.94	6.38	
PO_4-P(mg/l)	0.02846	0.04142	

Source: ”TEMPORAL AND SPATIAL CHANGES IN WATER QUALITY OF THE EUPHRATES RIVER – IRAQ”

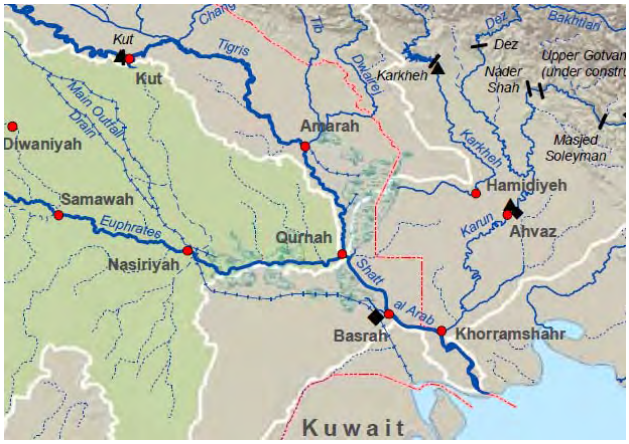
Chapter 3 Current Status of Water Supply and Sewerage Sector in Southern Iraq

3.1 Governorate Outlines

The four governorates in southern part of Iraq are; Basrah, Dhi-Qar, Al-Muthanna, Messan. The cities of Basrah, Nasiriyah, Samawah, and Amarah are the capitals of the governorates, reactively. Below provides some outlines on the governorates adapted from the Iraq Statistical Report and other official data.

3.1.1 Geographical Features of the Southern Four Governorates

Location of the four governorates' capital cities are shown in Figure 3.1. As seen in the figure, the Euphrates River flows through Nasiriyah and Samawah while the Tigris River flows through Amarah. Basrah, however lies on the Shatt al-Arab which is formed by the confluence of Euphrates and the Tigris and flows to the Arabian Gulf. These river systems are not only the source of water for the four governorates but also are where the governorates sewage is disposed.



Source: UN-ESCWA-BGR 2013, Note) Stream length of Samawah~Basrah is approx. 330km.

Figure 3.1 The Southern Four Governorates Locations by the Rivers

3.1.2 Basrah Governorate

(1) Geography and Topography

The Basrah Governorate with seven cities is located in southeast of Iraq and borders with Kuwait and Iran. Basrah is the capital of the governorate.

The south part of the governorate is a slope land formed by the Syrian Arab plateau and the Euphrates river basin, while the north and central parts are part of the Mesopotamian plateau.

The administrative area is 19,070km^2 which is 4.4% of Iraq.

(2) Economy and Industry

The Basrah governorate is center of the Iraq's economy and trade. It holds the main roads to both Iran and Kuwait, trade ports at the Arabian Gulf, and an international airport. It is also rich in natural resources, and its crude oil reserve is estimated as 67.8 billion barrels which is 59% of the whole country's reserve. The major industries are manufacturing industries relying on the oil resources such as gasoline, petrochemicals, fertilizer and steel, also agricultural industries utilizing the fertile soil to produce dates and tomatoes.

(3) Natural Conditions

The average temperature is 12-40ºC, the annual rainfall is 65.3mm and the dry season is from May to October.

The Euphrates and its tributaries are the main source of water for drinking/agriculture/industry. However, the total dissolved solids (TDS) concentration in the water has been recently growing and causing issues. The rising TDS is due to the increased amount of intake water in the upstream and seawater intrusion.

(4) Social Conditions

- The population is 2,403,301 (79.9% live in urban areas) with a growth rate of 2.6% from 2009 to 2012.
- The average household income is 618,300 IQD/Month, unemployment rate is 12.3%, and 16.1% of the population lives with on less than 2.5 USD/day.
- 42.1% of the population is provided by safe drinking water and 46.7% have access to appropriate sanitary facilities.
- The waste collection includes individual collecting system (7.1%) and public container usage (31.7%). 29.8% is also disposed in open areas (including rivers and drainage canals).
- Daily power failure period for households is over 12 hours/day (22.9%) and 3-12 hours/day (63%).
- The diarrhea incidence rate of the past two years was 4.2%.

3.1.3 Dhi-Qar Governorate

(1) Geography and Topography

The Dhi-Qar governorate is located on the northwestern side of the Basrah governorate and is historically known for the ancient Sumerian civilization. It is surrounded by the Basrah, Messan, Al-Muthanna, Qadissiya, and Wassit governorates. There are five cities within the governorate. The capital city of Nasiriyah stands along the Euphrates River, near the ancient Ur remains.

The Dhi-Qar governorate is situated on the Mesopotamian plateau with an administrative area of 12.9000km^2 (3.0% of Iraq).

(2) Economy and Industry

Dhi-Qar is one of the underdeveloped governorates whose economy relies heavily on agriculture. The main industries used to be dates, grain, horticulture, culture and livestock, but the overuse of marshlands in the 1980's has damaged the agriculture environment and had a severe impact on the economy. The current industry consists mainly of fishery and rice crop.

There are expectations for improvement in oil industry, regarding the large scale oil field of an estimated 6 billion oil reserve, and tourism industry, based on the archeological sites.

(3) Natural Conditions

The average temperature is 12-39ºC with annual rainfall of 85.1mm and dry season from May to October. The Euphrates River and its tributaries are the main source of water for drinking/agriculture/industry. However, the total dissolved solids (TDS) concentration of the water has been recently growing and causing issues for water supply. The rising TDS is due to the increased amount of intake water in the upstream and seawater intrusion.

(4) Social Conditions

- The population is 1,742,852, (with 62.9% living in urban areas) with a growth rate of 2.6% from 2009 to 2012.
- The average household income is 493,800 IQD/Month, unemployment rate is 20.9% (other data shows 31%), and 37.8% of the population lives with a cost of less than 2.5 USD/day.
- 58.2% of the population is provided by safe drinking water and 57.6% have access to appropriate sanitary facilities.
- The waste collection status includes individual collecting system (15.3%) and, public container usage (18.2%), 54.8% is disposed to open areas (including rivers and drainage canals).
- Daily power failure period for households is over 12 hours/day (70%) and 3-12 hours/day (26%).
- The diarrhea incidence rate of the past 2 years is 3.5%.

3.1.4 Al-Muthanna Governorate

(1) Geography and Topography

The Al-Muthanna governorate is surrounded by the Basrah, Dhi-Qar, Quaissiya, and Najaf governorates and has borders with Saudi Arabia. It is the second largest governorate in size of area and holds the second fewest population of the country.

There are four cities in the governorate. The capital city of Samawah is located near the Uruk remains, one of the oldest known ancient cities.
The Al-Muthanna governorate is situated on the slope land formed by the Syrian Arab plateau and the Euphrates river basin. The administrative area is 51,740km^2 (11.9% of Iraq).

(2) Economy and Industry

The desert areas of the Euphrates river system are suitable for farming thus agriculture related industry is the main sector of economy in the governorate. Al-Muthanna is also rich in mineral resources, and has potential for manufacture industries such as petroleum refinery, cement and salt. The ratio of the number of people employed in agriculture and manufacture is 44%. Tourism industry is expected to play a productive role in the future economic growth of the governorate giving its natural and historical tourist attractions. The economy could also be lifted when the number of employment increases at the University of Al-Muthanna, as natural science research institute.

(3) Natural Conditions

The average temperature is 11-38ºC with annual rainfall of 58.4mm and dry season from May to October.
The Euphrates River and its tributaries are the main source of water for drinking/agriculture/industry,. However, like the Basrah and Dhi-Qar governorates, the TDS concentration has been recently growing and causing issues in Al-Muthanna. The rising TDS is due to the increased amount of intake water in the upstream and seawater intrusion.

(4) Social Conditions

- The population is 682,520, (43.7% in urban areas) with a growth rate of 2.6% from 2009 to 2012.
- The average household income is 524,400 IQD/Month, unemployment rate is 14.3%, and 29.4% of the population lives with a cost of less than 2.5 USD/day.
- 24.6% of the population is provided by safe drinking water and60.6% have access to appropriate sanitary facilities.
- The waste collection includes individual collecting system (11.0%) and public container usage (22.4%). Many residents dispose waste to open areas (including rivers and drainage canals).
- Daily power failure period for households is over 12 hours/day (35.5%) and 3-12 hours/day (57.6%).
- The diarrhea incidence rate of the past 2 years is 2.8%.

3.1.5 Messan

(1) Geography, Topography

The Messan governorate is surrounded by Basrah, Wassit and Dhi-Qar governorates and boarders with Iran. The capital Amara stands 50km from the Iran's borders and situated between the Tigris and Euphrates rivers. There are six cities with the governorate.

The governorate is in the slope land formed by the Mesopotamian plateau and the Zagros mountains. The administrative area is 16,072km^2 (3.7% of Iraq).

(2) Economy and Industry

The governorate, previously, flourished by the agricultural and manufacturing industries but the economy is now declined due to the infrastructure destruction and service level deterioration caused by wars and disputes. Furthermore, environmental deterioration has negatively affected the living circumstances of the governorate residents who live in the marshlands (40%) and depend largely on the natural environment. The governorate yet manages to be a major producer of crude oil and construction materials (macadam, asphalt, etc.). Giving the natural, historical and religious attractions, the tourism industry is expected to have positive impacts on the governorate's economic growth in the future.

(3) Natural Conditions

The average temperature is 10-38ºC, the annual rainfall is 100.7mm and the dry season is from May to October.

The Tigris River and its river systems are the main water source for drinking/agriculture/industry use, however, the rise of TDS concentration due to seawater retroact and intake amount increase in the upstream are causing recent issues.

(4) Social Conditions

- The population is 922,072 (72.4% in urban areas) with a 2.6% of population growth from 2009 to 2012.
- The average household income is 534,600 IQD/Month, unemployment rate is 19.6%, and 16.4% of the population lives with a cost of less than 2.5 USD/day.
- 51.5% of the population is provided by safe drinking water and 60.2% have access to appropriate sanitary facilities.
- The waste collection is by individual collecting system (18.0%) while 41.8% is disposed in open areas (including rivers and drainage canals).
- Daily power failure period for households is over 12 hours/day (77.5%) and 3-12 hours/day

(18.8%).

- The diarrhea incidence rate of the past 2 years is 9.5%.

3.2 Current Status of Facility Development and Operational Conditions

Current status of facility development and operational conditions in water sector for each governorate are summarized below. All data and information are based on the results of this survey.

3.2.1 Basrah

(1) Water Supply

1) Overview

The water supply in Basrah serves 80-90% of the total population of 3,332,050. The leakage water rate is estimated 30-45% of total water production of 1,185,000m^3/day. According to the Central Statistical Organization, Ministry of Planning, 37.6% of the served population has water available for 24 hours while 34.4% have water for between 2 to less than 10 hours per day and 12.1% have water for less than 1 hour. Water supply coverage by each division is shown in the table below.

Table 3.1 Water Supply Coverage by Division

Division	Population (Person)	Coverage (%)	Water Production (m^3/ay)	Water Leakage (%)
Al- Basrah	1,658,300	95	750,000	30
AL-Zubair	628,300	80	120,000	40
AL-Qurna	298,700	80	80,000	40
Abo AL-khaseeb	236,900	85	70,000	45
AL-Medaynna	252,350	85	80,000	45
Shatt AL-Arab	195,700	80	65,000	45
AL-Fao	61,800	90	20,000	30

Source: Basrah Governorate (2014)

2) Facility Development

a) Source of Drinking Water

According to the Environmental Survey in Iraq 2010 (UNICEF, 2011) the Euphrates River system is the sole source of water for drinking.

b) Transmission/Distribution Pipe

Based on an interview conducted for this survey, most of the pipes were installed in the 1980's. The pipe material is ductile cast iron, polyvinyl-chloride and polyethylene pipe with diameters of 100 ~ 1200 mm and a total length of 10,500 km, approximately.

c) Water Treatment Plant (WTP)

The existing WTPs by facility type are summarized below. There are 300 plants of compact water supply units which are called "Water Complex" and treat 72.1% of the total water intake.

Table 3.2 Water Treatment Plants by Facility Type

Item	Projects	Water Complexes	Well Mounted	Desalination Stations	Solar Power Stations	Total
No. of WTP	12	300	-	49	22	383
Ratio of Water Intake (%)	27.7	72.1	-	0.1	0.1	100%

Source: Environmental Survey in Iraq2010 (UNICEF,2011)

d) On-going Projects

On-going projects of water supply are listed below.

Table 3.3 On-going Projects

Division	Component	Capacity	Contracted Price (Mil IQD)	Source of Funds	Percentage of Completion	Problems for Implementation
Al- Zubair	WTP of RO and Transmission Pipe (Um Qasir dist.)	1,000 m^3/hr	17,992	Governorate	75	-
Abo Al-khaseeb	Compact Unit (Mehalla Village)	1,600 m^3/hr	6,040	Governorate	95	-
Al-Medaynna	Compact Unit (Al-Imam Al Sadiq dist.)	800 m^3/hr	2,457	Governorate	85	-
Shatt Al-Arab	WTP(Phase-1)	4,500 m^3/hr	36,423	Governorate	80	-
	Compact Unit	800 m^3/hr	3,445	Governorate	75	-

Source: Basrah Governorate (2014)

3) Operation and Maintenance

Quality deterioration of the intake water and aged facilities have seriously lowered quality of the distributed drinking water. Water at the existing WTPs (including the compact units) was tested and the result is shown below. As seen, the result shows a high TDS level due to the increased salinity by seawater intrusion and exceeds the national standard of TDS for drinking water at many WTPs. The reason is that the common treating method at the WTPs, such as rapid sand filtration, cannot remove TDS.

Table 3.4 Influent Water Quality at Existing WTP (TDS)

Period	Influent TDS (mg/l)	Remarks
Mar, 2013	562 ~ 13,865	National Standard of Drinking Water in Iraq
Aug, 2014	134 ~ 3,988	TDS: 500~1500 mg/l

Source: Basrah Governorate

In addition, based on the interview in this survey, it is confirmed that there are many problems in O&M field caused by the unstable water source quality, unintegrated plants, aged facilities, lack of related data, illegal connection, insufficient budget, and lack of staff capacity.

(2) Sewerage

1) Overview

Coverage of sewer pipe network is about 60% for sanitary sewer and 70% for storm sewer in Basrah City. Meanwhile, for other divisions except for Basrah, coverage of sewer pipe network is only 0-30%. There is a big gap of coverage between the central city and rural cities. Only Basrah City has a sewage treatment plant (STP) with capacity of 240,000m^3/day. Current status of sewerage service by each division is shown in the table below.

Table 3.5 Current Status of Sewerage by Division

Division	Population (Person)	Coverage (%)	Type of Collection System	Generated Wastewater (m^3/day)	Existing Capacity of STP (m^3/day)
Al- Basrah	1,658,300	65	Separate System	150,000	240,000
AL-Zubair	628,300	5	Separate System	-	No STP
AL-Qurna	298,700	10	Separate System	-	No STP
Abo AL-khaseeb	236,900	3	Separate System	-	No STP
AL-Medaynna	252,350	20	Separate System	-	No STP
Shatt AL-Arab	195,700	25	Separate System	-	No STP
AL-Fao	61,800	70	Separate System	-	No STP

Source: Basrah Governorate (2014)

2) Facility Development

a) Sewer system and Pumping Station

Based on an interview conducted for this survey, most of the pipes were installed in the last half of 1970's. The pipe material is concrete including asbestos, ductile cast iron, polyvinyl-chloride and GRP pipe with a diameter of 110 ~ 2,250 mm and a total length of 3,500 km, approximately. There are a total of 210 pumping stations with 128 stations for stromwater and 82 stations for sanitary sewage.

b) Sewage Treatment Plant (STP)

The existing STP is listed below.

Table 3.6 Outline of Existing STP

Division	Name of STP	Capacity (m3/day)	Treatment Method	Remarks
Al-Basrah	Hamdan	240,000	Conventional Activated Sludge Process	

Source: Basrah Governorate (2014)

c) On-going Projects

On-going projects of sewerage are listed below.

Table 3.7 On-going Projects

Division	Component	Capacity	Contracted Price (Mil IQD)	Source of Funds	Percentage of Completion	Problems for Implementation
Basrah Center	STP Stage 4 &5	300,000 m^3/day	480,000	MMPW	21	

	STP for Industrial Area (SBR method)	5,000 m^3/day	37,000	Governorate	85	
Al- Zubair	STP and Sewer networks (Um Qsair Dist.)	10,000 m^3/day	93,798	Governorate	10	Land Acquisition
	STP and Sewer networks (Safwan dist.)	10,000 m^3/day	44,408	Governorate	10	Land Acquisition
	STP and Sewer networks (Al-Zubair center.)	120,000 m^3/day	105,000	MMPW	10	Land Acquisition
Al-Qurna	STP and Sewer networks (Sharesh dist.)	10,000 m^3/day	48,108	Governorate	5	Land Acquisition
	STP and Sewer networks (Nashwa dist.)	10,000 m^3/day	23,633	Governorate	33	Land Acquisition
	STP and Sewer networks (Al-Thaghir dist.)	5,000 m^3/day	12,797	Governorate	40	Land Acquisition
	STP and Sewer networks (Paper Factory dist.)	2,000 m^3/day	8,962	Governorate	27	Land Acquisition
Abo Al-Khaseeb	STP and Sewer networks	30,000 m^3/day	79,251	Governorate	15	Land Acquisition
Shatt Al-Arab	STP and Sewer networks	10,000 m^3/day	83,550	Governorate	15	Land Acquisition
Al-Fao	STP and Sewer networks	4,000 m^3/day	17,278	MMPW	90	Land Acquisition

Source: Basrah Governorate (As of 2014)

3) Operation and Maintenance

Based on an interview conducted for this survey, many sewerage facilities including pipes, pumping stations and STP, are under improper conditions due to deterioration of facilities and inadequate O&M.

Results of the water quality test at Hamdan STP are shown below. Both BOD and TSS exceed the national standard of wastewater and show low removal efficiency. It implies insufficient O&M work for the facilities.

Table 3.8 Water Quality at Hamdan STP (Average in Apr~Dec 2012)

Items	Influent (mg/l)	Effluent (mg/l)	Removal Efficiency	Remarks
BOD	192	61	68%	National Standard of Wastewater in Iraq; BOD<40mg/l, TSS<60mg/l
TSS	169	90	47%	

Source: Basrah Governorate

3.2.2 Dhi-Qar

(1) Water Supply

1) Overview

Coverage of water supply in Dhi-Qar with a total population of 2,150,068 achieves 90% in urban area but there is big gap with rural area with only 50% of coverage. The leakage water rate is estimated at 30% of total water production (569,580 m^3/day). According to the Central Statistical Organization, Ministry of Planning, 34.6% of the served population has water available for 24 hours, while 37.5% have water for 2 to less than 10 hours per day and 2.0% have water for less than 1 hour. Water supply coverage by each division is shown in the table below.

Table 3.9 Water Supply Coverage by Division

Division	Population (Person)	Coverage (%)	Water Production (m^3/day)	Water Leakage (%)
Nasiriyah	921,000	76	211,400	29
Suq Ashyok	354,000	71	87,000	-
Alchebaysh	94,000	91	48,900	30
Alshatra	400,113	75	131,840	20
Alrefaey	380,955	65	90,440	36

Source: Dhi-Qar Governorate (2014)

2) Facility Development

a) Source of drinking Water

According to the Environmental Survey in Iraq 2010 (UNICEF, 2011) the Euphrates River tributary is the sole source of drinking water.

b) Transmission/Distribution Pipe

Based on an interview conducted for this survey most of the pipes were installed in the last half of 1970's. The pipe material is ductile cast iron, polyvinyl-chloride and polyethylene pipe with a diameter of 110 ~1,000 mm and a total length of 7,500 km, approximately.

c) Water Treatment Plant (WTP)

The existing WTPs by facility type are summarized below. There are 300 plants of compact water supply units which are called "Water Complex" and treat 52.9% of the total water intake.

Table 3.10 Water Treatment Plants by Facility Type

Item	Projects	Water Complexes	Well Mounted	Desalination Stations	Solar powered Stations	Total
No. of WTP	15	160	0	48	0	223
Ratio of Water Intake (%)	46.2	52.9	0	0.9	0	100%

Source: Environmental Survey in Iraq 2010 (UNICEF,2011)

d) On-going Project

On-going projects of water supply are listed below.

Table 3.11 On-going Project

Division	Component	Capacity	Contracted Price (Mil IQD)	Source of Funds	Percentage of Completion	Problems for Implementation
Nasiriyah	Project-1 WTP (Nasiriyah)	10,000 m^3/hr	209,045	MMPW	10	Delay by the contractor
	Project-2 WTP (Al-Esllah- Chebaysh)	3,000 m^3/hr	23,478	MMPW	85	Delay by the contractor
Suq Ashyok	Included in Project-1 of Nasiriyah					

Alchebaysh	Included in Project-2 of Nasiriyah					
Alshata	Included in Project-1 of Nasiriyah					
Alrefaey	WTP (Refaey)	2,000 m^3/hr	12,552	MMPW	90	-
	WTP (Al-fajir)	2,000 m^3/hr	30,836	MMPW	100	-
	WTP (Al-Nasir)	1,000 m^3/hr	18,000	World Bank	75	-

Source: Dhi-Qar Governorate (2014)

3) Operation and Maintenance

Like Basrah, the quality deterioration of the intake water and aged facilities have seriously lowered quality of the distributed drinking water. Water at the existing WTPs (including the compact units) was tested and the result is shown below. As seen, the result shows a high TDS level due to the increased salinity by seawater intrusion and exceeds the national standard of TDS for drinking water at many WTPs. The reason is that the common treating method at the WTPs, such as rapid sand filtration, cannot remove TDS.

Table 3.12 Influent Water Quality at Existing WTP (TDS)

Period	Influent TDS (mg/l)	Remarks
Jan, 2013	825 ~ 1,980	National Standard of Drinking Water in Iraq TDS: 500~1500 mg/l
Jul, 2013	618 ~ 2,270	

Source: Dhi-Qar Governorate

In addition, as a common issues in southern four governorates, it is confirmed that there are many problems in O&M field caused by unstable water source quality, unintegrated plants, aged facilities, lack of related data, illegal connection, insufficient budget, and lack of staff capacity.

(2) Sewerage

1) Overview

Development of sewerage facility is delaying and coverage of sewer pipe network is only 19%.

There are two STPs in central city Nasiriyah with capacity of 17,000m^3/day which is growing old and 8,000m^3/day respectively. Meanwhile, other divisions have no treatment facility and domestic sewage is treated by septic tanks. Current status of sewerage service by each division is shown in the table below.

Table 3.13 Current Status of Sewerage by Division

Division	Popupation (Person)	Coverage (%)	Type of Collection System	Generated Wastewater (m^3/ay)	Existing Capacity of STP (m^3/day)
Nasiriyah	921,000	24	Separate/Combined System	177,000	25,000 (Under Rehabilitation)
Suq Ashyok	354,000	7	Separate System	51,000	No STP
Alchebaysh	94,000	22	Separate System	21,000	No STP
Alshatra	400,113	26	Separate System	83,000	No STP
Alrefaey	380,955	17	Separate System	58,000	No STP

Source: Dhi-Qar Governorate (As of 2014)

2) Facility Development

a) Sewer system and Pumping station

Based on the interview in this survey, major part of pipes installed in the first half of 1980's. Pipe material is concrete including asbestos, polyvinyl-chloride and GRP with a diameter of 110 ~ 2,200 mm, and total length is 1,140 km approximately. There are total 86 pumping stations consisting of 64 stations for stromwater and 22 stations for combined sewage.

b) Sewage Treatment Plant (STP)

Existing STPs are listed below.

Table 3.14 Outline of Existing STP

Division	Name of STP	Capacity (m3/day)	Treatment Method	Remarks
Nasiriyah	Nasiriya-1	17,000 m^3/day	Conventional Activated Sludge Process	Under Rehabilitation
Nasiriyah	Nasiriya-2	8,000 m^3/day	Conventional Activated Sludge Process	

Source: Dhi-Qar Governorate (As of 2014)

c) On-going Project

On-going projects of sewerage are listed below.

Table 3.15 On-going Project

Division	Component	Capacity	Contracted Price (Mil IQD)	Source of Funds	Percentage of Completion	Problems for Implementation
Nasiriyah	2 STPs	60,000 m^3/day each	101,000	MMPW	72	Delay by the Contractor
	STP and Sewer networks	60,000 m^3/day	251,000	MMPW	57	-
Suq Ashyok	Study and Design	72,000 m^3/day	1,980	MMPW	93	Approve by MOWR
Alshatra	STP and Sewer networks	50,000 m^3/day	110,000	MMPW	36	-
Alrefaey	STP and Sewer networks	64,000 m^3/day	44,000	MMPW	35	Making some amendments to the design

Source: Dhi-Qar Governorate (As of 2014)

3) Operation and Maintenance

Based on an interview for this survey, many sewerage facilities including pipes, pumping stations and STPs, are under improper conditions due to deterioration of facility and inadequate O&M. Breakage and clogging of sewer pipes cause inundation in urban areas.

Results of a water quality test at Nasiriya STP are shown below. Although only the BOD data exceeds the national standard of wastewater and shows low removal efficiency. It implies insufficient O&M work for the STPs.

Table 3.16 Water Quality at Nasiriyah STP (Average in 2010~2014)

Items	Influent (mg/l)	Efluent (mg/l)	Removal Efficiency	Remarks
BOD	122	84	31%	National Standard of Wastewater in Iraq; BOD<40mg/l, TSS<60mg/l
TSS	-	-	-	

Source: Dhi-Qar Governorate

3.2.3 Al-Muthanna

(1) Water Supply

1) Overview

Coverage of water supply of Al-Muthanna with a total population of 788,209 achieves 90% in urban area but there is a big gap with rural area which only 40% coverage. Leakage water rate is estimated 7-42% of total water production (235,200m^3/day). According to the Central Statistical Organization, Ministry of Planning, less than 1% of the served population has water available for 24 hours 68.1% have water for between 2 to less than 10 hours per day, and 5.6% have water for less than 1 hour. Water supply coverage by each division is shown in the table below.

Table 3.17 Water Supply Coverage by Division

Division	Population (Person)	Coverage (%)	Water Production (m^3/day)	Water Leakage (%)
Al-Samawah	290,850	50	165,000*	42
Al-Rumaytha	117,941	77		42
Al-Hilal	39,262	10	6,800	25
Al-Najmi	34,783	15	4,000	22
Al-Majid	42,846	47	9,000	30
Al-sawayer	46,767	11	5,000	32
Al-Khudhair	89,175	42	16,000	33
Al-Daraji	18,841	21	6,000	24
Al-Warkka	97,049	35	19,800	32
Al-Salman	10,695	14	3,600	7

Source: Al-Muthanna Governorate (2014)

Note: *All divisions are supplied from Al Rumaytha because its TDS is lower than others 165,000m^3/day is not for Al-Samawah and Al-Rumaytha only.

2) Facility Development

a) Source of Drinking Water

According to the Environmental Survey in Iraq 2010(UNICEF, 2011) the Euphrates River system provides 99% of drinking water and with only 1% of relies on groundwater.

b) Transmission/Distribution Pipe

Based on an interview for this survey most of the pipes were installed in the 1970's. The pipe material is ductile cast iron, polyvinyl-chloride and asbestos pipe with a diameter of 110 ~ 900 mm and a total length of 5,000 km, approximately.

c) Water Treatment Plant (WTP)

The existing WTPs by facility type are summarized below. 62% of total water intake is drawn by projects.

Table 3.18 Water Treatment Plants by Facility Type

Item	Projects	Water Complexes	Well Mounted	Desalination Stations	Solar powered Stations	Total
No. of WTP	4	54	3	13	28	102
Ratio of Water Intake (%)	62	34.9	0.7	2.4	-	100%

Source: Environmental Survey in Iraq2010 (UNICEF, 2011)

d) On-going Projects

On-going projects of water supply are listed below.

Table 3.19 On-going Projects

Division	Component	Capacity	Contracted Price (Mil IQD)	Source of Funds	Percentage of Completion	Problems for Implementation
Rumaytha to Supply all Divisions	WTP	10,000 m^3/hr	168,000	MMPW	20	-Poor water source -Delay of design drawings

Source: Al-Muthanna Governorate (2014)

3) Operation and Maintenance

Same as the Basrah governorate, there are serious problems on distributed water quality caused by deterioration of water quality in water sources and aged facilities.

Result of the water quality test of the existing WTP including the compact units are shown below. It shows that high TDS -which correlate with salinity and the distributed water quality- exceeds the national standard of drinking water in many WTPs.

Table 3.20 Influent Water Quality at Existing WTP (TDS)

Period	Influent TDS (mg/l)	Remarks
Feb~Apr,2013	616 ~ 4,473	National Standard of Drinking Water in Iraq TDS: 500~1500 mg/l
Jun~Aug,2013	695 ~ 4,152	

Source: Al-Muthanna Governorate

In addition, as a common issue in all of the four southern governorates, there are many problems in O&M caused by unstable water source quality, unintegrated plants, aged facilities, lack of related data, illegal connection, insufficient budget, and lack of staff capacity.

(2) Sewerage

1) Overview

Facility development of sewerage is delaying and coverage of sewer pipe network is only 27%. There are no sewerage facilities in the Al-Muthanna governorate except for Samawah and Rumaytha. Only Samawah, the capital of governorate has a STP with capacity of 30,000m^3/day. Other cities have no treatment facilities and the domestic sewage is treated by septic tanks. However, these septic tanks are not functioning properly

either because of difficulty of discharging due to high groundwater level. These situation causes water pollution in the surrounding areas and in the Euphrates River and moreover it affects the water sources quality for downstream area, such as Basra and Dhi-Qar. Current status of sewerage service by each division is shown in the table below.

Table 3.21 Current Status of Sewerage by Division

Division	Population (Person)	Coverage (%)	Type of Collection System	Generated Wastewater (m^3/day)	Existing Capacity of STP (m^3/day)
Al-Samawah	290,850	35	Separate System	20,000*	37,000
Al-Rumaytha	117,941	80	Separate System	20,000	25,000
Al-Hilal	39,262	0	-	-	No STP
Al-Najmi	34,783	0	-	-	No STP
Al-Majid	42,846	0	-	-	No STP
Al-sawayer	46,767	0	-	-	No STP
Al-Khudhair	89,175	0	-	-	No STP
Al-Daraji	18,841	0	-	-	No STP
Al-Warkka	97,049	0	-	-	No STP
Al-Salman	10,695	0	-	-	No STP

Source: Al-Muthanna Governorate (2014)
Note: * come from biggest part of center of Samawah only

2) Facility Development

a) Sewer System and Pumping Station

Based on an interview for this survey most pipes were installed in the last half of 1980's. The pipe material is ductile cast iron, polyvinyl-chloride and GRP pipe with a diameter of 110 ~ 1,500 mm and a total length of 650 km, approximately. There are a total of 25 pumping stations with 11 stations for stromwater, 14 stations for sanitary sewage.

b) Sewage Treatment Plant (STP)

Existing STP is listed below.

Table 3.22 Outline of Existing STP

Division	Name of STP	Capacity (m3/day)	Treatment Method	Remarks
Al-Samawah	Samawah STP	37,000	Conventional Activated Sludge Process	Serve biggest part of Samawah central

Source: Al-Muthanna Governorate (2014)

c) On-going Projects

On-going projects of sewerage are listed below.

Table 3.23 On-going Project

Division	Component	Capacity	Contracted Price (Mil IQD)	Source of Funds	Percentage of Completion	Problems for Implementation
Rumaytha	Sewer networks	Total Length 100 km	27,470	Government	75	-
	STP	25,000 m^3/day	31,999	Governorate	93	-

Source: Al-Muthanna Governorate (2014)

3) Operation and Maintenance

Results of the water quality test at Samawah STP are shown in the table below. Although it only shows the BOD data, it has met the national standard of wastewater.

Table 3.24 Water Quality at Samawah STP (Average in 2014)

Items	Influent (mg/l)	Effluent (mg/l)	Removal Efficiency	Remarks
BOD	128	22	83%	National Standard of Wastewater in Iraq; BOD<40mg/l, TSS<60mg/l
TSS	-	-	-	

Source: Al-Muthanna Governorate

3.2.4 Messan

(1) Water Supply

1) Overview

Coverage of the water supply of the Messan governorate with a total population of 1,112,570 achieves 90% in both urban and rural areas. The leakage water rate is estimated at 25% of the total water production of 396,200 m^3/day. According to the Central Statistical Organization, Ministry of Planning, only 2.3% of the served population have water available for 24hr while 88.4% have water for less than 1 hour. Water supply coverage by each division is shown in the table below.

Table 3.25 Water Supply Coverage by Division

Division	Population (Person)	Coverage (%)	Water Production (m^3/day)	Water Leakage (%)
Al-Amarra	623,330	93	170,950	25
Al-Maymonna	108,059	94	129,300	25
Al-Mejir Alkabeer	161,872	93	24,500	25
Ali Al-Gharbi	52,766	93	17,500	25
kalaat Salih	110,288	93	21,750	25
Al-Kahllaa	56,255	93	32,000	25

Source: Messan Governorate (2014)

2) Facility Development

a) Source of Drinking Water

According to the Environmental Survey in Iraq 2010 (UNICEF, 2011) all water source of drinking water relies on the Tigris River system.

b) Transmission/Distribution Pipe

Based on an interview for this survey most pipes were installed in the 1980's. The pipe material is ductile cast iron, polyvinyl-chloride pipe with a diameter of 110 ~ 900 mm and a total length of 5,000 km, approximately.

c) Water Treatment Plant (WTP)

The existing WTPs by facility type is summarized below. There are 252 plants of compact water supply unit called “Water Complex” which treat 85.2% of total water intake.

Table 3.26 Water Treatment Plants by Facility Type

Item	Projects	Water complexes	Well mounted	Desalination stations	Solar powered stations	Total
No. of WTP	13	252	0	12	22	299
Ratio of Water Intake (%)	14.1	85.2	0	0.4	0.3	100%

Source: Environmental Survey in Iraq2010 (UNICEF,2011)

d) On-going Projects

On-going projects of water supply are listed below.

Table 3.27 On-going Project

Division	Component	Capacity	Contracted Price (Mil IQD)	Source of Funds	Percentage of Completion	Problems for Implementation
Al-Amarra	6 CU (1,450 m3/hr) and 5 network	50(1), 200(3), 400 (2) m^3/hr	232~2,046	Governorate	15~80	-
Al-Mejir Alkabeer	6 CU (900m^3/hr)	50(2), 200(4) m^3/hr	581~1,400	Governorate	66~80	-
Ali Al-Gharbi	2 CU(500m^3/hr)	100(1), 400(1) m^3/hr	1,162, 1,560	Governorate	40,80	-
kalaat Salih	9CU (1,050m^3/hr)	50(3), 100(3) 200(3) m^3/hr	627~1,410	Governorate	20~80	-
Al-Kahllaa	2 CU (150m^3/hr)	50(1), 100(1) m^3/hr	740, 795	Governorate	80	-

Source: Messan Governorate (As of 2014)

3) Operation and Maintenance

About 90% of the served population has water available for less than 1 hour. It implies an inefficient distribution control caused by insufficient O&M and aged facilities. Meanwhile, influent water quality of the existing WTP including the compact unit shown in the table below indicates that the TDS in water source is below the national standard of drinking water.

Table 3.28 Influent Water Quality at Existing WTP (TDS)

Period	Influent TDS (mg/l)	Remarks
Oct, 2013	880 ~ 1,300	National Standard of Drinking Water in Iraq TDS: 500~1500 mg/l

Source: Messan Governorate

(2) Sewerage

1) Overview

Messan is the most developed governorate for sewerage facilities among the four governorates and has 72% coverage of sewer pipe network. Al-Amara, Al-Maymonna, and Al-Mejir Alkabeer have STPs with a capacity of 96,000 m^3/day (3 STPs total), 5,000 m^3/day, and 36,000 m^3/day, respectively.

Meanwhile, other divisions have no treatment facilities and the collected sewage is discharged into the surrounding marshlands without treatment which causes water pollution in the areas.

The current status of sewerage service by each division is shown in the table below.

Table 3.29 Current Status of Sewerage by Division

Division	Population (Person)	Coverage (%)	Type of Collection System	Generated Wastewater (m^3/ay)	Existing Capacity of STP (m^3/day)
Al-Amarra	623,330	99	Separate/Combined System	127,580	96,000
Al-Maymonna	108,059	100	Separate/Combined System	9,450	5,000
Al-Mejir Alkabeer	161,872	100	Separate/Combined System	27,735	36,000
Ali Al-Gharbi	52,766	100	Separate/Combined System	6,796	No STP
kalaat Salih	110,288	100	Combined System	13,055	No STP
Al-Kahllaa	56,255	98	Combined System	9,097	No STP

Source: Messan Governorate (As of 2014)

2) Facility Development

a) Sewer System and Pumping Station

Based on the interview in this survey, major part of pipes installed in the firsthalf of 1980's. Pipe material is ductile cast iron, concrete, polyvinyl-chloride and GRP pipe, diameter is 110 ~ 2,400 mm, and total length is 965 km approximately. There are total 57 pumping stations consisting of 12 stations for stromwater, 14 station for sanitary sewage, and 31 stations for combined sewage.

b) Sewage Treatment Plant (STP)

Existing STPs are listed below.

Table 3.30 Outline of Existing STP

Division	Name of STP	Capacity (m3/day)	Treatment Method	Remarks
Al-Amara	Amara STP	96,000	Conventional Activated Sludge Process	
Al-Maymonna	Maymonna STP	5,000	Conventional Activated Sludge Process	
Al-Mejir Alkabeer	Mejir Alkabeer STP	36,000	Conventional Activated Sludge Process	

Source: Messan Governorate (As of 2014)

c) On-going Project

On-going projects of sewerage are listed below.

Table 3.31 On-going Project

Division	Component	Capacity	Contracted Price (Mil IQD)	Source of Funds	Percentage of Completion	Problems for Implementation
Al-Amarra	Al-Amara STP (Phase 3)	60,000m^3/day	82,206	MMPW	99	-
Ali Al-Gharbi	Design Preparation	-	340	MMPW	0	-
kalaat Salih	Design Preparation	-	500	MMPW	0	Disagreement with MOWR about the discharge point

Source: Messan Governorate (As of 2014)

3) Operation and Maintenance

Results of the water quality test at Amara STP are shown in the table below. Both BOD and TSS exceed the national standard of wastewater which indicates a low removal efficiency and implies insufficient O&M work for the STP.

Table 3.32 Water Quality at Amara STP (Average in 2011-2014)

Items	Influent (mg/l)	Efluent (mg/l)	Removal Efficiency	Remarks
BOD	277	150	46%	National Standard of Wastewater in Iraq; BOD<40mg/l, TSS<60mg/l
TSS	514	275	46%	

Source: Messan Governorate

3.2.5 Summary of Facility Development and O&M Conditions in the Governorates

(1) Water Supply System

In the water supply sector, central cities in all governorates have achieved 80-95% of coverage and facility development in central city has almost completed. Meanwhile, it is confirmed that the facility development in rural cities and rural area is still delayed. The leakage water rate is estimated at approximately 30% in all governorates but that of Basrah and Al-Muthanna are exceeding 40% or more.

Table 3.33 Water Supply Coverage in Southern Four Governorates

Area	Basrah	Dhi-Qar	Al-Muthanna	Messan
Urban	80%	90%	90%	95%
Rural	80%	40%	50%	90%

Source: Southern four Governorates (As of 2014)

(2) Sewerage System

In the sewerage sector, coverage in each governorate are 24-99% varying among the four governorates. As a water supply sector, it is notable that there is a big gap of facility development in central cities and rural cities in which facility development is still delayed. In addition, many areas with a high coverage of facility development have developed only sewer pipes without treatment facilities especially in rural areas.

Table 3.34 Sewerage Coverage in Southern Four Governorates

Area	Basrah	Dhi-Qar	Al-Muthanna	Messan
Central City	65%	24%	35%	99%
Rural City	5~25%	7~26%	0~80%	67~100%

Source: Southern four Governorates (As of 2014)

(3) Operation and Maintenance

Regarding the O&M work, the counterparts of the governorates pointed out some common issues for O&M listed below and that many facilities are under inappropriate conditions.

- Problems on water sources caused by increase of salinity by seawater intrusion and pollution by domestic wastewater

- Unintegrated facilities constructing with many small units
- Old Facilities with more than 30% of water leakage
- Lack of related data for evaluation and analysis of existing facilities
- No master plans
- Lack of customer cooperation, such as illegal connection and nonpayment of tariff
- Insufficient budget
- Lack of staff capacity and experiences

These situations, such as delay of facility development and inadequate O&M, deteriorate sanitary condition in the surrounding areas within the governorates. It also causes pollution of the Euphrates River and affects water supply project in the downstream areas as well.
For improvement of such conditions, systematic and prevenient project should be formulated based on the future needs. In addition, not only facility development projects as stopgap measurement are necessary but attentions should be brought to the comprehensive project implementations and coordination of all three stages of the projects including planning/design, construction stage, and O&M stage

3.3 Management and Organizations

3.3.1 Organizations of Water Supply and Sewerage System

(1) Water Directorate

1) Organizational Structure

Figure 3.9, 3.10, and Table 3.26 to 3.29 show organizational structure and staff allocations for the four water supply and sewerage directorates in southern Iraq. Basically organizational structures of these governorates are same.
These organizations have trinity functional divisions of Main Office Division, Administrative Assistance Division, and Technical Assistant Division, plus IT Unit. Technical Assistant Division has line functionality, and covers activity of technical planning, facility designing, supervising construction projects, operating and maintaining facilities, testing water quality, and managing compact units. Compact unit is a small size water purified facility around 3 meters wide, 10 meters long, and 3 meters height. This unit could produce potable water alone and be introduced for quick solution to shortage of capacity on the existing water purification facilities. Compact Units and Maintenance Group under Districts and Respects Division is a unique team.
Administrative Assistance controls activities of administrative works including budget planning, budget control, casher works, and accounting under the Accountants Office, human resources management under HR Office, legal services, stock control, vehicle management, and water tariff collection under Income Unit.
Main Office Division has a nature of staff functionality which covers activities of managing user complaints, PR, secretary works, and offices management. Also, this organization has IT units as staff functionality independent from Main Office Division.

2) Efficiency

Table 3.25 shows major performance indicators of organizational efficiency. Number of layer is 4, and control span is 21 to 57. Control span of Al-Muthanna Water Supply System is 21 and shows too much middle class managers. Ratio of technical staff is 9 to 27%, and in reasonable range for technical oriented organization. Ratio of clerk is 3 to 9%, also in a reasonable range. However, number of connections per staff is only 54 to 81. This figure is quite low compare with 200, the standard of the World Bank. This figure suggests problem on efficiency. (Calculate number of connections with population served from questionnaire survey and divide with 7.7 as average family size on the census.)

(2) Sewerage Directorate

1) Organizational Structure

Basically same concept of organizational design adapted to sewerage sectors, however, directory controlled by Management Assistant. This directly control structure may makes too much works to management assistant. In a standard organization, they categorize activities and works into three functional groups of administrative, customer services, and technical works. Middle manager empowered and could make decisions for not serious matters. Only serious issues are reported to top management for their final decision making, and avoid wasting time and energy of top management to small matters. In this concept of functional structured organization, Planning Unit, Design Unit, Operation Unit, Executing Unit and Laboratory Unit should better grouping to one group of Technical Division. Income Unit should better be Customer Service Division. Legal Division, Vehicles Unit may better grouping to Administrative Division with Accounting Division and HR Division. Existing organizational structure is rather chaotic and lack of concept on grouping with functionality.

2) Efficiency

Layer is 4, however, consider Manager is only supervising Management Assistant, actual layer is only 3. Layer may better be few, however, too few.

Control span is 13 to 38, and too much middle class manager, especially Basra and Al-Muthana. Ration of Technical staff is 10 to 13%, almost similar with Water Supply Section. However, ratio of clerk is 7 to 36% and figure of 36% is quite high for technical oriented organization. Normally, this ratio would be around 10%. Main reason of this high ratio of clerks may come from assigning almost the same number of clerks with Water Supply Sector. Although volume of works of sewerage system depends on number of connection in water supply system as well as related situation, however, this ratio suggests inefficiency of work compare with water supply system. Number of connections per staff is 14 to 81, quite low, except 264 for Basra.

Table 3.25 Performance Indicators of Organizational Efficiency

Item	Water Supply System				Sewerage System			
	Basrah	Dhi-Qar	Al-Muthanna	Messan	Basrah	Dhi-Qar	Al-Muthanna	Messan
Layer	4	4	4	4	4	4	4	4
Managers	56	55	56	56	46	46	46	46
Control Span	57	45	21	40	13	38	17	26
Technical Staff	422	694	154	206	63	239	100	141
Ratio of Technical Staff	13%	27%	13%	9%	10%	13%	12%	12%
Ratio of Clerk	9%	3%	11%	3%	36%	13%	12%	7%
Connections	263,000	211,800	71,620	124,960	168,000	49,200	11,020	98,800
Connections per Staff	81	82	59	54	264	27	14	81

Note: Number of connection is based on assumptions

Figure 3.2 and Figure 3.3 show organizational structure of water supply system and sewerage system for the four governorates. Table 3.26 to 3.29 shows the number of staff.

Water Directorate

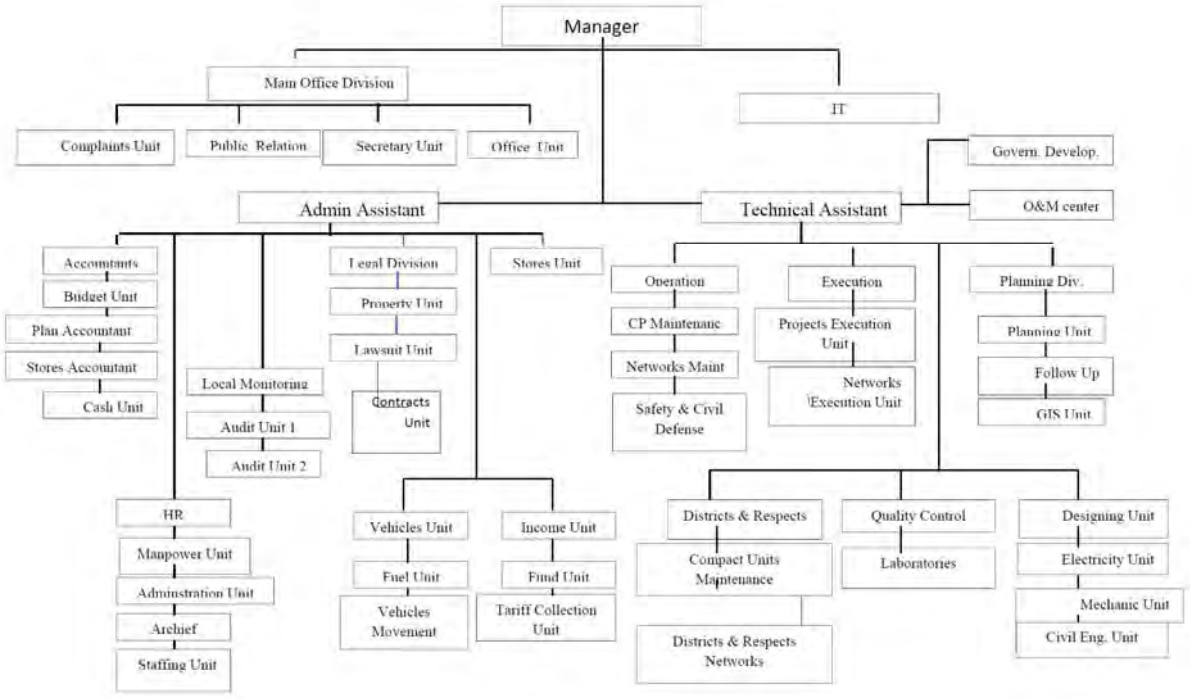


Figure 3.2 Organizational Structure of Water Supply System

Sewerage Directorate

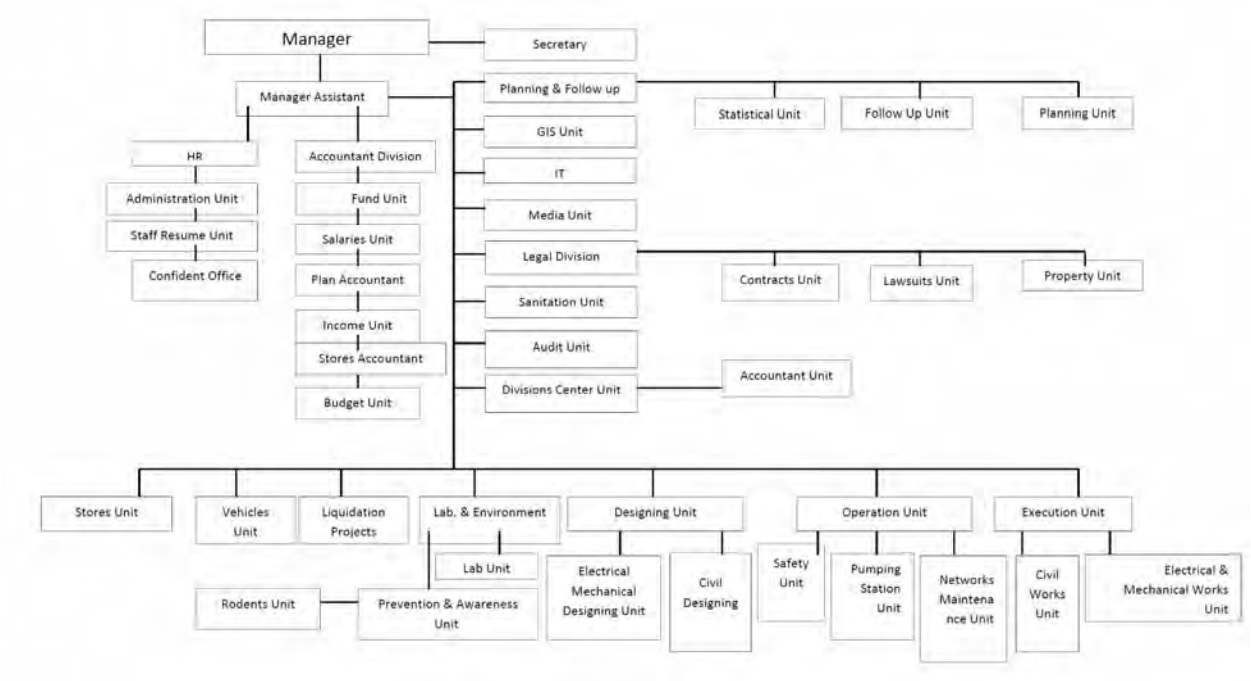


Figure 3.3 Organizational Structure of Sewerage System

Table 3.35 Number of Staff (Basrah)

	Water Supply System				Sewerage System			
Jobs	Fulltime	Contract	Day Labor	Total	Fulltime	Contract	Day Labor	Total
Engineer	111	0	0	111	47	3	2	52
Work Supervisor	90	0	20	110	100	11	16	127
Technician	233	0	78	311	11	0	0	11
Administrator	267	0	28	295	79	53	96	228
Unskilled labor	1,946	0	210	2,156	80	0	0	80
Driver	121	0	34	155	129	0	0	129
Others	105	0	22	127	0	13	0	13
Total	2,837	0	392	3,265	446	80	114	640

Table 3.36 Number of Staff (Dhi-Qar)

	Water Supply System				Sewerage System			
Jobs	Fulltime	Contract	Day Labor	Total	Fulltime	Contract	Day Labor	Total
Engineer	89	2	14	105	46	13	25	84
Work Supervisor	65	0	0	65	0	0	0	0
Technician	551	0	38	589	131	16	8	155
Administrator	75	1	12	88	154	3	78	235
Unskilled labor	235	1	320	556	0	0	0	0
Driver	103	0	0	103	101	0	16	117
Others	659	0	419	1,078	694	8	505	1,207
Total	1,777	4	803	2,584	1,126	40	632	1,798

Table 3.37 Number of Staff (Al-Muthanna)

	Water Supply System				Sewerage System			
Jobs	Fulltime	Contract	Day Labor	Total	Fulltime	Contract	Day Labor	Total
Engineer	39	1	2	42	35	4	1	40
Work Supervisor	0	0	0	0	13	0	20	33
Technician	108	0	4	112	21	0	39	60
Administrator	138	0	0	138	73	0	24	97
Unskilled labor	378	20	205	603	256	0	268	524
Driver	76	6	2	84	69	0	0	69
Others	64	0	161	225	0	0	0	0
Total	803	27	374	1,204	467	4	352	823

Table 3.38 Number of Staff (Messan)

	Water Supply System				Sewerage System			
Jobs	Fulltime	Contract	Day Labor	Total	Fulltime	Contract	Day Labor	Total
Engineer	42	0	20	62	26	5	3	34
Work Supervisor	624	80	600	1,304	0	0	0	0
Technician	113	0	31	144	92	5	10	107
Administrator	69	2	4	75	73	4	11	88
Unskilled labor	90	111	312	513	504	114	291	909
Driver	114	1	6	121	82	0	0	82
Others	78	2	7	87	0	0	0	0
Total	1,130	196	980	2,306	777	128	315	1,220

3.3.2 Budget Allocation and Execution

The Iraq government has two types of budget; capital budget and operational budget. The government uses capital budget for construction of facility and the operational budget for operating and maintaining facilities. Projects of urgent, important which require a huge budget for construction are categorized as national projects. Budget for this type of projects is disbursed from MMPW directly and mainly for building facilities for the state capitals and big cities. Construction of facilities for other cities use the budget allocated to governorates. Execution of capital budgets for water supply and sewerage system is mostly on schedule, however there are some problems for construction quality and some delays.

Basically, operational budget for facilities that are constructed by the national projects are disbursed by MPWP (to Directorate) and operational budget for facility constructed by governorate projects comes from governorates. However, it is possible to adjust between the two operational budgets when in shortage.

The Government of Iraq is implementing a decentralization policy and is shifting budget allocation to a new system. Presently, budgets for salaries and wages come directly from MPWP (to Directorate) and other operational budgets come from governorates. In future, MPWP will plan to transfer all facilities and operational staff to governorate, and request to execute all operational budgets from prefecture governorates.

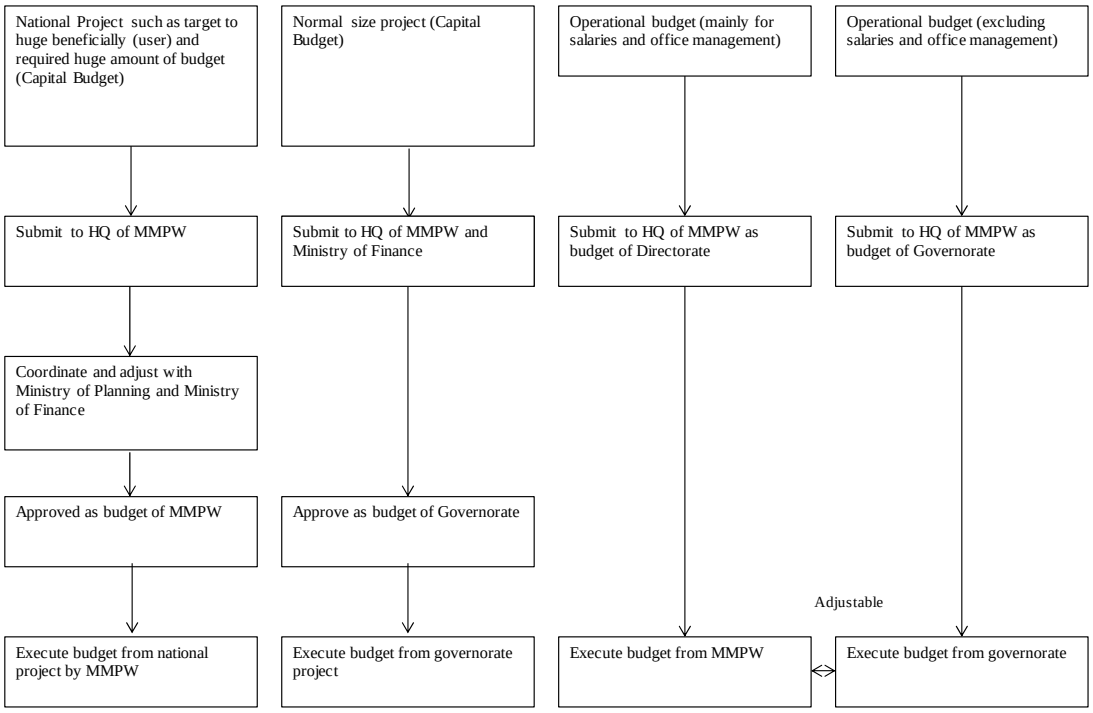


Figure 3.4 Budgeting and Budget Execution Flow

Note: MMPW covers operational budget for salaries and costs for office management including stationary, telephone and miscellaneous cost for administrative work. Governorate covers operational budget for electricity, chemical, spare parts and maintenance cost excluding salaries of staff.

Government of Iraq does not adapt concept of cost recovery and user contribution to social business operation of water supply and sewerage system. They do not adapt concept to fulfill with subsidiary to shortage of revenue from water tariff and sewerage collection. Capital budget and operational budget for water supply and sewerage system are independent budget for social services of the government. In this concept, water tariff and sewerage charge assumed as sort of tax, and pay to the National Treasury.

Table 3.39 to Table 3.42 and Figure 3.5 to Figure 3.8 show capital and operational budget to each directorate and governorate.

(1) Basrah Governorate

Their answer to the questionnaire lacks administrative budget and capital budget. Graph of Figure 3.5 including assumptions of budget for salaries and administrative based on number of staff, and assumption of total operational budget may increase 15% annually.

Basically amount and allocation of budget is not significantly changed inlast 4 years; capital budget is 72%, operational budget is 28% in water supply sector. Budget for administrative work would be 13% and operation and maintenance budget excluding salaries and wages would be 15% among 28% of operational budget (based on assumptions).

In the sewerage sector, capital budget is 63% and operational budget is 37%. Budget for administrative work would be 17% and operational budget excluding salaries and wages may 21% (as assumptions). These figures including assumptions mentioned before, however, ratio of HR cost is rather high as that may be 46% for water supply section and 45% for sewerage section compare with normally less than 35% for pumping oriented system (non-gravity system).

Table 3.39 Budget of Water Supply and Sewerage Sector (Basrah)

Items	unit	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1.Water supply budget	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
1a).Construction budget	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	123,739,000	143,770,000	132,250,000	171,000,000
1b).Supporting for O&M	,000 IQD	5,800,072	6,759,420	6,848,191	9,718,361	18,643,636	17,937,415	27,354,357	26,607,199	30,873,556	35,263,704
1c).Administration in the department	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
2.Sewerage budget	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
2a).Construction budget	,000 IQD	DNA	3,270,000	5,860,000	4,660,000	DNA	3,050,000	24,200,000	16,700,000	0	DNA
2b).Supporting for O&M	,000 IQD	DNA	690,000	662,000	1,220,000	DNA	2,220,000	1,050,000	1,600,000	7,055,000	7,300,000
2c).Administration in the department	,000 IQD	DNA	1,230,000	1,380,000	2,270,000	5,340,000	6,610,000	8,900,000	9,900,000	6,800,000	5,900,000

Source) Basrah Governorate

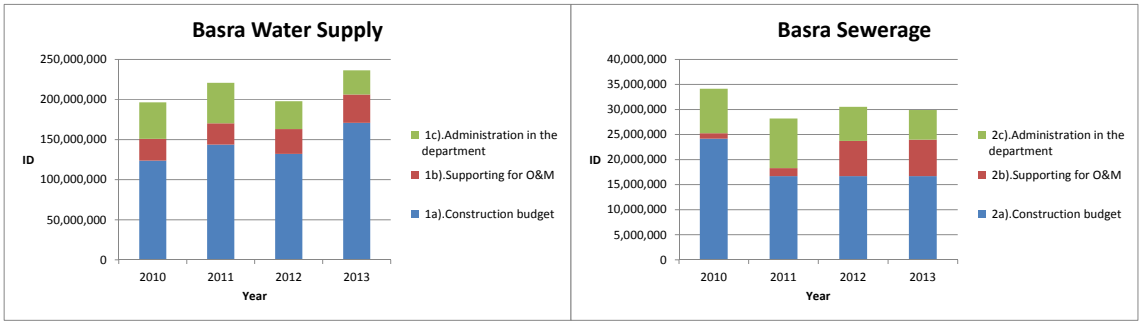


Figure 3.5 Cost Analysis of Basrah Water Supply and Sewerage Section (including assumption)

(2) Dhi-Qar Governorate

Their capital budget was 46% and operational budget was 54% in 2013. Administrative budget was 34% and operational budget excluding salaries and wages was 21% for water supply sector.

Capital budget was 81% and operational budget was 19%. Administrative budget would be 12% and operational budget excluding salaries and wages would be 7% for sewerage sector. Administrative ratio in operational budget is rather high, as 62% both water supply and sewerage section.

Table 3.40 Budget of Water Supply and Sewerage Sector (Dhi-Qar)

Items	unit	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1.Water supply budget (From Governorate & MMPW)	,000 IQD	DNA	DNA	DNA	DNA	38,530,476	29,906,814	17,469,069	31,923,800	70,522,629	48,177,525
1a).Construction budget (Governorate Budget)	,000 IQD	DNA	2,818,920	12,851,774	14,726,050	32,116,853	6,398,100	1,987,750	12,381,723	47,173,153	21,959,517
1b).Supporting for O&M (From MMPW)	,000 IQD	DNA	DNA	DNA	DNA	800,902	15,004,002	3,720,907	5,680,907	7,384,704	10,049,104
1c).Administration in the department (From MMPW)	,000 IQD	DNA	DNA	DNA	DNA	5,612,721	8,504,712	11,760,412	13,861,170	15,964,772	16,168,904
2.Sewerage budget	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
2a).Construction budget (MMPW + Governorate)	,000 IQD	DNA	DNA	DNA	DNA	141,650,754	DNA	DNA	4,250,000	390,979,000	44,588,000
2b).Supporting for O&M	,000 IQD	240,000	240,000	600,000	600,000	750,000	1,920,000	2,000,000	4,000,000	4,000,000	4,000,000
2c).Administration in the department	,000 IQD	35,778	115,825	287,244	395,950	3,479,915	4,887,608	5,983,278	6,174,630	6,359,217	6,621,760

Source) Dhi-Qar Governorate

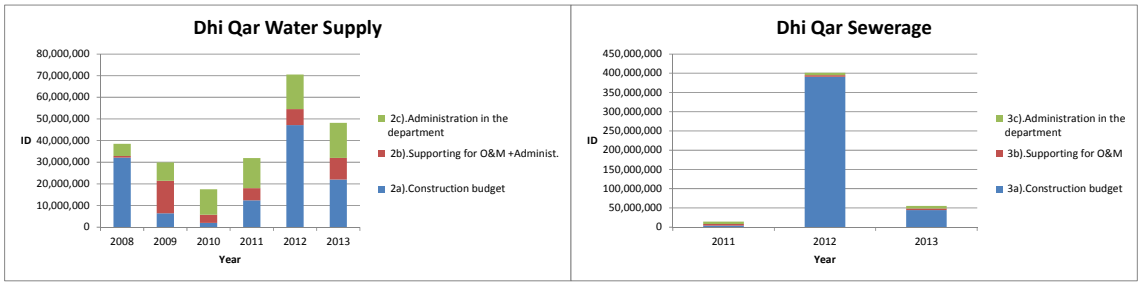


Figure 3.6 Cost Analysis of Dhi-Qar Water Supply and Sewerage Sector (including assumption)

(3) Al-Muthanna Governorate

Their answer to questionnaire lacks administrative budget and capital budget in water supply sector. In sewerage sector, capital budget is only 5% and operational budget is 95% in 2013. Administrative budget is 38% and operational budget excluding salaries and wages is 58%. This means quite a high administrative cost rate of 61% among operational budget. Also ratio of capital budget is quite low, that may suggest delay/stop of infrastructure development.

Table 3.41 Budget of Water Supply and Sewerage Sector (Al-Muthanna)

Items	unit	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1.Water supply budget	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
1a).Construction budget	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
1b).Supporting for O&M	,000 IQD	1,597,635	2,143,531	2,711,507	3,758,133	5,877,687	7,328,799	14,196,983	11,666,714	13,556,380	13,169,799
1c).Administration in the department	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
2.Sewerage budget	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
2a).Construction budget	,000 IQD	23,515	31,274	3,397	893	2,209	15,002	261,827	298,128	391,290	367,428
2b).Supporting for O&M	,000 IQD	121,125	321,137	514,818	613,258	677,749	979,900	2,119,483	2,987,507	2,234,440	3,027,062
2c).Administration in the department	,000 IQD	362,275	386,978	442,375	758,917	14,466,100	2,167,989	2,153,841	2,588,447	3,022,978	4,638,482

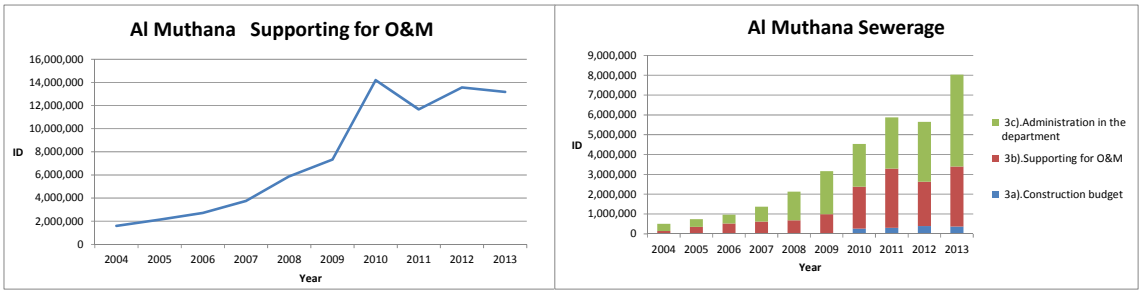


Figure 3.7 Cost Analysis of Al-Muthanna Water Supply and Sewerage Sector (including assumption)

(4) Messan Governorate

Their answer to questionnaire lacks administrative budget and capital budget in water supply sector. In sewerage sector, they allocate budget for mostly to capital budget and operational budget is quite limited. Administrative budget is 0.6% and operational budget excluding salaries and wages is 0.4%. This means quite high administrative cost ratio of 60% among operational budget.

Table 3.42 Budget of Water Supply and Sewerage Sector (Messan)

Items	unit	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1.Water supply budget	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
1a).Construction budget	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
1b).Supporting for O&M + Administ.(1c)	,000 IQD	DNA	2,795,500	373,380	4,513,800	541,529	8,200,714	11,786,024	12,710,950	1,424,770	16,475,368
1c).Administration in the department	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
2.Sewerage budget	,000 IQD	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
2a).Construction budget	,000 IQD	DNA	DNA	95,000,000	85,000,000	85,000,000	70,000,000	DNA	45,000,000	78,000,000	70,000,000
2b).Supporting for O&M	,000 IQD	20,000	20,000	35,000	60,000	65,000	95,000	130,000	300,000	DNA	DNA
2c).Administration in the department	,000 IQD	72,000	73,000	96,000	107,000	151,000	300,000	367,000	365,000	398,000	378,000

Source) Messan Governorate

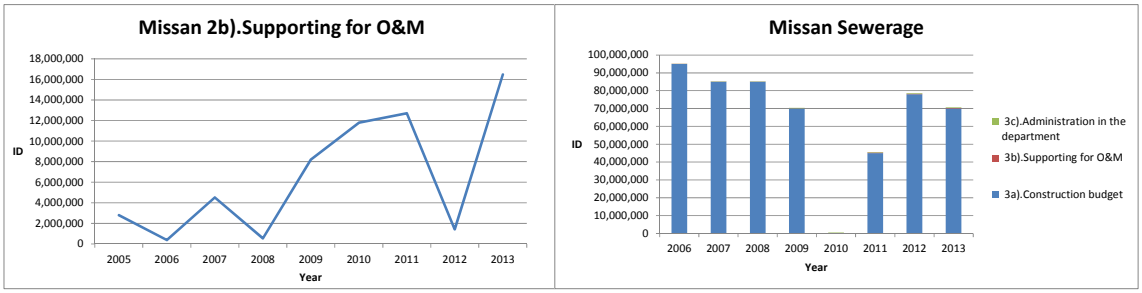


Figure 3.8 Cost Analysis of Messan Water Supply and Sewerage Sector (including assumption)

3.3.3 Tariff Collection

They charge water tariff and sewerage tariff together with other public charges to customer. Rate of water supply is equal in the country. Because of the water quality problem (could not remove salt in drinking water), they do not take any actions (including disconnection) to customers who do not pay water and sewerage bill.

Added more, they do not establishing application system as well as they do not involve with house construction works. Customers hire plumbers and connect with distribution pipe networks by themselves without any requirements to get permissions and inspections. However, lack of an inspection system leads to poor quality of house connections work and further leading to leakage problems. Both water supply section and sewerage section do not manage customer information sufficiently, that leading billing problem. For these reasons, collection amount (and collection efficiency) of water and sewerage bill is very low. There is a unit work for billing and collection in the organization, however, does not function well. With lack of customer names and addresses, it is basically impossible to bill and collect water tariff and sewerage charges. Water supply sector considers developing customer information management system and solving so called this illegal connection problem after they can solve the problem of water quality.

3.3.4 Observation of Issues and Problems on Management and Organization

(1) Organization

The Team observed duplication of activities, responsibilities and decision makings with other ministries like water intake with the Ministry of Water and Resources and coordination and adjustment of infrastructure development with the Ministry of Planning and Cooperation. Also there are unclear zones of empowerment between head offices, directorates of MMPW and the governorates. These issues are resulting in slow decision makings and loose project implementation.

As another issue, the organizational structure concept of functional integration completely fails/disappears from the design stage at all four directorates. Standard organizational structure of water supply and sewerage system has 3 functions; administrative, customer service, and technical works. They should reform their organizational structure to the standard organizational structure and reallocate staff for improving efficiency and quality of work (especially quality and efficiency of work by middle management).

(2) Process

Secondly, the operational process is not only standardized but also fails to conduct trainings to the operational staff which is a common practice in a standard operational procedure. They do training to middle management on management and engineering issues. However, not deliver any training for operational staff. Such situation could be one of reasons for poor facility operation and maintenance (for example operational staff miss to repair when a facility is broken).

Related with such observed problems and issues, several international assistant agencies pointed out contacting issues with constructors. MMPW recognizes contract with sufficient consultants and constructor s as a success factor in project implementation and urgent improvement issues. The Ministry of Planning already decided to apply international billings and contract procedures for every national project, however, not yet perfectly implemented due to the poor experiences and hesitation towards new challenges among the government staff.

(3) Management Information System and Customer Services

Thirdly, poor wiliness in providing customer services by recording sufficient customer information. They do not have any application systems for approve house connection. But register information on application form is first step on procedure of customer services. They do neither develop MIS: Management Information System for monitoring management situation, nor attempt to collect basic management data for governing organization and activities.

3.4 Other Circumstances Surrounding the Water Sector

Other circumstances surrounding the water sector in the governorates are summarized below.

3.4.1 Procedure of Environmental and Social Considerations

As stated in Chap.2 about the environmental & social considerations, projects which might affect environments shall conduct an EIA and acquire approval of project implementation for environment conservation by Law No.27/2009 established by the central government.

Since there is no additional regulation and rules about environmental & social considerations in the governorates, corresponded projects shall conduct EIA and get approval of project implementation based on the Law No.27/2009. However, even though EIA process is required, some projects are implemented

without EIA and thus cause troubles, such as exhausting water source after starting the operation in water supply projects.
Projects which are requested EIA execution are categorized by the Ministry of Environment.

3.4.2 Power Supply Condition

According to the report for the domestic power supply conditions by Central Statistical Organization, Ministry of Planning, over 80% of households in the governorates have electrical power failure for more than 3 hours per day, with 86% in Basrah, 96% in Dhi-Qar, 93% in Al-Muthanna, 96% in Messan, especially in summer season.
Based on the interview conducted for this survey, since water sector projects receive electric power by priority measurements, even in the power failure conditions, there is no a serious problem for operation of the water sector projects.

3.4.3 Private Sector Participation

Regarding the private sector participation in the governorates, there are only service contracts for consulting service, construction, or O&M work, and no case of the contract with project management such as BOT (Build-Operate-Transfer) contract have observed.
Meanwhile, as stated in Chap. 2, “promotion of private sector participation” is targeted in national development plan and is expected that private sector function effectively for technical, financial, and management aspect of the projects in the governorates.
It is reported that the Ministry of Planning has prepared the guideline for PPP (Public-Private Partnership） projects but it is not utilized yet due to the staff’s lack of experience and skills.

3.4.4 Environmental Impact

Lack of source of water is a one of the main issues of water sector from the environmental aspect. Reduction of water intake potential and increase of salinity of water sources, which might be caused by construction of dams in upstream areas, are common issue in the governorates. It is required to address such situations immediately.
In this survey, high TDS of water source, which correlate with salinity, is confirmed in many projects. From the middle-term point of view, it is required to formulate an integrated management plan of water sources including water treatment with RO for desalination, water usage distribution between upstream and downstream areas, and coordination with water use for industrial and irrigation.

3.4.5 Current Status in Rural Areas

“Poverty Profile in Iraq” (Mar2012, JICA) mentioned that, in urban areas, almost all households including poverty group are connecting to the public water supply network but, in rural area, water supply coverage is only 38% for the poverty groups and around half for the non-poverty groups. In addition the water supply

service is not stable. Only 9% of poverty groups and 13% of non-poverty groups are under the stable condition of public water supply service. One-third of households connected public water service reported that water supply is insufficient and there is interruption in supply once per week. Under such situations, many households have to rely on water trucks or wells for secondary water sources. In rural areas, 22% of households which can access public water services get water from river or stream directly during the frequent interruption of the service.

According to the survey interview, many households in rural area with no water supply systems receive water from water truck and then reserve it by water tank on their house roofs.

3.4.6 Activity of Donors

All on-going projects of the water sector in the governorates are funded by Iraq's own budget except for the Basra water project which was funded by Japanese Yen Loan. The Basra water project is now implementing by the following packages.

- Package 1: Rehabilitation of Transmission and Distribution Network *(Source of fund is not fixed yet)*
- Package 2: Rehabilitation of R-Zero WTP, Construction of TRWTP and TR,
- and Extension of Transmission Systems *(Japanese Yen loan Project)*
- Package 3: Construction of Proposed Al Hartha WTP *(Japanese Yen loan Project)*
- Package 4: Construction of RO Plant *(Funded by Iraq own Budget)*

Package 2 includes WTP construction with RO membrane and it will cope with salinity of water source. Pipe network installation is also included in Package 2 but it was transferred to Package 1 due to the lack of budget for Package 2. Pipe network installations are important components of the project because a lot of water leakages are found in the city, but source of budget of Package 1 is not yet fixed.

3.4.7 Industrial Water & Wastewater

According to the survey interview, there are not any industrial water systems in the governorates and industrial buildings intake water on their own responsibility.

Meanwhile, discharged water into public waters has to meet Iraq's standards of discharged water by Law No.25/1967. Major factories, such as oil refinery, have their own wastewater treatment plants but nobody check the results whether the treated water meets the standard.

According to 'Water and Sewage Sectors in Iraq Sector Report (Feb 2013, JCCME)', many wastewater treatment plants in major factories, which include oil refinery and cement factory etc, are under insufficient O&M condition and it is one of the reasons for water pollution in public water bodies.

From the viewpoint of improvement for living environment and conservation of water sources, it is required to strengthen a management system for industrial wastewater which includes promotion of development of wastewater treatment plants, monitoring discharged water quality, and penalizing violators etc.

Chapter 4 Action Plan for Improvement of Water Supply and Sewerage Project in Southern Four Governorates

4.1 Issue, Problem and Solution

Last chapter reviewed and analyzed the current water supply and sewerage conditions in the Iraq's four southern governorates of Basrah, Dhi-Qar, Al-Muthanna, and Messan and pointed out several issues and problems. This chapter, in turn, provides solutions to those problems including facility constructions and operation and management, improvement programs, and presents road maps and outlines for priority projects.

4.1.1 Water Supply

(1) Planning and Design

The issues and problems related to planning and design are similar in all four governorates as described below:

1) Issues

Issues and problems are as follows;

- Too many compact units cause ineffective operation and maintenance.
- Water demand is not watched and water leakage is not concerned.
- Water treatment facilities are not suitable for treating water salinity.
- Lack of master plans due to the absence of skills for designing and planning, insufficient information on the existing facilities including WTP and network, and general low awareness on the importance of master plans in delivering successful projects.
- Priority of projects is not clear due to lack of master plans.

2) Solution

To integrate water treatment plants and to take countermeasures on prevent pipe leakage, it is necessary to obtain information on the facilities, estimate the future population, plan facilities based on the demand and implementation programs. It is difficult to take countermeasures for each facility respectively, master plan preparation is necessary.

- Selection of consultants for planning, design, tendering and supervising.
- Human resource development for planning and design
- Survey and assessment of the existing facilities and establishment of O&M database
- Preparation of comprehensive water resource management plan
- Preparation of water supply master plans including integration of WTP, rehabilitation and renewal of network, and leakage reduction.

(2) Facility Construction

1) Future Demand Projection

Future demands are important in assessing the capacity of water supply facilities. The future demand for each governorate is shown in Table 4.1 based on the conditions below:

- Target year : 2030
- Current population : Submitted by the counterparts for each division, it should be confirmed by social survey
- Population growth rate : 2.6 – 2.9 %/year (as presented in Chapter 2)
- Coverage for future : 100%
- Leakage rate : 25 - 30% in the future

Per capita water demand : Supply 350 lpcd including losses is applied
Net water consumption ranges from 245 to 263;
245 = 350 x (1-0.3) , 263 = 350 x (1-0.25)

Table 4.1 Water Supply Demand Projection for Southern Four Governorates

Basrah

Category	Name of Division	2014 Current							2030 Future						
		Population	Coverage (%)	Produced Water (m^3/day)	Average Rate of Leakage (%)	PerCapita Supply (lpcd)	WTP Capacity (m3/day)	Availability (Capacity/Demand)	Population	Coverage (%)	PerCapita Supply (lpcd)	Total Demand of Water (m^3/day)	Additional Capacity (m3/day)	Total Capacity (m3/day)	Availability (Capacity/Demand)
Center	Al- Basrah	1,658,300	95	750,000	30	476	786,050	1.05	2,546,000	100	350	891,000	220,000	1,006,050	1.13
Other	AL-Zubair	628,300	80	120,000	40	239	127,000	1.06	965,000	100	350	338,000	24,000	151,000	0.45
	AL-Qurna	298,700	80	80,000	40	335	95,000	1.19	459,000	100	350	161,000		95,000	0.59
	Abo AL-khaseeb	236,900	85	70,000	45	348	77,400	1.11	364,000	100	350	127,000	38,400	115,800	0.91
	AL-Medaynna	252,350	85	80,000	45	373	87,450	1.09	387,000	100	350	135,000	80,000	167,450	1.24
	Shatt AL-Arab	195,700	80	65,000	45	415	72,000	1.11	300,000	100	350	105,000	127,200	199,200	1.90
	AL-Fao	61,800	90	20,000	30	360	22,600	1.13	95,000	100	350	33,000		22,600	0.68
Total		3,332,050	88	1,185,000			1,267,500	1.07	5,116,000			1,790,000	489,600	1,757,100	0.98

Dhi-Qar

Category	Name of Division	2014 Current							2030 Future						
		Population	Coverage (%)	Produced Water (m^3/day)	Average Rate of Leakage (%)	PerCapita Supply (lpcd)	WTP Capacity (m3/day)	Availability (Capacity/Demand)	Population	Coverage (%)	PerCapita Supply (lpcd)	Total Demand of Water (m^3/day)	Additional Capacity (m3/day)	Total Capacity (m3/day)	Availability (Capacity/Demand)
Center	Nasiriyah	921,000	76	211,400	29	302	234,840	1.11	1,414,000	100	350	495,000	100,800	335,640	0.68
Other	Suq Ashyok	354,000	71	87,000		346	88,680	1.02	544,000	100	350	190,000	48,000	136,680	0.72
	Alchebaysh	94,000	91	48,900	30	572	51,780	1.06	144,000	100	350	50,000	43,200	94,980	1.90
	Alshatra	400,113	75	131,840	20	439	130,420	0.99	614,000	100	350	215,000	96,000	226,420	1.05
	Alrefaey	380,955	65	90,440	36	365	110,660	1.22	585,000	100	350	205,000	120,000	230,660	1.13
	Total	2,150,068	74	569,580			616,380	1.08	3,301,000			1,155,000	408,000	1,024,380	0.89

Al-Muthanna

Category	Name of Division	2014 Current							2030 Future						
		Population	Coverage (%)	Total amount of Produced Water (m^3/day)	Average Rate of Leakage (%)	PerCapita Supply (lpcd)	WTP Capacity (m3/day)	Availability (Capacity/Demand)	Population	Coverage (%)	PerCapita Supply (lpcd)	Total Demand of Water (m^3/day)	Additional Capacity (m3/day)	Total Capacity (m3/day)	Availability (Capacity/Demand)
Center	Al-Samawah*	290,850	50	(60,000)	42	413		0.00	447,000	100	350	156,000		0	0.00
Other	Al-Rumaytha	117,941	77	165,000	42	1,817	180,800	1.10	181,000	100	350	63,000	240,000	420,800	6.68
	Al-Hilal*	39,262	10	6,800	25	1,732	7,872	1.16	60,000	100	350	21,000		7,872	0.37
	Al-Najmi*	34,783	15	4,000	22	767	4,980	1.25	53,000	100	350	19,000		4,980	0.26
	Al-Majid*	42,846	47	9,000	30	447	12,840	1.43	66,000	100	350	23,000		12,840	0.56
	Al-sawayer	46,767	11	5,000	32	972	6,000	1.20	72,000	100	350	25,000		6,000	0.24
	Al-Khudhair*	89,175	42	16,000	33	427	21,180	1.32	137,000	100	350	48,000		21,180	0.44
	Al-Daraji	18,841	21	6,000	24	1,516	6,300	1.05	29,000	100	350	10,000		6,300	0.63
	Al-Warkka*	97,049	35	19,800	32	583	27,000	1.36	149,000	100	350	52,000		27,000	0.52
	Al-Salman	10,695	14	3,600	7	2,404	3,600	1.00	16,000	100	350	6,000		3,600	0.60
	Total	788,209	44	235,200			270,572	1.15	1,210,000			423,000	240,000	510,572	1.21

Note: * marked division is supplied from Al Rumaytha

Messan

Category	Name of Division	2014 Current							2030 Future						
		Population	Coverage (%)	Total amount of Produced Water (m^3/day)	Average Rate of Leakage (%)	PerCapita Supply (lpcd)	WTP Capacity (m3/day)	Availability (Capacity/Demand)	Population	Coverage (%)	PerCapita Supply (lpcd)	Total Demand of Water (m^3/day)	Additional Capacity (m3/day)	Total Capacity (m3/day)	Availability (Capacity/Demand)
Center	Al-Amarra	623,330	93	170,950	25	295	190,000	1.11	957,000	100	350	335,000	34,800	224,800	0.67
Other	Al-Maymonna	108,059	94	129,300	25	1,273	142,300	1.10	166,000	100	350	58,000		142,300	2.45
	Al-Mejir Alkabeer	161,872	93	24,500	25	163	27,000	1.10	249,000	100	350	87,000	21,600	48,600	0.56
	Ali Al-Gharbi	52,766	93	17,500	25	357	19,300	1.10	81,000	100	350	28,000	12,000	31,300	1.12
	kalaat Salih	110,288	93	21,750	25	212	24,000	1.10	169,000	100	350	59,000	25,200	49,200	0.83
	Al-Kahllaa	56,255	93	32,000	25	612	35,200	1.10	86,000	100	350	30,000	3,600	38,800	1.29
Total		1,112,570	93	396,000			437,800	1.11	1,708,000			597,000	97,200	535,000	0.90

2) Issues and Problems

a) Basrah

i) Source of Drinking Water

Current source of water for Basrah and the surrounding areas is surface water which has a very high TDS concentration of more than 4,000mg/l in maximum value in 2014. This does not meet the standard value of 1,500mg/l and not suitable for drinking. The salinity is expected to rise in the future due to the water intake increase.

ii) Intake, Conveyance and Water Treatment Plant (WTP)

Currently the per capita water supply ranges from 239 to 476 lpcd. It means that the current supply capacity is almost sufficient except Al-Zubair. Giving the ongoing projects, it is estimated that the water supply capacity will almost match as 98% of the future demand in 2030 in the in Basrah governorate. However, some shortage is estimated for the Al-Zubair, Al-Qurna, Abo Al-khaseeb and Al-Fao divisions in future.

iii) Transmission and Distribution

Current water service coverage for each division is considerably high as much as 85 to 95 %.

The estimated leakage rate is 30% to 45% for each division. It is an issue for the efficiency of water use and transmission cost. It should be noted that the leakage rate is an estimated value because both water supply and consumption are not measured.

b) Dhi-Qar

i) Source of Drinking Water

Current source of water in Dhi-Qar is surface water. Its TDS exceeds the limitation of standard value of 1,500mg/l. The salinity is expected to be higher due to the water intake increase in the future. Thus the high TDS is one of the issues for Dhi-Qar.

ii) Intake, Conveyance and WTP

Currently the per capita water supply ranges from 302 to 572 lpcd in Dhi Qar. It means that the current supply capacity is almost sufficient. Giving the ongoing projects, it is estimated that the water supply capacity will 11 % shortage in the future demand in 2030 in all Dhi-Qar governorate. Some shortage is estimated for the Nasiriyah and Suq Ashyok divisions.

iii) Transmission and Distribution

Current service coverage for divisions ranges from 65% to 91%. In the capital city of Nasiriyah, however, the coverage is as low as 76%. The overall low rate of coverage is an issue.

The estimated leakage rate is 20% to 36% for each division. It is an issue for the efficiency of water use and transmission cost. It should be noted that the leakage rate is an estimated value because both water supply and consumption are not measured.

c) Al-Muthanna

i) Source of Drinking Water

Current source of water in Al-Muthanna is surface water. Its TDS does not meet the standard of 1,500mg/l or less. The salinity is expected to be higher due to the water intake increase in the future. Thus the high TDS is one of the issues for Al-Muthanna. Water source of Al-Rumaytha WTP is estimated to be insufficient in the future, Ministry of Water Resource is proceeding new water source and long conveyance pipeline construction.

ii) Intake, Conveyance and WTP

Currently the per capita water supply is more than 400 lpcd for each division. It means that the current supply capacity is almost sufficient. Giving the ongoing projects, it is estimated that the water supply capacity will exceed 21 % of the future demand in 2030 in all Al-Muthanna governorate. Water is supplied from Al-Rumaytha WTP to all the divisions in Al-Muthanna and it will be solved when the on-going project completed, however, it may takes time because a development of new water source is necessary as mentioned above.

The center of Al Samawah depends totally on a WTP located in Al Rumaytha with about 25km distance, the transmission pipelines from Al Rumaytha to the center of Al Samawah are relatively long and have the problem with leakage and illegal connection. Thus, sufficient water is not obtained in Al Samawah.

iii) Transmission and Distribution

Current service coverage for divisions ranges from 14% to 77 %. In the capital city of Al-Muthanna, however, the coverage is as low as 50 %. The overall low rate of coverage is an issue.

The estimated leakage rate is 7% to 42% for each division. It is an issue for the efficiency of water use and transmission cost. It should be noted that the leakage rate is an estimated value because both water supply and consumption are not measured.

d) Messan

i) Water Source

Though a high TDS is not currently an issue it is expected to be in the future. Current source of water in Messan is surface water. Its maximum TDS meets the standard. The salinity is expected to be higher due to the water intake increase in the future.

ii) Intake, Conveyance and WTP

Currently the per capita water supply ranges between 163 to 1,273 lpcd for each division. It means that the current supply capacity is not sufficient in some division. With the ongoing projects, it is estimated that the water supply capacity will not be sufficient in some division for the future demand in 2030.

iii) Transmission and Distribution

Current division wise coverage ranges from 93% to 94 %. They are considerably high.

The estimated leakage rate is 25% for all divisions. It is an issue for the efficiency of water use and transmission cost. It should be noted that the leakage rate is an estimated value because both water supply and consumption are not measured.

3) Solutions

a) Basrah

i) WTP Construction

Both Basrah city and its surrounding areas need to integrate the compact units and also facilities that treat high TDS. A WTP construction/expansion is needed for the Al-Zubair, Al-Qurna, Abo Al-khaseeb and Al-Fao because the demand will exceed their capacity in 2030.

ii) WTP/Network Rehabilitation

The network rehabilitation is highly needed due to the large leakage rate for both Basrah and the surrounding areas. Also WTP rehabilitation is necessary

b) Dhi-Qar

i) WTP Construction

Both Nasiriyah and its surrounding areas need to integrate the compact units and also to treat the high TDS. A WTP construction/expansion is needed for Nasiriyah and Suq Ashyok because the demand will exceed their capacity in 2030.

ii) Network Expansion

Network expansion is highly needed especially for the low service areas including Nasiriyah. Only 76% are covered even the capital city of this governorate.

iii) WTP/Network Rehabilitation

Network rehabilitation is highly needed for both Nasiriyah and the surrounding areas. Because there are no actual data of leakage a survey for leak detection and also water meter installation are needed. Also WTP rehabilitation is necessary

c) Al-Muthanna

i) WTP Construction

Both Al Samawah and its surrounding areas need to integrate the compact units and also to treat the high TDS. A new WTP construction at Al-Rumaytha is on-going and the capacity will exceed the demand in 2030 for total Al-Muthanna. However, a new WTP is necessary for center of Al Samawah to secure sufficient water urgently.

ii) Network Expansion

Network expansion is highly needed due to the low service coverage including Al-Samawah. Only 44 % of the governorate is covered by the current network.

iii) WTP/Network Rehabilitation

Network rehabilitation is highly needed for both Al-Samawah and the surrounding areas. Because there are no actual data of leakage a survey for leak detection and also water meter installation are needed. Also WTP rehabilitation is necessary

d) Messan

i) WTP Construction

A WTP construction/expansion is needed for Al-Amara because their demand in 2030 will exceed the capacity. WTPs construction/expansion is needed for surrounding two areas because the demand in 2030 will exceed their capacity.

ii) WTP/Network Rehabilitation

Network rehabilitation is highly needed for both Al-Amara and the surrounding areas. Because there are no actual data of leakage a survey for leak detection and also water meter installation are needed. Also WTP rehabilitation is necessary

(3) Operation and Maintenance

The issues and problems related to operation and maintenance are similar in all four governorates as seen below:

1) Issues and Problems

Issues and problems are as follows;

- Most of treated water is not meet the standards especially TDS.
- Water supply consumption is not measured due to the lack of water meter.
- Leakage rate is high in network.
- Tariff collection rate is low/no specific application system is applied
- Motivation of O&M staff is low.
- O&M work is not conducted properly due to the lack of skills and experiences. And the

working records of O&M are not recorded and analyzed properly.

- Aged and damaged of existing facilities.
- Customer database does not exist.

2) Solutions

The countermeasures are studied and shown below;

- Human resource development (O&M training)
- Preparation O&M guideline/manual
- Introduction of SCADA system
- Survey for assessment of the existing facility
- Management of O&M record
- Establish customer and facility database with GIS
- Improve tariff collection by establishing a collection system and water meter installation
- Introduce proper treatment process in compliant with the raw water quality
- Improve work process

4.1.2 Sewerage

(1) Planning and Design

The issues and problems related to planning and design are similar for all four governorates, as seen below:

.

1) Issues and Problems

Issues and problems are as follows;

- Priority is not decided for the project implementation.
- The gap of connection became larger between urban and rural areas.
- The sanitary environment is worsening due to the industrial wastewater and/or other reason.
- Treated effluent is not utilized effectively.
- The main reasons for the absence of sewerage master plan are:
  - The staff's insufficient skill set and experience in planning and designing.
  - Facility information is not organized.

2) Solution

Solutions are needed for collection of accurate data/information, functional diagnosis, preparation of master plan including size of sewerage development, determination of off-site or on-site treatment areas, target quality of treated effluent, and priority of implementation. And needs for a guideline and/or a master plan for the treated effluent reuse is also large because it is one of the important water source. Considering above, solutions are shown below:

- Selection of consultants for planning, design, tendering and supervising.

- Human resource development (planning and design).
- Survey and assessment of the existing facilities and establishment of O&M database.
- Preparation of sewerage development plan, on-site or off-site treatment.
- Preparation of sewerage master plan including:
  - Rehabilitation and renewal of network
  - Industrial wastewater management plan
  - Re-use plan for treated effluent

(2) Facility Construction

1) Future Demand Projection

To assess the capacity of sewerage facility, future demand is projected using a simple method of calculation. The 2030 is applied for the target year to evaluate the urgent needs. The future demand for each governorate is shown in Table 4.2. The conditions of the projection are as follow;

- Target year : 2030
- Population : Same as water supply
- Coverage for future : Planned to be 100%
- Per capita sewerage demand : 200 lpcd considering 30 % loss and discharge rate of 80%
  350 x (1-0.3) x 0.8 = 196 → 200

Table 4.2 Sewerage Demand Projection for Southern Four Governorates

Basrah

Category	Name of Division	Current Coverage of Water Supply (%)	2014 Current					2030 Future							
			Population	Coverage (Percentage of Population connected) (%)	Total amount of Produced Wastewater (m^3/day)	Total Capacity of Wastewater Treatment Plant (m^3/day)	Availability (Capacity/ Demand)	Population	Coverage (%)	Served Population	PerCapita Consumption (lpcd)	Sewerage Demand (m^3/day)	Additional Capacity (m^3/day)	Total Capacity (m^3/day)	Availability (Capacity/ Demand)
Center	Al- Basrah	95	1,658,300	65	150,000	240,000	1.60	2,546,000	100	2,546,000	200	509,200	300,000	540,000	1.06
Other	AL-Zubair	80	628,300	5	DNA			965,000	100	965,000	200	193,000	120,000	120,000	0.62
	AL-Qurna	80	298,700	10	DNA			459,000	100	459,000	200	91,800	20,000	20,000	0.22
	Abo AL-khaseeb	85	236,900	3	DNA			364,000	100	364,000	200	72,800	30,000	30,000	0.41
	AL-Medaynna	85	252,350	20	DNA			387,000	100	387,000	200	77,400		0	0.00
	Shatt AL-Arab	80	195,700	25	DNA			300,000	100	300,000	200	60,000	10,000	10,000	0.17
	AL-Fao	90	61,800	70	DNA			95,000	100	95,000	200	19,000	4,000	4,000	0.21
Total		88	3,332,050	39	150,000	240,000	1.60	5,116,000		5,116,000		1,023,200	484,000	724,000	0.71

Dhi-Qar

Category	Name of Division	Current Coverage of Water Supply (%)	2014 Current					2030 Future							
			Population	Coverage (Percentage of Population connected) (%)	Total amount of Produced Wastewater (m^3/day)	Total Capacity of Wastewater Treatment Plant (m^3/day)	Availability (Capacity/ Demand)	Population	Coverage (%)	Served Population	PerCapita Consumption (lpcd)	Sewerage Demand (m^3/day)	Additional Capacity (m^3/day)	Total Capacity (m^3/day)	Availability (Capacity/ Demand)
Center	Nasiriyah	76	921,000	24	177,000			1,414,000	100	1,414,000	200	282,800	180,000	180,000	0.64
Other	Suq Ashyok	71	354,000	7	51,000			544,000	100	544,000	200	108,800		0	0.00
	Alchebaysh	91	94,000	22	21,000			144,000	100	144,000	200	28,800		0	0.00
	Alshatra	75	400,113	26	83,000			614,000	100	614,000	200	122,800	50,000	50,000	0.41
	Alrefaey	65	380,955	17	58,000			585,000	100	585,000	200	117,000	64,000	64,000	0.55
Total		74	2,150,068	20	390,000	0		3,301,000		3,301,000		660,200	294,000	294,000	0.45

Al Muthanna

Category	Name of Division	Current Coverage of Water Supply (%)	2014 Current					2030 Future							
			Population	Coverage (Percentage of Population connected) (%)	Total amount of Produced Wastewater (m^3/day)	Total Capacity of Wastewater Treatment Plant (m^3/day)	Availability (Capacity/ Demand)	Population	Coverage (%)	Served Population	PerCapita Consumption (lpcd)	Sewerage Demand (m^3/day)	Additional Capacity (m^3/day)	Total Capacity (m^3/day)	Availability (Capacity/ Demand)
Center	Al-Samawah	78	290,850	35	20000	37000	1.85	447,000	100	447,000	200	89,400		37,000	0.41
Other	Al-Rumaytha	77	117,941	80	20000	25000	1.25	181,000	100	181,000	200	36,200	25,000	50,000	1.38
	Al-Hilal	10	39,262	0	0	0		60,000	100	60,000	200	12,000		0	0.00
	Al-Najmi	15	34,783	0	0	0		53,000	100	53,000	200	10,600		0	0.00
	Al-Majid	47	42,846	0	0	0		66,000	100	66,000	200	13,200		0	0.00
	Al-sawayer	11	46,767	0	0	0		72,000	100	72,000	200	14,400		0	0.00
	Al-Khudhair	42	89,175	0	0	0		137,000	100	137,000	200	27,400		0	0.00
	Al-Daraji	21	18,841	0	0	0		29,000	100	29,000	200	5,800		0	0.00
	Al-Warkka	35	97,049	0	0	0		149,000	100	149,000	200	29,800		0	0.00
	Al-Salman	14	10,695	0	0	0		16,000	100	16,000	200	3,200		0	0.00
Total		55	788,209	25	40,000	62,000	1.55	1,210,000		1,210,000		242,000	25,000	87,000	0.36

Messan

Category	Name of Division	Current Coverage of Water Supply (%)	2014 Current					2030 Future							
			Population	Coverage (Percentage of Population connected) (%)	Total amount of Produced Wastewater (m^3/day)	Total Capacity of Wastewater Treatment Plant (m^3/day)	Availability (Capacity/ Demand)	Population	Coverage (%)	Served Population	PerCapita Consumption (lpcd)	Sewerage Demand (m^3/day)	Additional Capacity (m^3/day)	Total Capacity (m^3/day)	Availability (Capacity/ Demand)
Center	Al-Amarra	93	623,330	99	127,580	96,000	0.75	957,000	100	957,000	200	191,400	60,000	156,000	0.82
Other	Al-Maymonna	94	108,059	100	9,450	5,000	0.53	166,000	100	166,000	200	33,200		5,000	0.15
	Al-Mejir Alkabeer	93	161,872	100	27,735	36,000	1.30	249,000	100	249,000	200	49,800		36,000	0.72
	Ali Al-Gharbi	93	52,766	100	6,796			81,000	100	81,000	200	16,200		0	0.00
	kalaat Salih	93	110,288	100	13,055			169,000	100	169,000	200	33,800		0	0.00
	Al-Kahllaa	93	56,255	98	9,097			86,000	100	86,000	200	17,200		0	0.00
Total		93	1,112,570	99	193,713	137,000	0.71	1,708,000		1,708,000		341,600	60,000	197,000	0.58

2) Issues and Problems

Issues and problems related to the facility construction considering the future demand projection are as follow;

a) Basrah

i) Pipes and Pump Stations

Current sewerage coverage of Basrah is 65%, and 75% in Al-Fao. Pipes have not been constructed in the other divisions. A lack of collection system is one of the issues in the governorate including Basrah center.

ii) Sewage Treatment Plant (STP)

Treatment capacity of Basrah center is currently 240,000m^3/day and additional 300,000m^3/day constructing now. Considering both, the sewage treatment capacity will exceed the demand in 2030. No STPs are available for surrounding area of Basrah. Four divisions of the total six are under construction. However the treatment capacity is not enough. Shortage of STP capacity for the surrounding areas is an issue.

b) Dhi-Qar

i) Pipes and Pump Stations

Current sewerage coverage of Nasiriyah is 24% and some sewerage has been developed in the surrounding areas, however, the coverage is low and only 7 to 26 %. Development of collection system is one of the issues in Dhi-Qar.

ii) STP

The STP in Nasiriyah is not working because it is under maintenance/repair. Five STPs are under construction in Nasiriyah(3), Alshatra and Alrefaey and their capacities are shown as Table 3.15. Although their capacities are not sufficient for the demand of 2030, shortage of treatment capacity is an issue.

c) Al-Muthanna

i) Pipes and Pump Stations

Currently there is a sewerage system in Al-Samawah and Al-Rumaytha with coverage of 35% and 80%, respectively. The other areas have do not have sewer network which is one of the issues in Al-Muthanna.

ii) STP

The current STP capacity in Al-Samawah is 37,000m^3/day and is 25,000 m^3/day in Al-Rumaytha, any project is not going. With the current capacity at the STPs the demand of 2030 will not be meet except Al-Rumaytha. Thus, shortage of treatment capacity is another issue as well.

d) Messan

i) Pipes and Pump Stations

The coverage in Al-Amara, capital of Messan, is 98% and more than 97% in other divisions which shows a considerable high coverage within the governorate.

ii) STP

STPs have been developed in only 3 divisions out of the six. The current STP capacity meets the demands of only 75% in Al-Amara, 53% in Al-Maymonna, 130 % in Al-Mejir Alkabeer. It will improve by 82%, 15%, 72%, respectively in 2030. The treatment capacity shortage is an issue in the governorate except for Al-Amara and Al-Mejir Alkabeer.

1) Solutions

The countermeasures are studied for each governorate, respectively.

a) Basrah

i) Relation with Water Supply

The need for sewerage is high because more than 80 % in the Basrah governorate are covered by the water supply.

ii) STP construction/expansion

Needs for STP construction/ expansion is high except for Basrah and Al-Zubair.

iii) Collection system development/expansion

Needs for collection system development/expansion is high for Basrah and other divisions.

b) Dhi-Qar

i) Relation with Water Supply

Sewerage needs is high because more than 65 % in the Dhi-Qar governorate are covered by the water supply network.

ii) STP construction/expansion

Needs for STP construction/ expansion is high due to shortage of capacity including Nasiriyah.

iii) Collection system development/expansion

Needs for collection system development/expansion is high due to the low coverage of 7% to 26% for Nasiriyah and other divisions.

c) Al-Muthanna

i) Relation with Water Supply

Water supply coverage is lower than 50% except in Al-Samawah and Al-Rumaytha. The needs for sewerage should be realized after water supply development for these areas.

ii) STP construction/expansion

Needs for STP construction/ expansion is high due to shortage of capacity for Al-Samawah.

iii) Collection System Development/Expansion

Needs for collection system development/expansion is high due to the low coverage of 35 % for Al-Samawah.

d) Messan

i) Relation with Water Supply

Sewerage needs is high because more than 93 % in the Messan governorate are covered by the water supply network.

ii) STP construction/ expansion

Needs for STP construction/ expansion is high for four divisions due to lack or shortage of STPs capacities.

(3) Operation and Maintenance

The issues and problems related to operation and maintenance are similar in the four governorates as described below:

1) Issues and Problems

Treated effluent quality does not meet for the STPs in Basrah, Dhi-Qar, and Al-Muthanna for both BOD and SS. On the other hand the influent water quality is lower than the usual domestic wastewater as 122 in STP in Dhi-Qar and 128 in Al-Muthanna.

- Some treated effluent quality of STP exceeds the standard levels.
- Pipes are damaged and the flow is blocked in many places.
- O&M work is not recorded and reviewed.
- Tariff collection rate is low.
- Motivation of O&M staff is low.

The reasons for these problems include absence of improvement mechanism such as the PDCA cycle; an example is when the effluent quality exceeds the standard level but no improvement action has done. The situation of tariff collection is almost the same as water supply.

- There may be problems in structure, equipment, and/or operation.
- Unknown water infiltration may happen at a point of damage or misconnection in the case of a low concentration of influent.
- Industrial wastewater might be connected in case of high concentration of influent.
- O&M work is not conducted properly due to the lack of the staff's skills and experiences. The working records of O&M are not input and analyzed properly as well.
- Aged and damaged existing facilities.
- Customer database is not established. The absence of application system of house connection is one of the reason.
- Water meter and tariff collection system do not exist.

2) Solutions

The countermeasures are studied and shown below;

- Human resource development (O&M training)
- Preparation O&M guideline/manual
- Introduction of SCADA system
- Survey for assessment of existing facility
- Management of O&M record
- Establish customer database and facility database with GIS
- Improve tariff collection by including water meter installation
- Improve work process

4.1.3 Operation and Management

(1) Issues, Problems and Solution

Issues and problems on operation and management area categorized into four groups:

- Structure
- Process
- Governance and administrative work
- Customer services

1) Structure

a) Issues and problems regarding organizational structure

i) Issues and Problems

There is a duplication of activities and functions between the related ministries (Ministry of Water and Resources, Ministry of Planning and Cooperation). These duplications forces to change the plan of intake volume and/or cause difficulties regarding the necessary data collection and data management. Also, there

is unclear part (gray zone) on empowerment to directorate from head office in Bagdad which effects a smoothly and speedy decision making process.
Regarding organizational structure, lack of concept of functional integration causes inefficiency of decision making. All units are directly controlled by manager and management assistant, and force unnecessary work load to him. Manager is top of directorate and a management assistant is representative of the manager.
Regarding staff allocation, there is a high ratio of technical staff at some organization while the ratio is high for administrative staff in other organization. Such ratio differentials could be reasonable if is in a low level due to the differences in the situation and management environments (such as difference of facility and system design, difference of beneficially, and difference of geometrical condition). Furthermore, business process should be standardized and staff should be sufficiently allocated based on the workload and required skills in order to improve the efficiency of work.

ii) Recommendable Solution

Two organizational reforms may be necessary. One is for the head quarter of the Ministry and other is for the Directorate. Organizational reform to headquarter focuses to avoid duplication of activities and responsibility with other ministry as well as clear job demarcation between work and responsibility between headquarters and directorates. It should be noted here that the Team could not interview the head quarter of MMPW during the survey. Based on the observation, however, the head quarter seemed not functioning well for their duty on formulate national plan, developing standard guideline and only consume their time and energy for adjustment of projects from the directorate offices.
Organizational reform of the directorate focuses on functional integration to the job area of technical works, customer services, and administrative works as well as clear determination on responsibility of the middle management and empowerment.
Regarding the staff reallocation it is recommended that they first analyze work load and do skill inventory of the existing staff. Then re-allocate them based on the actual skills of each staff, also strengthening their skill with operational training to required level of sufficiently necessary for carrying on activities and achieving the targets.

b) Human Resources Development

iii) Issues and Problems

There are two types of trainings; training for middle managers and training for operational staff. Presently, only the former type of training is being carried on. In the training for middle managers, the Ministry of Planning and International Assistant agencies provides some trainings. However, these trainings are partially and not comprehensive, also not based on the activities of MMPW. MMPW should establish structure of required skills by considering some activities that are different and unique from other ministries, and could not be covered with readymade trainings.
Regarding the training for operational staff; A real training doesn’t exist. Only short and limited trainings for operating the facilities are done by the constructors based on the contract when construction of facility is completed. There are no more training for operational staff while further training is necessary to maintain a

professional level of skills for operational staff to achieve the mission which is to provide safe and potable water to users. For this purpose, continuous operational training is very necessary. However, lack of this type of training causes maintenance problem such as ignoring any repairmen when facility is out of order.

iv) Recommendable Solution

It is important to develop necessary skill set and knowledge structure. For middle class management trainings, it is necessary to develop training course for cover gap with readymade training which are provided by the Ministry of Planning and the donor agencies. For training of operational staff, it is necessary to develop standardized operational procedures at first and then conduct training based on this standardized operational process to follow up short initial training by constructor and keep maintaining required skill and knowledge for daily routine operation.

2) Issues and Problem Regarding Operational Process

c) Standardization of Operational Procedure

i) Issues and Problems

As mentioned before, it is required to standardize the operational procedure and training for operational staff based on a standardized procedure for operating and maintaining facility. This is very helpful in maintaining a standard quality of work. This way, water supply system can provide safe and potable water and standard quality of service to users. Unfortunately, MMPW lacks this concept of standardization for improving quality of work. The operational staff only follows operational manuals. Since they have neither basic knowledge/theory behind their work nor enough skills, they waste time in waiting for direction from technicians and/or engineers without doing anything when an accident emerges even when it is a small issues and could be possibility solved by themselves if knowledgeable. Currently when an accident emerges, the operation of facility is stopped every time. Work load to technicians and engineers become heavy for solving and directing for every emergency case.

ii) Recommendable Solution

Standardizing operational procedure and strengthening skill of senior operational staff is a requirement for managing daily normal operations under their supervising and control. SOP (Standard Operational Procedure) is the concept and system for standardizing daily operational and carrying on activities based on this standardized procedure. Inspection team inspects the maintenance of facilities and coaches the operational staff on site.

d) International Bidding and Procurement Process

i) Issues and Problems

Ministry of Planning issues regulation on adapting the international standard and standard bidding process for project implementations. The regulations, however, are ignored by the staff of other ministries. This disregard causes selection of unskilled and inexperienced local consultants and local contractors in the bidding process who create so many problems on construction including improper designs and

constructions, even delaying and/or stopping the entire projects. Such unqualified constructors and consultants could not get disbursement by their poor documentation of progress reports, and abolish the work, and escape for afraid to be enforced reconstruction by their expenses. There is no mechanism for technical and skill transfer to local constructors and consultants from experienced international constructors and consultants. The government staff themselves lack the skills and knowledge/experience for selecting qualified constructors and consultants so unable to educate local consultants and constructors.

ii) Recommendable Solution

Government staff should learn what a sufficient international consultant would be and how to contract with. This is possible only through experience. They need to establish a system to hire sufficient consultants and constructors. It is also recommended that they establish a mechanism and system for transfer of skill and technical knowledge to local consultants and contractors with conducting cooperative works and joint venture projects. It is also recommended to establish a continuous mechanism such as technical transfer centers and/or training centers to enhance and strengthen the technical skill and knowledge of local contractors and consultants.

3) Issues and Problem Regarding Governance and Administrative Work

e) Business Planning

i) Issues and Problems

Basically many issues and problems caused by absence of sector plans (master plans for water supply and sewerage), as well as development plans by directorates.

Absence of sector plans misleads to only focusing on new facility constructions for water demand due to the rapid urbanization and ignores large scale facility maintenance and rehabilitation. Thus, primary budget is allocated to construction of new facilities and there is no more budget for preventing maintenance and/or rehabilitation of facilities. Such circumstance causes issues of not to repair facilities when they are out of order. If this situation was emerged, MMPW need to construct additional new facilities for cover drop of capacity because of failing to repair. Though capital budget and operational budget are prepared in the annual budgeting schedule but lacks the prospection that focuses on development of infrastructure for medium and long term.

ii) Recommendable Solution

It is very important to formulate business plan covers for medium and long term in order to improve many management issues and problems including confirming connection of users, improving billing and collection systems, improving customer services such as inspection of service connections, developing MIS systems, improving water quality which will be explained in details later in this report. Business plan determines how to achieve these improvements.

f) Management Information System

i) Issues and Problems

It is necessary to develop a MIS integrated with the computerized billing systems and customer database. Presently, the customer information is managed manually on paper ledger, but quite incomplete. Number of connections may exceed more than a million except Al-Muthana. Managing such huge volume of customer information and providing customer services (including billing and collection of water and sewerage tariff) may only be possible with only computerization. Presently, quality of customer service and other operational works are not concerned by the top management. This system needs to link with MIS for supervising quality of customer services and other operational works.

ii) Recommendable Solution

MIS: Management Information System is required for supervising achievements of activities and progress of implementing business plans. The management data indicates the situation of water supply and sewerage system that need to be collected, compiled and managed by MIS for assisting decision making by the top management. Such management information including intake volume, production volume, distribution volume, test result of water quality, number of connection, expense, billing amount, collection amount, and indicator for representing progress of improvement activity including reduction of user complaints.

Middle management utilizes the GIS mapping system and asset management system to find cause of user complaints and/or judge condition of pipes as their daily activities. Ideally, management information should be collected through normal daily routine work sand not to require extra work load to the staff. In this term, the computer systems would better be integrated.

4) Issues and Problem Regarding Customer Services

a) Manage Customer Information

i) Issues and Problems

Fail to manage customer information indicates not only a poor customer service but also an inefficient management. Lack of concept on customer service itself is a serious issue. Absence of an application system allows everyone to connect to the water supply pipelines freely without getting any permission and inspection from the authority. Waster directorate neither has user information (name, their location, consumptions) nor knows number of connections. Water meters are not installed so the volume of consumption is unknown to the directorate. Managing customer information means collect, record and maintaining information of customer name, address, consumption volume, billing amount and date, collection amount and date, complaints and other data by customer ledger or database of computer system. Activity of managing information is not the same as the billing activity. For this reason, here mentions the activity of managing customer information and activity of billing separately.

ii) Recommendable Solution

It is recommended that the governorate establish application systems to approve house connections based on the applications and requests they receive. Water directorate should establish the customer database. Customers can hire plumbers and ask for connection works, however, water directorate should establish a system to inspect the quality of plumbing works, and approve the connecting work only to limited certificated plumbers.

To improve the quality of customer services it is important to sufficiently collect and manage customer information, charge water and sewerage tariff by the consumption amount, and support/supervise the staff of technical support and top management. This could be possible by integrating the customer database with MIS and GIS mapping systems and asset management system.

b) Billing and Collection of Water and Sewerage Tariff

i) Issues and Problems

Incorrect billings due to the incorrect customer information is a serious issue along with the fact that the directorate of water and sewerage does not consider collection of water and sewerage tariff seriously. One of the reasons is that they have problem on water quality. Basically this situation occurred from lack of proper customer service system. A proper customer service includes approving service connection based on applications, inspect quality of plumbing works, and install water meters to calculate consumption volume.

ii) Recommendable Solution

It seems impossible to achieve full cost recovery on both operational cost and capital cost with revenue from water and sewerage tariff. Cost recovery concept needs to be introduced to the staff for to operational cost recovery, even not 100%. That may reduce subsidiary to operational cost. Water and sewerage directorates should decide the cost recovery level and resettle water and sewerage tariff structures, and focus on collecting water and sewerage tariff.

For improving cost recovery by revenue from water tariff it is necessary; to establish an application system to examine and approve house connections and inspect quality of plumbing works; confirm customer information and improve customer record; install water meter and shifting to volumetric charge system. It is recommended to computerize the billing systems and customer database and integrate them with GIS mapping system to enhance the quality of customer service.

(2) Summary of Issues and Solutions

Table 4.3 shows summary of recommendable solution for water supply and sewerage sector of the four directorates in South Iraq.

Table 4.3 Summary of Issues and Solutions

Category	Issues and Problems	Causes	Solution
(1) Structure			
Organizational reform	✓ Delay of implementing plan and project by consuming time and energy for coordination and adjustment with related government agencies ✓ Gap of job and responsibility ✓ Delay of decision making, inefficient decision making process ✓ Skill gap of staff	➢ Duplication, gap and vague determination of job and responsibility ➢ Functionally, not unified organizational structure ➢ Heavy workload of top management, not empower to his staff ➢ Insufficient staff allocation	■ Reviewing job, activity and responsibility ■ Re-organization ■ Staff reallocation and human resources development based on capacity assessment
Human Resources Development	✓ Skill gap of operational staff	➢ Lack of structured plan and program on human	■ Training program based on structure of required skill,

Category	Issues and Problems	Causes	Solution
	✓ Incomprehensive middle management training, heavily relay on training course sponsored by donor agencies	resources development ➢ Lack of training system for operational staff	training policy and plan ■ Establishing training center, developing training material and incubating trainer
(2) Process			
Standardization	✓ Could not collect management information through daily routine activity ✓ Could not check the record of work ✓ Could not conduct operational training (not know skill gap and training needs)	➢ Activity is not clearly determined in structure of job description ➢ Job process is not standardized	■ Develop SOP and operational training based on SOP ■ Inspection of facility maintenance and on site couching to staff by inspection tour team
International Bidding and Procurement Process	✓ Delay/stop of construction project by insufficient supervising (delay of infrastructure development) ✓ Absent of technical/skill transfer from experienced international constructor/ consultant to local constructor/ consultant	➢ Unclear selection process and criteria ➢ Inexperience of selection process and criteria for choose sufficient consultant	■ Staff training on selection of sufficient consultant and supervising construction project ■ Establishing standard bidding procedure and selection criteria consider specific situation and requirement for Iraq
(3) Governance and administrative work			
Business plan	✓ Absent of business and operational strategy. ✓ Not scheduled budget for facility rehabilitation and large scale maintenance. ✓ Top management does not understand actual management situation and management environment	➢ Lack of performance indicator and target as well as data of performance ➢ Absence of monitoring system on management situation ➢ Absent of mind and concept for management efficiency	■ Formulate medium and long term business plan ■ Monitoring and take necessary corrective action for keep maintaining implementation of business plan on right truck
Management Information System	✓ Could not manage activity and quality of customer service efficiently and effectively base on management information ✓ Not collected basic management information including number of connection and NRW ✓ Could not formulate sufficient business plan based on correct information and data.	➢ Absent of management information and analysis of situation from lack of system for collect management data. ➢ Absent of planning cycle management concept on setting target and focus for achieving target (ignorance to concept of data and fact based management)	■ Develop MIS/GIS mapping system ■ Monitoring and supervising improvement and quality of work utilizing management information on MIS
(4) Customer services			
Customer database	✓ Inaccurate customer/user information (not known who is customer) ✓ Could not provide sufficient customer service based on accurate customer/user information	➢ Not establishing application system for approve house connection ➢ Not clearly know situation of house connection ➢ Not establishing customer data base	■ Establishing control system and regulation for approve house connection ■ Customer survey of house connection ■ Develop customer data base and integrate with MIS/GIS mapping system
Billing and collection of water	✓ Low tariff collection efficiency	➢ Improper management of customer information	■ Develop billing system ■ Install water meter

Category	Issues and Problems	Causes	Solution
and sewerage tariff	✓ Lack of concentration to activity of billing and collection	➢ Unclear billing and collection policy and system ➢ Not install water meter	■ Establishing sufficient tariff collection mechanism and shifting to volumetric charge system

4.2 Project Road Map

The solutions examined in section 4.1 are arranged and summarized as a project road map considering scale of project, implementation period, possibility and urgency/importance.

4.2.1 Water Supply

Project road map for water supply for the governorates is shown in Figure 4.1.

For the facility construction, after summarizing the needs for facility construction -based on the current status and the future demand and schedule- a discussion with counterpart was made and priority projects are selected.

i) Basrah

Needs for Basrah include introducing treatment process for high TDS and integration of compact units, also network rehabilitation.

Needs for the surrounding area of Basrah include the same as Basrah; introducing treatment process for high TDS, integration of compact units, and network rehabilitation. Additionally a capacity improvement of WTP in Al –Zubair and Shatt Al-Alab is also needs.

ii) Dhi-Qar

Needs for Nasiriyah, capital of Dhi-Qar, include introducing treatment process for high TDS, integration of compact units, and network expansion.

Needs for the surrounding area of Dhi-Qar include introducing treatment process for high TDS, integration of compact units, network rehabilitation, and capacity improvement of WTP in some divisions.

iii) Al-Muthanna

Needs for Al-Samawah, capital of Al-Muthanna, include capacity improvement of WTP, introducing treatment process for high TDS, integration of compact units, and network expansion.

Needs for the surrounding area of Al-Muthanna inlcude network expansion and capacity improvement of WTP due to the considerable low water supply coverage. Introducing treatment process for high TDS, integration of compact units, network rehabilitation are also recommended.

iv) Messan

Needs of water supply facility for Al-Amarra, capital of Messan is not significant because of the high service coverage of 93 %, sufficient WTP capacity tor future demand, and that the raw quality of TDS is not exceeded the standard value. Only integration of compact units and network rehabilitation may be recommended.

Needs for surrounding areas in Messan is not also significant because the same reason as Al Amarra.

v) Common for Four Governorates

Both supply water and consumptions are not measured, so the needs include facility diagnosis after actual data observation after meter installation including leakage survey.

After the discussion, following two projects are nominated as priority projects;

- Samawah Water Supply Project in Al-Muthanna Province
- Al Zubair Water Supply Project in Basrah Province

The priority project for planning & design and operation & maintenance are examined as common issues and problems for the four governorates. The following two items are selected for urgent/important one for effective project implementation.

- Preparation of water supply master plan
- Preparation of guidelines/ manuals on O&M

Category		Object		Projects	Implementation Schedule Short (～2025)	Middle (～2035)	Long (～2045)	Remarks
Water Supply	Planning/ Design	Common for four governorates		Guideline/manual for planning & design				
				Water Supply Master Plan				
				Comprehensive Water Resource Management Plan				Relation with MoWR
				Survey and Diagnosis of Existing Facilities				
	Facility Development	Basrah	Center Division *(Basrah)*	WTP Construction				On-going
				WTP Rehabilitation				
				Network Construction				95% Covered
				Rehabilitation of network (Leakage Reduction)				
			Other Divisions	WTP Construction				Al-Zubair (Priority project)
				WTP Rehabilitation				
				Network Construction				80~90% Covered
				Rehabilitation of network (Leakage Reduction)				
		Dhi-Qar	Center Division *(Nasiriyah)*	WTP Construction				On-going Partially
				WTP Rehabilitation				
				Network Construction				
				Rehabilitation of network (Leakage Reduction)				
			Other Divisions	WTP Construction				On-going Partially
				WTP Rehabilitation				
				Network Construction				
				Rehabilitation of network (Leakage Reduction)				
		Al-Muthanna	Center Division *(Al-Samawah)*	WTP Construction				Al-Samawah(Priority Project)
				WTP Rehabilitation				
				Network Construction				
				Rehabilitation of network (Leakage Reduction)				
			Other Divisions	WTP Construction				On-going Partially
				WTP Rehabilitation				
				Network Construction				
				Rehabilitation of network (Leakage Reduction)				
		Messan	Center Division *(Al-Amara)*	WTP Construction				On-going
				WTP Rehabilitation				
				Network Construction				93% Covered
				Rehabilitation of network (Leakage Reduction)				
			Other Divisions	WTP Construction				On-going
				WTP Rehabilitation				
				Network Construction				93% Covered
				Rehabilitation of network (Leakage Reduction)				
	O&M for Water Treatment and Network	Common for four governorates		Guideline/manual for O & M				
				Facility Database				GIS System
				establishment of effective operation system				SCADA System
				Water Meter Installation				Tariff Coleection

Note) Priority project selected after discussions with Iraq side

Figure 4.1 Road Map for Water Supply Facility Development

4.2.2 Sewerage

Project road map for sewerage for southern four governorates is shown in Figure 4.2.

For the facility construction, after summarizing the needs for facility construction considering the current status, future demands and schedules, discussions with counterpart was made and the priority projects were selected.

i) Basrah

Needs for the Basrah is the expansion of sewer because of the low coverage.

Needs for other divisions in Basrah are both for sewer and STP construction.

ii) Dhi-Qar

Needs for Nasiriyah and other divisions in Dhi-Qar are both for sewer and STP construction.

iii) Al-Muthanna

Needs for Al-Samawah are both for sewer and STP construction.

Needs for other division in Al-Muthanna is not significant now because one division has been developed and the others are still have low service coverage of water supply. Sewerage needs will be realized after the water supply is developed.

iv) Messan

Needs for Al-Amara is not significant because of the high sewerage coverage and sufficient STP capacity for future demand.

Needs for the other divisions in Messan is STP construction and/or expansion.

After the discussion, following two projects are nominated as priority projects;

- Samawah Sewerage Project in Al-Muthanna Province
- Al- Zubair Sewerage project in Basrah Province
- Nasiriyah Sewerage Project in Dhi Qar Province.

The priority project for planning & design and operation & maintenance are examined as common issues and problems for four governorates, following two items are selected for urgent/important one for effective project implementation.

- Preparation of sewerage master plan
- Preparation of guidelines/ manuals on O&M

Category		Object		Projects	Inplementation Schedule Short (～2025)	Middle (～2035)	Long (～2045)	Remarks
Sewerage	Planning/ Design	Common for four governorates		Guideline/manual for planning & design				
				Sewerage Master Plan				
				Centralized sewerage area selection plan				
				Survey and Diagnosis of Existing Facilities				
	Facility Development	Basrah	Center Division *(Basrah)*	STP Construction				On-going
				STP Rehabilitation				
				Sewer Construction				
				Sewer rehabilitation				
			Other Divisions	STP Construction				On-going
				STP Rehabilitation				
				Sewer Construction				
				Sewer rehabilitation				
		Dhi-Qar	Center Division *(Nasiriyah)*	STP Construction				On-going Partially
				STP Rehabilitation				
				Sewer Construction				
				Sewer rehabilitation				
			Other Divisions	STP Construction				On-going Partially
				STP Rehabilitation				
				Sewer Construction				
				Sewer rehabilitation				
		Al-Muthanna	Center Division *(Al-Samawah)*	STP Construction				Al-Samawa(Priority Project)
				STP Rehabilitation				
				Sewer Construction				
				Sewer rehabilitation				
			Other Divisions	STP Construction				Following water supply
				STP Rehabilitation				
				Sewer Construction				
				Sewer rehabilitation				
		Messan	Center Division *(Al-Amara)*	STP Construction				On-going
				STP Rehabilitation				
				Sewer Construction	—			99% Covered
				Sewer rehabilitation				
			Other Divisions	STP Construction				
				STP Rehabilitation				
				Sewer Construction				
				Sewer rehabilitation				
	O&M for Sewage Treatment and Network	Common for four governorates		Guideline/manual for O & M				
				Facility Database including Survey				GIS System
				Establishment of effective operation system				SCADA System
				Monitoring/ Inspection Industrial Wastewater				

Note) Priority project selected after discussions with Iraq side

Figure 4.2 Road Map for Sewerage Development

4.2.3 Operation and Management

Figure 4.3 shows the road map for improving the discussed issues and problems on management and operation areas for the four directorates in Southern Iraq. As it is common in implementing solution in this category, a maximum 10 years is consider and is divided into 3 periods; short term, medium term and long term.

Category		Solution	Activity	Implementing schedule			Remarks
				Short Term (2-3 years)	Medium Term (3-5 years)	Long Tem (5-10 years)	
Management and Operation	Structure	Re-organization	Reviewing job, activity and responsibility				
			Capacity Assessment				
			Re-organization and staff re-allocation				
		HRD	On demand training				
			Establishing training center				
	Process	Job standardization	Develop SOP				
			Formulation of inspection team				
		Hire sufficient consultant	Staff training on bidding process and criteria				
			Establishing standard contract document				
	Governance and administrative work	Business Plan	Formulate medium and long term business plan				
			Monitoring and take necessary countermeasures				
		MIS	Develop MIS				
			Utilizing MIS for data based management				
Customer services	Customer services	Customer database	Establishing application system				
			Customer survey				
			Develop customer database				Link with GIS system and MIS
		Billing and collection	Awareness program				
			Develop billing and collection system				
			Shifting to volumetric charge system				Including install water meter

Figure 4.3 Road map for Implementing Solution (Management and Operation)

4.3 Outlines of Priority Projects

The outline of priority projects and action plans is shown in this section.

4.3.1 First Priority Projects

Outline of the first priority projects for facility developments are shown below.

(1) Al-Muthanna

■ **Sewerage Project of Al Samawah in Al-Muthanna**

Items	Description
Project Background	The small part of the center of Al-Samawah has no sewerage system. Since this area was used to be filled with water in the past, the land still contains much water and residents cannot use any on-site system such as septic tank. Therefore, sewerage from houses is discharged into river through open channel without treatment. Due to such a condition, diseases such as cholera often becomes problem. Now that there has been constructed important public service building such as university and hospital in the smaller area, demand of sewerage facility in the smaller area is rapidly increasing.
Outline of the Project	- Target Year : 2035 - Design Population : 150,000 persons - STP : Capacity Q=30,000 m^3/day - Pumping Station and Sewer Pipes are also required
Related Information	- Status of Feasibility Study : Already done (Prepared in 2011) - Status of Land Acquisition : Already acquired (inside the existing STP land) - Status of EIA : Already approved

(2) Al-Muthanna

■ **Water Supply Project of Al Samawah in Al-Muthanna**

Items	Description
Project Background	The center of Al Samawah depends totally on a project located in Al Rumaytha which is about 25Km away from the city center. Therefore, there is a huge risk for the center of Al Samawah where the treated water could not be obtained if some accident or shortage of water resources occur in Al Rumaytha. In addition, the transmission pipelines from Al Rumaytha to the center of Al Samawah are relatively long and have the problem of non-revenue water with leakage and illegal connection. The project is planned to construct the WTP in the center of Al Samawah and it contributes to decrease the level of non-revenue water.
Outline of the Project	- Target Year : 2025 - Design Population : 300,000 persons - WTP : Capacity Q=120,000 m^3/day (RO plant) - Intake Facility and Transmission Pipes are also required
Related Information	- Status of Feasibility Study : Not yet done - Status of Land Acquisition : Not yet acquired - Status of EIA : Not yet done

(3) Basrah

■ **Water Supply Project of Al Zubair in Basrah**

Items	Description
Project Background	Even the division is the second largest in Governorate, people in Al Zubair are suffering from shortage of water, supplying by very old compact units. The project is expected to provide treated water for 400,000 beneficiaries in the city center.
Outline of the Project	- Target Year : - Design Population : 400,000 persons - WTP : Capacity Q=120,000 m^3/day (Installation of the RO plant might be considered) - Transmission Pipe : Length 20km
Related Information	- Status of Feasibility Study :no - Status of Land Acquisition :available - Status of EIA Approval : not yet

(4) Comment on the First Priority Projects

Among the above three projects, the first priority was given to the Samawah Sewerage Project because the project impact is large and easy to understand. Sanitation and environmental condition in the small part of Samawah are very bad due to the lack of sewerage, while there is a big potential of urban facility development such as hospital and business buildings.

The second priority was given to the Samawah Water Supply Project. Currently water is supplied from 25 km distance of Al-Rumaytha WTP and a new WTP construction is on-going at Al-Rumaytha, however, it may takes time because a development of new water source and long conveyance pipeline to be implemented by Ministry of Water Resource is necessary. It should be noted that RO is necessary because the TDS of raw water at Samawah is considerably high.

4.3.2 Second Priority Projects

Outline of the second priority projects for facility developments are shown below.

(1) Basrah

■ **Sewerage Project of Khor-Al Zubair in Basrah**

Items	Description
Project	Khor-Al Zubair
Summary	＜Facility＞ STP Capacity：Q=10,000 m^3/day Pipe Length：15 km for transmission, 15 km for extension of existing network separate system including pumping stations.
Project Cost	Approximately　35 Million USD including consulting services design and supervision
Related Information	- Status of Financial Source：not yet - Status of Feasibility Study：not yet - Status of Land Acquisition：available

(2) Dhi-Qar

■ **Sewerage Project of Nasiriyah kalat Sukar in Dhi-Qar**

Items	Description
Project	Nasiriyah kalat Sukar
Summary	＜Facility＞ STP Capacity：Q=20,000 m^3/day Pipe Length：45 km including transmission and network
Project Cost	Approximately 55 Million USD （including/excluding consultancy service）
Related Information	- Status of Financial Source：not yet - Status of Feasibility Study：not yet - Status of Land Acquisition：available

All four governorates are recommended to prepare “Water Supply and Sewerage Master Plan” before or along with the implementation of priority/urgent projects. It should include following contents and be prepared as the highest level plan to be followed by all the projects in the water sector.

- Contents of Water Supply Master Plan
  - Water resource plan
  - Facility development plan including WTP and network
  - Staged construction and integration plan
  - Replacement/leakage reduction plan
  - Implementation plan
- Contents of Sewerage Master Plan
  - Facility development plan including STP and sewer
  - Rehabilitation/replacement plan
  - Industrial wastewater management plan
  - Reuse plan of treated effluent

- Implementation plan

4.3.3 Operation and Management

The following table shows improvement programs for all of the four governorates on operation and management areas.

(1) Organizational Reform

Item	Contents
Program	(Structure) : Organizational Reform
Purpose and summary	Objective: Improve to effective and efficient organization Removing duplication of responsibility with other government agency, restructure organization, and re-allocate staff
Target	MMPW (HQ)、Directorate of Water & Sewerage (4 Prefectures)
Related agency	Ministry of Planning, Ministry of Water Resources
Activities	Approved by General Human Resources Directorate of MMPW and Strategic Office MMPW with discussion and adjustment between related government agencies. <Major activities> - Reviewing function and responsibility of target organization - Reviewing job process and decision making process - Analysis of work volume and required skill - Redesign organizational structure - Reviewing job description and related institutional system - Skills inventory - Review of HR plan and HRD plan - Formulate HR plan (organizational reform, job process reform and staff re-allocation) - Implementation of HR plan - Monitoring and evaluation of achievement
Means of Validation (Outputs)	・New organization chart and new job description ・HR plan ・Monitoring and evaluation report
Budget (for information)	Consulting support (if necessary and required) International Consultant 1 M×6 /M/M=6MM Local assistant Consultant 2M ×6 /M/M=12 MM

(2) HRD: Human Resources Development

Item	Contents
Program	(Structure) HRD Plan
Purpose and summary	Objective: remove gap between actual skill and required skill Improving skill of staff to required level by job/position and operate activity smoothly and efficiently
Target	MMPW (HQ), Directorate of Water & Sewerage (4 Prefectures)
Related agency	Non
Activities	Determine necessary skill and knowledge for carry on activity and job missioned by MMPW, structuralizing skill, and define necessary skill levels, conducting skills inventory and carry on staff training to eliminate skill gap based on required skill structure. <Major activities> - Confirmation of required skill for carry on necessary activity conducted by MMPW - Structuralizing necessary skill and knowledge by each functions - Skills inventory and gap analysis (linkage with organizational reform) - Confirm trainer, training material and facility for training, and their availability - Reviewing HRD system and related system and regulation for maintaining training effectiveness - Formulating HRD plan (including establishing training center, incubating trainer, and developing of training material)

Item	Contents
	- Implementing HRD plan - Monitoring and evaluation of achievement
Means of Validation (Outputs)	・HRD plan (including training program) ・Developed training facility and training material ・Training report ・Monitoring and evaluation report of HRD plan (including monitoring and evaluation to follow up activity after training)
Budget (for information)	Consulting support (if necessary and required) International Consultant 3 M×3 /M/M=9 MM Local assistant Consultant 6M ×3 /M/M=18 MM (3 functional areas of technical, customer services and administrative)

(3) Job Standardization

Item	Contents
Program	(Process) SOP
Purpose and summary	Objective: Standardizing job process for improving quality of work as well as make them controllable by middle management Standardizing operational process and conducting operational training based on SOP and inspect for ensue the standardization. With this way of job standardization, quality of work would be improved and maintained.
Target	Operational Unit of Directorate of Water & Sewerage (4 prefectures)
Related agency	None
Activities	Standardizing operational process and conducting training for ensuring the standardization. Formulate inspection team and check the quality of maintenance as well as coaching and guiding for ensuring the standardization. . <Major activities> - Check and confirm target job process and existing format - Formulate standardization plan (including action plan of inspection team) - Standardizing operation procedure (develop as SOP) - Staff training based on SOP (class room training and OJT) - Operate and maintain facility based on SOP - Formulate inspection team - Develop check item and inspection method based on SOP - Training to member of inspection team (classroom training and OJT) - Inspecting facility maintenance, coaching/guiding operational staff on site, feedback of skill strengthening subject to training program - Monitoring and evaluation on quality of work, awarding best practice
Means of Validation (Outputs)	・SOP ・Inspection manual/guideline ・Activity report of inspection team ・Monitoring and evaluation report
Budget (for information)	Consulting support (if necessary and required) International Consultant 3 M×3 /M/M=9 MM Local assistant Consultant 6M ×3 /M/M=18MM (experts of 3 areas, water quality management, purification facility, distribution facility + maintenance of water meter)

(4) Procurement Process Improvement

Item	Contents
Program	(Process) Improving procurement process for hire sufficient consultant
Purpose and summary	Objective: Hire sufficient consulting who can qualify to manage project for meet specific situation of Iraq, as well as transfer skill to government staff and local consultant Disregarding specific situation of Iraq on facility designing and poor quality of work on construction delays/stops implementation of the project. Establishing system and process for hire sufficient consultant who has skill to carry project sufficiently and meet specific requirement of Iraq, as well as transfer skill and knowledge to local consultant and contractor.
Target	Planning unit, Designing unit, Project control unit, inspection unit and local

Item	Contents
	consultant/contractor of 4 prefecture
Related agency	Ministry of Planning
Activities	Develop job process and selection criteria for hire sufficient consultant who has qualified for manage project implementation sufficiently and meet specific requirement of Iraq, as well as could transfer skill and knowledge to local consultant and contractor. <Major activities> - Review standard format and contract document adapted internationally (contract document and selection criteria) - Check specification that should be incorporated in contract document - Improving bidding and selection procedure, format and evaluation criteria - Developing training material and carry on training of international competitive bidding to staff (classroom training and OJT) - Establishing mechanism of technical transfer to local consultant/contractor - Technical transfer to local consultant and contractor with mainly joint venture project - Evaluate quality of work (consultant), and improvement of skill (local consultant/ contractor)
Means of Validation (Outputs)	・Improved procurement guideline ・Monitoring and evaluation report
Budget (for information)	Consulting support (if necessary and required) International Consultant 1 M×6 /M/M=6 MM Local assistant Consultant 2M ×6 /M/M=12MM

(5) Business Planning

Item	Contents
Program	(Governance and administrative work) Formulation of business plan
Purpose and summary	Objective: managing water supply and sewerage business with planning cycle standing prospect of medium and long term view Managing operation and project based on business planning cycle and improving job efficiency and effectiveness. Presently, absent of business plan causes shortage of rehabilitation budget and facility was leaved without repair.
Target	Management of MMPW, Directorate of Water and Sewerage, and middle management of Governorate of 4 prefectures
Related agency	Governorate
Activities	Establishing medium and long term business plan and implementing <Major activities> - Conforming and reviewing condition and situation for planning, and set target for achieve (including population, target population served, service coverage, target production volume, target treatment volume, etc.) - Formulate medium and long term business plan (including schedule and budget of large scale rehabilitation and preventing maintenance) - Link with sector plan and budget allocation to water supply and sewerage system - Implementing business plan (annual base) - Annual monitoring and evaluation for confirm performance and outputs, progress of implementation.
Means of Validation (Outputs)	・Medium and long term business plan ・Annual report (including financial report) ・Report from internal auditor
Budget (for information)	Consulting support (if necessary and required) International Consultant 2 M×3 /M/M=6 MM (Two experts, technical planning and customer service + administrative + financial planning) Local assistant Consultant 3M ×3 /M/M=9MM (Three experts, technical, customer service, administrative + financial)

(6) MIS

Item	Contents
Program	(Governance and administrative work) Establishing MIS
Purpose and summary	Objective; Establishing MIS and support decision making of management with data and fact Collect management data from daily routine work of operational staff and provide necessary information and fact for decision making to top and middle management
Target	Management of MMPW, Directorate of Water & Sewerage, and middle management of Governorate
Related agency	Governorate
Activities	Develop MIS, and training for utilizing the system. MIS is system and mechanism including both computerized and manual operation. <Major activities> (1) MIS - Confirm necessary information and data for MIS including intake volume, production volume, consumption volume, treatment volume etc. - Reviewing data collection mechanism and system, process and format - Confirming system for providing management information including process, frequency, style and format - Design and develop MIS - Consider integration with GIS mapping system/ asset management system, and customer database. (Ideally, integrate as computerized system and provide all necessary information to staff who need through computer) - Training to staff for utilize MIS - Provide information such as monthly report to staff and related government agencies - Link with monitoring and evaluation, and updating process of medium and long term business plan, annual plan and budget formation - Review mechanism of data collection and provide information, and improve the system (2) GIS mapping system - Confirm availability of software and hardware - Input data of drawing, chart and information of distribution facility (valve and pipeline network) including date of construction work, material used, etc. - Measure location and record to the system - Manage mapping data and information - Consider integration with asset management system, customer database and MIS - Input data on leakage detection and leakage repair, and support decision making including maintenance/replace of pipeline, finding cause of user complaints - Monitoring and evaluating usability of GIS mapping system (3) Asset management system - Confirm availability of software and hardware - Input data on fixed asset including intangible asset (such as drawing) and tangible asset (such as building, facility and pipeline) on construction date and book value, and manage data and information. - Consider system integration with GIS mapping system, customer database and MIS - Provide data and information of asset to accounting and annual reporting (4) Customer DB Please refer improvement program of customer services
Means of Validation (Outputs)	・System documentation of MIS (and GIS mapping system, asset management system and billing/collection system) ・MIS monthly report
Budget (for information)	Consulting support (if necessary and required) International Consultant 1 M×3 /M/M=3 MM (Only consultation for MIS. Consultation for GIS mapping system and asset management system required preparatory study before cost estimation) Local assistant Consultant 1M ×3 /M/M=3MM

(7) Customer Database

Item	Contents
Program	(Customer Services) Customer information database
Purpose and summary	Objective: computerizing managing customer information and support to improving quality of customer service and billing/collection process Confirm information of customer with customer survey and establish data collection system though application, and manage customer data
Target	Customer service division (mainly billing and collection unit) of Directorate of Water & Sewerage (4 prefectures)
Related agency	None
Activities	Establish system for manage customer data and information, and supporting customer service activities including billing and collection of water and sewerage tariff <Major activities> - Confirm necessary data item on customer information management system - Review format of application and establishing system for approve house connection base on application and inspect quality of plumbing work - Confirm method for confirm customer information and formulate customer survey plan - Prepare survey sheet, formulate survey team and carry on customer survey based on customer survey plan - Develop customer ledger system or customer database system - Manage customer data and information with customer ledger or computerized customer database - Consider system integration with MIS, GIS mapping system and asset management system - Provide accounting information including billing amount, collection amount, account receivable amount to accounting system and/or accounting unit. (If system was integrate, computer system may automatically provide to accounting system and accounting unit) - Provide information of accounting and customer services including billing amount, collection amount, consumption volume, number of connection to MIS - Provide customer information including history of complaints and size of pipe to GIS mapping system - Provide customer information including history of billing and collection, complaints for user complaints management - Calculate billing amount and provide information of water and sewerage tariff to tax collection unit of the Ministry of Finance, in Directorate
Means of Validation (Outputs)	・System documentation of customer database (customer ledger) and billing/collection system ・MIS monthly report (on column of connection, billing and collection amount)
Budget (for information)	Consulting support (if necessary and required) International Consultant 1 M×3 /M/M=3 MM (Only system design. Required preparatory survey for cost estimation of customer survey and data input) Local assistant Consultant 3M ×3 /M/M=9MM

(8) Billing and Collection of Water and Sewerage Tariff

Item	Contents
Program	(Customer Services) Billing and collection
Purpose and summary	Objective: Improving billing and collection system, and shifting to volumetric charge system Sharing operational cost with users and conserve water resources
Target	Customer Service Division (mainly Billing and Collection Unit) on Directorate of Water & Sewerage (4 prefectures)
Related agency	Non
Activities	Establishing sufficient and accurate billing and collection system based on established customer database <Major activities> - Based on established customer database system: - Installing water meter - Recruiting and training to mete reader

Item	Contents
	- Charge water and sewerage bill to user based on their consumption volume - Confirm payment of user and take necessary action if necessary (including warning to delay of payment)
Means of Validation (Outputs)	・Annual report ・MIS monthly report (how accurately fulfill column and item related billing and collection activity)
Budget (for information)	Consulting support (if necessary and required) International Consultant 1 M×2 /M/M=2 MM (Work load mentioned here is for training of meter reading. Because other training item depend on development of customer database, cost estimation require preparatory survey) Local assistant Consultant 2M ×2 /M/M=4MM