Ministry of Construction and Housing and Municipalities and Public Works

Regional Ministry of Municipalities and Tourism in Kurdistan

Mayoralty of Baghdad, Basrah City and Erbil City

DATA COLLECTION STUDY

ON SOLID WASTE MANAGEMENT IN IRAQ

FINAL REPORT

JANUARY 2022

JAPAN INTERNATIONAL COOPERATION AGENCY

YACHIYO ENGINEERING CO., LTD.

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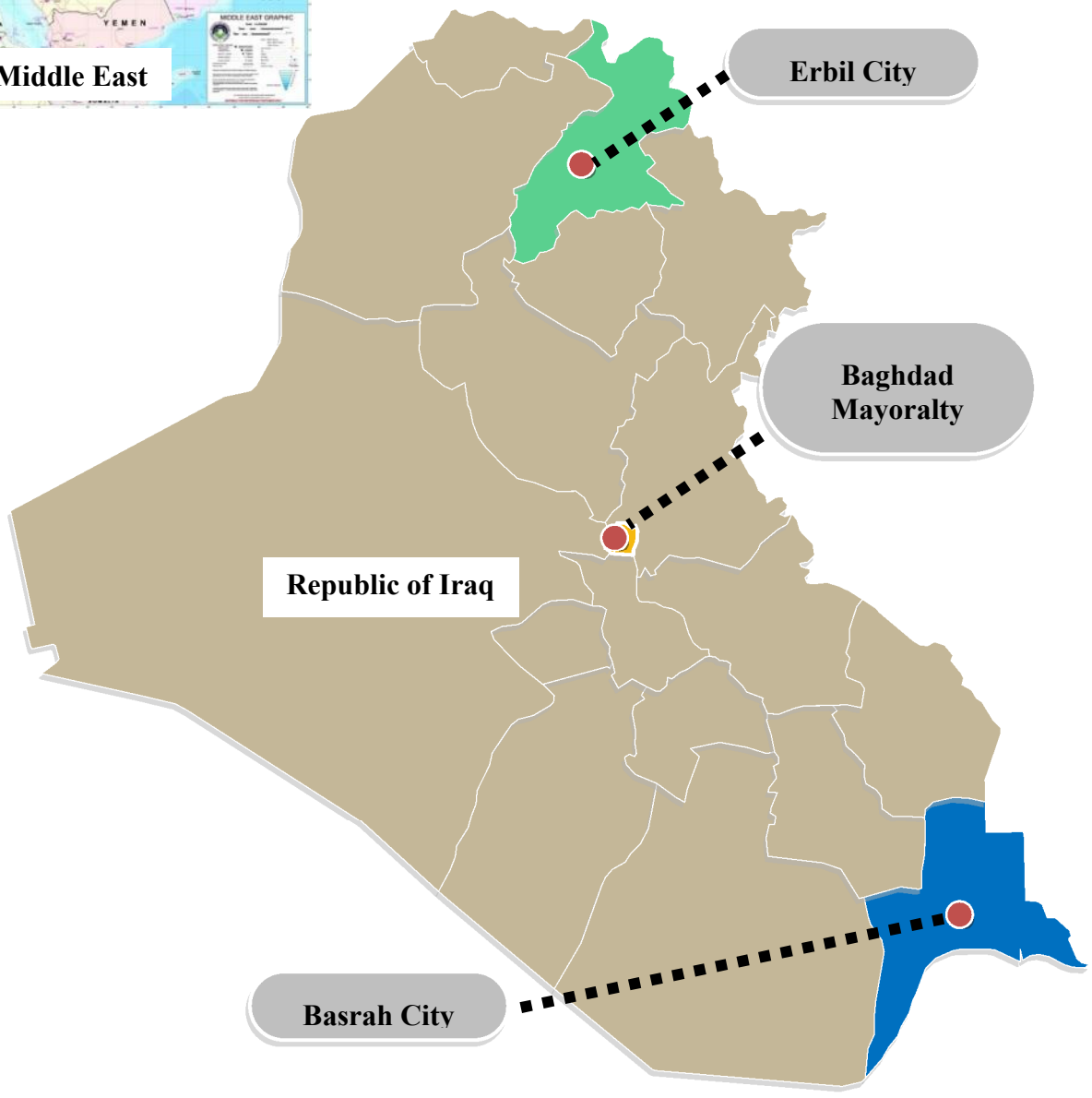

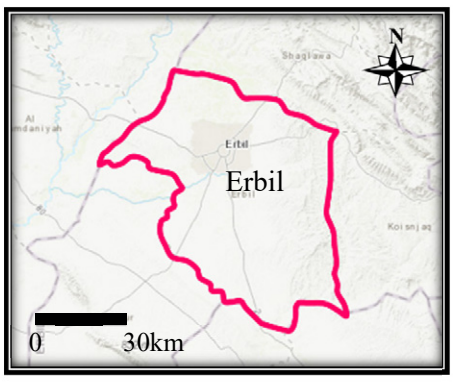

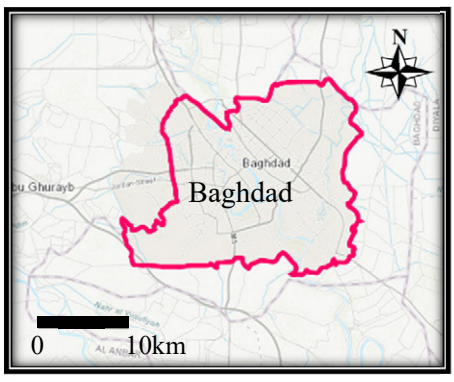

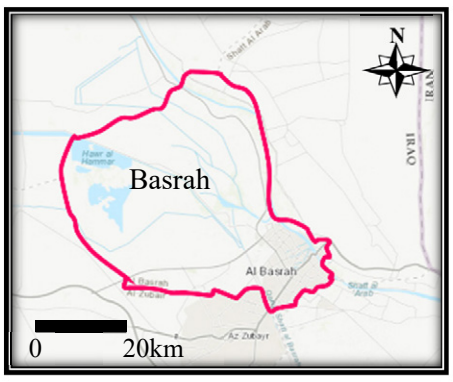

Source: Esri, HERE, Garmin, Earthstar Geographics (c), Esri Japan

Location of Map

Data Collection Study on Solid Waste Management in Iraq

Final Report

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List of Abbreviation

Abbreviation	Description
CIA	Central Intelligence Agency
C&D	Construction and Demolition Wastes
CSO	Central Statistics Office
DF	Disposal Facility
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
IDP	Internally Displaced Person
IOM	International Organization for Migration
IMF	International Monetary Fund
IQD	Iraqi Dinar
IT	Information Technology
ITF	Intermediate Treatment Facility
JICA	Japan International Cooperation Agency
JST	JICA Study Team
KRG	Kurdistan Regional Government
M/P	Master Plan
MCHMPW	Ministry of Construction, Housing, Municipalities and Public Works
MNR	Ministry of Natural Resources - KRG
MOE	Ministry of Environment
MOH	Ministry of Health
MOMT	Ministry of Municipalities and Tourism - KRG
MOST	Ministry of Science and Technology
MSW	Municipal Solid Waste
NDP	National Development Plan
NSWMP	National Solid Waste Management Mater Plan
NGO	Non-Governmental Organization
NPO	Non-Profit Organization
PPP	Public Private Partnership
RDF	Refuse Derived Fuel
SDGs	Sustainable Development Goals
SWM	Solid Waste Management
SWED	Solid Waste and Environment Directorate - Baghdad Mayoralty
SOMO	State Organization for the Marketing of Oil
SOP	Standard Operation Procedure
UN	United Nations
UNDP	United Nations Development Plan
UNICEF	United Nations International Children's Emergency Fund
UN-Habitat	United Nations Habitat
USAID	United States Agency for International Development
WB	World Bank
WHO	World Health Organization
WtE	Waste-to-Energy

Chapter 1 Introduction of the Data Collection and Survey Study

1.1 Study Background and Outline

In the Republic of Iraq (hereinafter referred to as "Iraq"), the economy has been on a recovery trend after the end of the war, against the background of abundant oil resources, and despite the turmoil the nation has suffered such as political divisions and terrorism. However, the per capita GDP shown in Fig. 1-1 has fallen sharply due to the impact of the global downfall in crude oil prices since 2014, highlighting the issue of dependence on crude oil. Furthermore, the global trend towards a decarbonized society may have a great impact on the industry and lifestyle in Iraq in the future._The population of Iraq has been steadily increasing and reached 40.22 million in 2020. On the other hand, the ratio of urban population, which is defined as a city with more than 300 thousand population in Fig 1-2 only of this report has remained around 70% since the late 1980s.

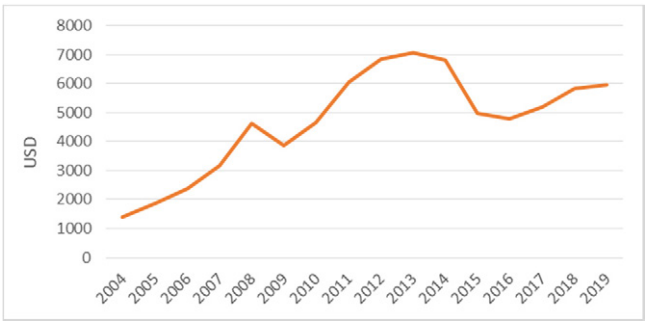


Fig. 1-1 Trends in the per Capita GDP

Source: https://databank.worldbank.org/ (The World Bank)

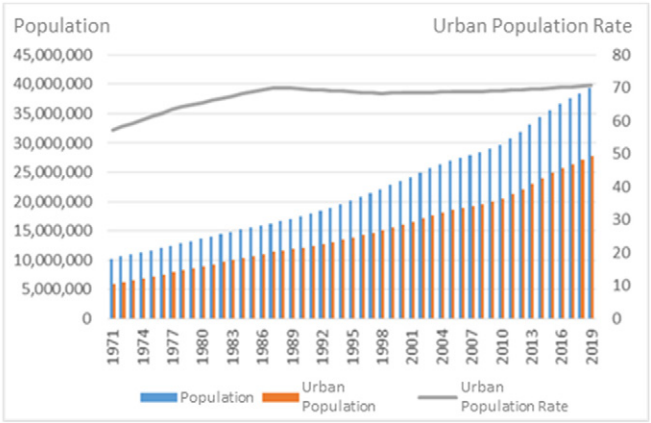


Fig. 1-2 Trends in Population

*Urban area in Fig 1-2 only of this report is defined the city with more than 300,000 population.
Source: https://databank.worldbank.org/ (The World Bank)

According to the Environmental Statistics of Iraq - Municipal Service sector (2019) issued by Central Statistical Organization (hereinafter referred to as "CSO"), the current situation of waste management in Iraq is shown Table 1-1.

In the table, it is impossible to make a simple comparison over time because the data was not collected from all prefectures and for all years, but the collection amount of municipal waste in 2019 was 29,024 ton/day excluding the Kurdistan region. The waste collection rate (population basis: ratio of population served by waste collection against total population) in urban areas is about 90%, which means that there are still uncollected areas. In terms of the total population this represents about 60% in the whole country. The number of transfer stations is decreasing, and that of disposal facilities is increasing. However, as of 2019, of the 224 final disposal facilities, there are only 67 sanitary landfills and the other 157 sites are open dumping sites. Problems such as pollution of soils, rivers, and groundwater caused by seepage of leachate from open dumping sites, scattering of uncollected wastes in rural areas, and their inflow into waterways and rivers have become apparent.

Table 1-1 Summary of Waste Management in Iraq

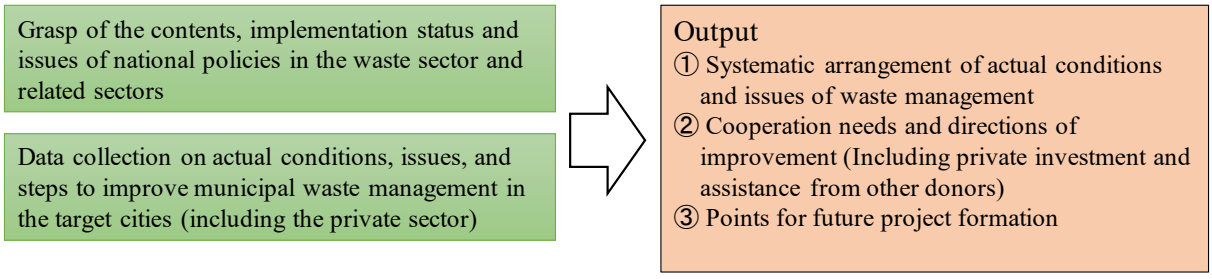
Year	Waste collection amount (ton/day)	The number of transfer stations	The number of disposal facilities	Collection Rate (%) (Population Basis)*1		Number of municipal institutions targeted	Region where data is not collected
				Urban Area	Whole Country		
2010	28,640	133	389	91.3	65.7	425	-
2011	22,343	103	147	-	62.8	253	Kurdistan region

Year	Waste collection amount (ton/day)	The number of transfer stations	The number of disposal facilities	Collection Rate (%) (Population Basis)*1		Number of municipal institutions targeted	Region where data is not collected
				Urban Area	Whole Country		
2012	23,137	104	144	91.1	61.2	257	Kurdistan region
2013	22,752	101	138	92.5	62.4	257	Kurdistan region
2014	22,507	100	144	92.5	62.6	257	Nineveh, Anbar and Salah al-Din, Kurdistan region
2015	31,867	108	236	88.4	67.0	369	Nineveh and Anbar
2016	26,070	65	156	87.1	63.9	204	Nineveh and Anbar
2017	24,622	82	205	87.7	61.9	251	Kurdistan region
2018	26,370	87	213	88.8	63.5	261	Kurdistan region
2019	29,024	77	224 (Including 67 sanitary landfills)	88.7	63.6	265	Kurdistan region

Source: Environmental Statistics of Iraq - Municipal Service sector, 2018 and 2019, CSO
*1 Collection Rate (%) (Population Basis) refers to the percentage of population served by waste collection service

1.2 Study Objectives

The output and objective of this study are shown in Fig. 1-3. Waste management is closely related to lifestyles and industrial patterns. Therefore, JICA Study Team (hereinafter referred to as "JST") will study not only the solid waste management, but also the related sectors such as environment policy including decarbonization, industrial policy, and citizen participation in environmental activities. In addition, compared to other countries, Iraq has circumstances unique to this country such as post-war peace dividends and security issues. Accordingly, JST will also study the points of concern for project formation as an output.



Source: JST

Fig. 1-3 Output and Objective of this Study

1.3 Study Period and Schedule

The study period is from March 2021 to January 2022.

1.4 Area Covered in the Study

The target area in this study are the three (3) cities of Baghdad, Basrah, and Erbil. Basic data of the country and cities are shown in Table 1-2. The population growth rate of Basrah and Erbil are lower than the national average, while the population of Baghdad is growing rapidly beyond the national average.

Table 1-2 Basic Data of the Target Country and Cities

Target Country/ City	Population*1(thousand people)				Population Growth Rate*2 (%)	Population Density*3 (persons/km^2)	Area*4(km^2)		GDP*5 (hundred million dollars)
	2005	2010	2015	2020			Whole area	Urban area	
Iraq	26,922	29,742	35,572	40,223	2.16	890	43,830	-	256
Baghdad	5,327	5,652	5,535	6,302	2.44	7,930	900	670	-
Basrah	891	1,113	1,327	1,510	2.04	5,580	1,560	181	-
Erbil	717	735	1,090	1,372	1.56	7,304	3,701	133	-

*1 2005, 2010: World Population Prospects 2019, (2020), 2015: Population Estimation of Iraq 2015 – 2018, (2018), CSO 2020: JICA Study Team estimate by using Population Estimation of Iraq 2015 – 2018, (2018), CSO *2 Iraq:(2020), CIA, Three cities: World Population Prospects 2019, (2020), UN *3 Calculated by Population ÷ Area *4 M/P of Each City *5 [World Economic Outlook Database]Estimated Value in 2018, International Monetary Fund (IMF)

1.5 Organizations Covered in the Study

As shown in Table 1-3, the stakeholders related to solid waste management in Iraq are classified into government, private sector, waste generator, and donors. JST will confirm their roles, obligations, activities, etc. They are covered in the study, and studies are conducted through direct hearings, online meetings and/or field surveys.

Table 1-3 Organizations and Survey Items Covered in the Study

Division		Target	Survey Item
Government	Country	Ministry of Construction, Housing, Municipalities and Public Works, Ministry of Municipalities and Tourism - KRG	・Roles / Authority of Solid waste management ・Organization Chart / Personnel ・Budget for Solid waste management ・Structure / Method of Financial Management
	Gover-norate	Baghdad, Basrah, Erbil	
	City	Baghdad, Basrah, Erbil	
Private Sector		Private Company ・Collection / Transport ・Recycling ・Waste Treatment	・The Number of Workers, Handling Items, Handling Amount ・Contents of Services ・Charge ・Contents of Contract, Implementation Situation, etc.
		Informal Sector	The Number of Persons, Gender, Age, Contents of Activities, etc.
		NGO, NPO	Activities Area, Contents, Scale, Achievements, etc.
Waste generator		・Household, Business Operator (Market, Industry, Medical, etc.) ・Community	・Discharge Responsibility, Discharge Method, Roles by Gender ・The Number of Persons, Contents of Activities, Sharing Roles by Gender, Satisfaction by Gender, etc.
Donors		UNDP / UNICEF / UNHABITAT/ WHO, World Bank, USAID, etc.	・Outlines of related Projects ・Strategy and policy on the cooperation in Solid Waste Management Sector

Source: JST

Chapter 2 Republic of Iraq Basic Information

2.1 General Outline

The Republic of Iraq became the thriving ground of the ancient Mesopotamian civilization when the Sumerians established the world's first urban civilization from around 6000 BC. The Abbasid dynasty (750-1258) established Baghdad as the capital (766), and Islamic culture flourished. After being ruled by non-Arabs such as the Ottoman empire, Iraq fell under the British mandate from 1920. In 1932, the country became independent as a kingdom with Faisal as the first king. The revolution of 1958 established Iraq as a republic with the Ba'athist government headed by General Bakir in 1968, and Saddam Hussein became president in 1979. After that, the Iran-Iraq War (September 1980-August 1988), the Invasion of Kuwait (August 1990), the Gulf War (January-February 1991), etc. were fought under the Hussein administration. The use of force against Iraq by the United States and other countries began in March 2003, and Baghdad fell in April, and the Hussein administration collapsed.

The National Development Plan (NDP) 2018-2022 envisioned a set the following goals – above all: protecting and improving air quality, protecting and improving water quality, limiting land deterioration and fighting desertification, developing and improving a system for waste management, and limiting radiation pollution.

Solid waste management is still very rudimentary, and solid waste collection in Iraq covers mainly urban population since municipal institutions, pursuant to Municipal Administration Act No. 165 of 1964, are not responsible for providing the service to rural areas beyond the borders of the municipality master plan. There are several attempts to provide services in rural areas including collection of waste, backfilling of swamps, and maintenance of roads even though these areas are outside the boundaries of municipality masterplan.

On the other hand, Hazardous waste includes poisonous materials, high concentrations of flammable materials, explosives, and substances which can interact, corrode and impact the health of human beings, animals, plants and the environment, whether alone or when combined with other materials. The quantity of hazardous solid industrial waste in Iraq reached 119,425 ton/year (Unit generation rate: 0.01 kg/capita/day) in 2012. On the other hand, Specially-controlled industrial waste collected was 2,696 thousand ton/year[1] (0.05kg/capita/day= 2,696 thousand tons÷126,786 thousand people[2]÷365 days) in FY2017 in Japan. According to What a Waste 2.0 (2018, World Bank), the Unit generation rate of global harmful waste is 0.32 kg/person/day. Considering the above, it can be said that the amount of industrial waste in Iraq is small compared to other countries and it is possible that not enough data is collected.

The quantity of medical waste disposed of by health facilities in Iraq reached 6,432 ton/year (Unit generation rate: 0.0005 kg/capita/day) in 2015. On the other hand, the amount of collected infectious industrial waste in FY2017 in Japan, which is a similar type of waste to the medical waste in Iraq was 382,031 ton/year[3] (Unit generation rate: 0.01 kg/capita/day). According to What a Waste 2.0 (2018, World Bank), the basic unit of medical waste in the world is 0.25 kg/person/day. Since the definition of medical waste differs in each country, it is not possible to make a comparison easily, however it can be said that the amount of medical waste in Iraq is extremely small. Therefore, it is possible that not enough data is collected.

From the perspective of climate change issues between 2014 and 2015, greenhouse gases – due to increased methane emission – increased from 1.621 p.p.m to 1.758 p.p.m. In the same period, the

[1] Project in FY2019 year Specially-controlled industrial waste discharge and treatment survey report (FY 2017), Ministry of Environment

[2] Statistics Office, Ministry of Internal Affairs and Communications, Population estimation (as of 1st July, 2017)

[3] Report on infectious industrial waste treatment (FY 2017), Ministry of Environment

concentration of contaminants in air increased as well, with the dust concentration increasing from 18 to 19.6 g/m^2/month. Particulate matter in air also remained above the proposed national standard of 350 µg/m^3.

There is a problem of poor water quality as a result of leakage of sewage (obsolete and inefficient treatment plants and poor capacity) and untreated wastewater, as well as the effluent from factories that flows into rivers without treatment. Besides, there is a problem of accumulated hazardous residues, with their quantities collected by municipal institutions from health, industrial, agricultural, and other institutions in 2010 amounting to 42,591 kg/day. In 2015, country-wide it reached 56,498 kg/day without collection of data from the Nineveh and Anbar provinces due to deteriorating security conditions.

2.2 Natural Conditions

2.2.1 Geography

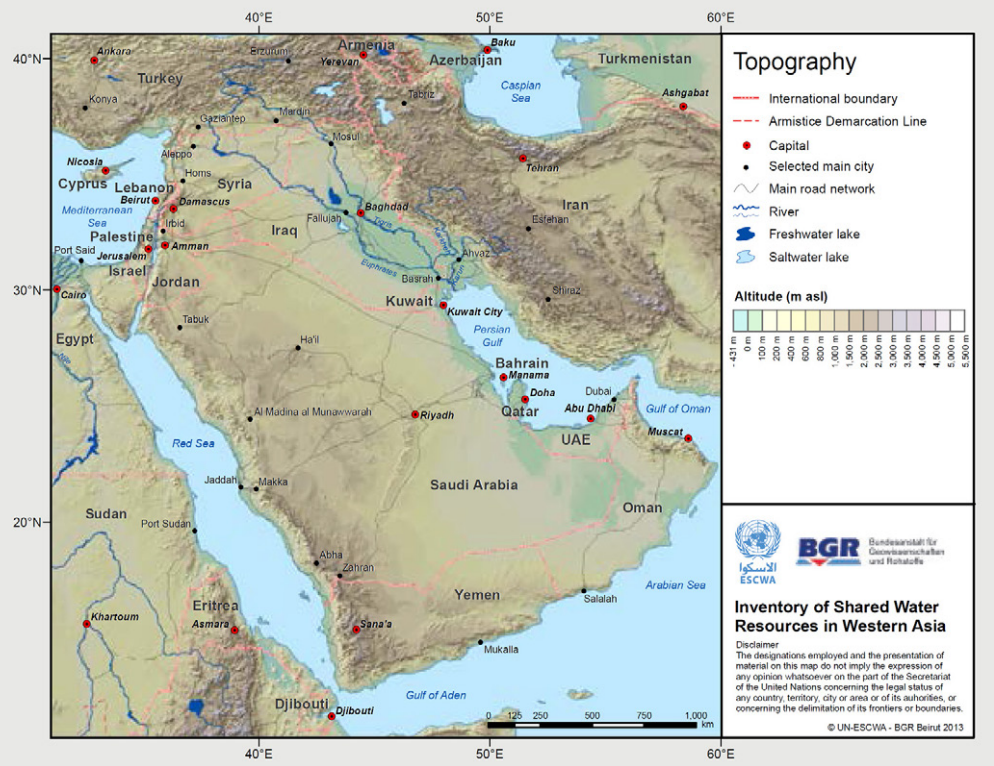
The western region of Iraq is a part of the Syrian Desert and borders with the Syrian Arab Republic (hereinafter referred to as "Syria") and Hashemite Kingdom of Jordan (hereinafter referred to as "Jordan") (Fig. 2-1). The north borders with the Republic of Turkey (hereinafter referred to as "Turkey"), the east edge forms the Arabian Gulf, and the south region borders with the State of Kuwait (Kuwait) and the Kingdom of Saudi Arabia (hereinafter referred to as "Saudi Arabia") and is included in the Nafud Desert.

Source: UNHCR

Fig. 2-1 Location of Iraq

2.2.2 Topography

The topography of Iraq is classified into three types. The southern region of The Euphrates is composed of a gentle sloping plateau of an altitude of 1,000 meters, the Syrian Desert, and the Nefud Desert (Fig. 2-2). The Mesopotamian Plain extends around the Tigris and The Euphrates, and the altitude of the region east of the Tigris River rises to form the Zagros Mountains.



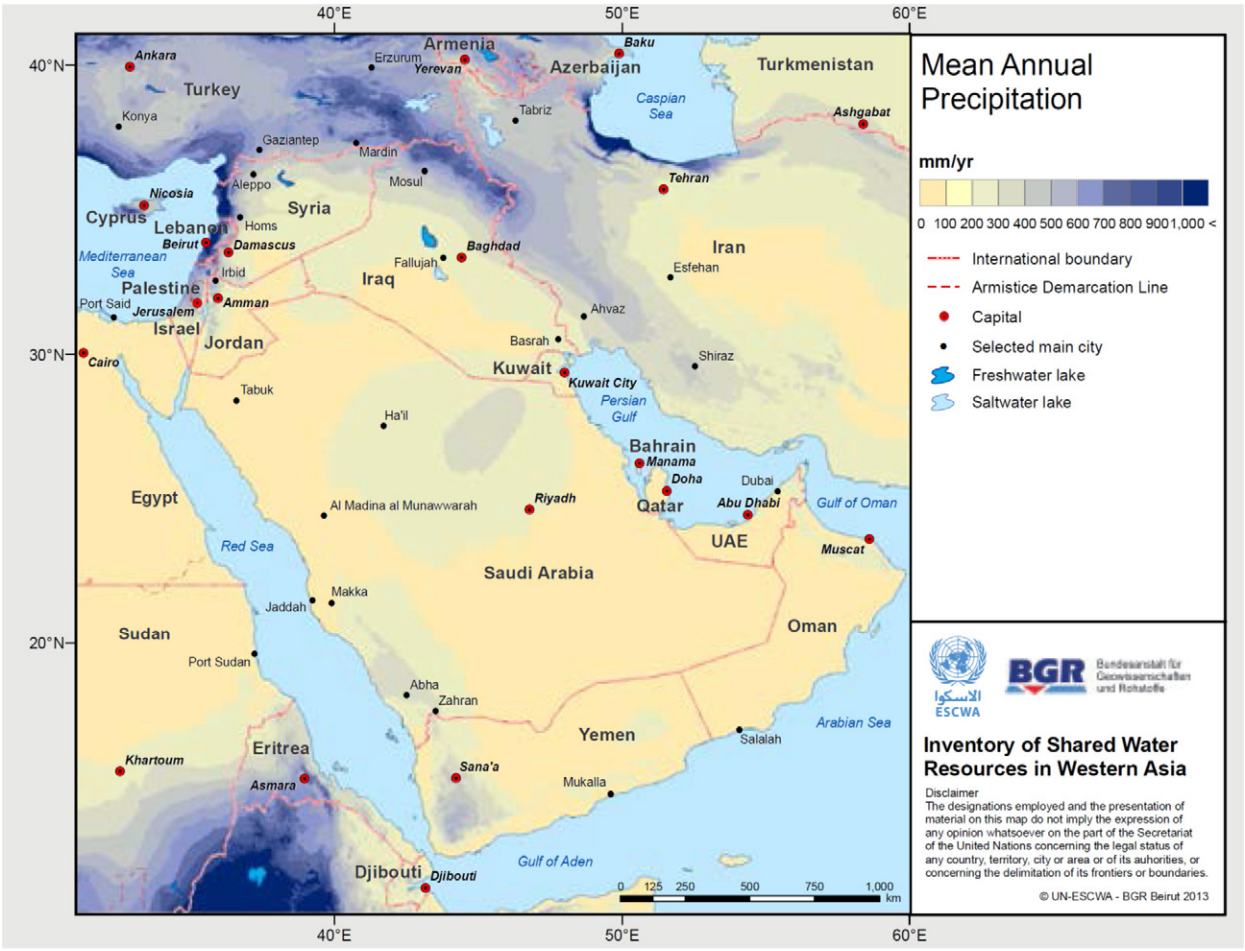
Source: UN-ESCWA-BGR, (2013)

Fig. 2-2 Topography of Iraq

2.2.3 Natural Conditions

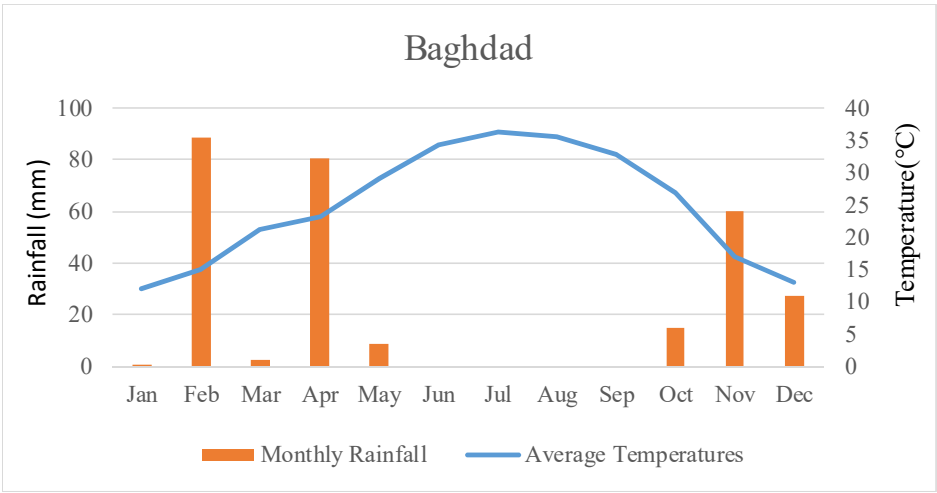
(1) Climate (Temperature and Precipitation)

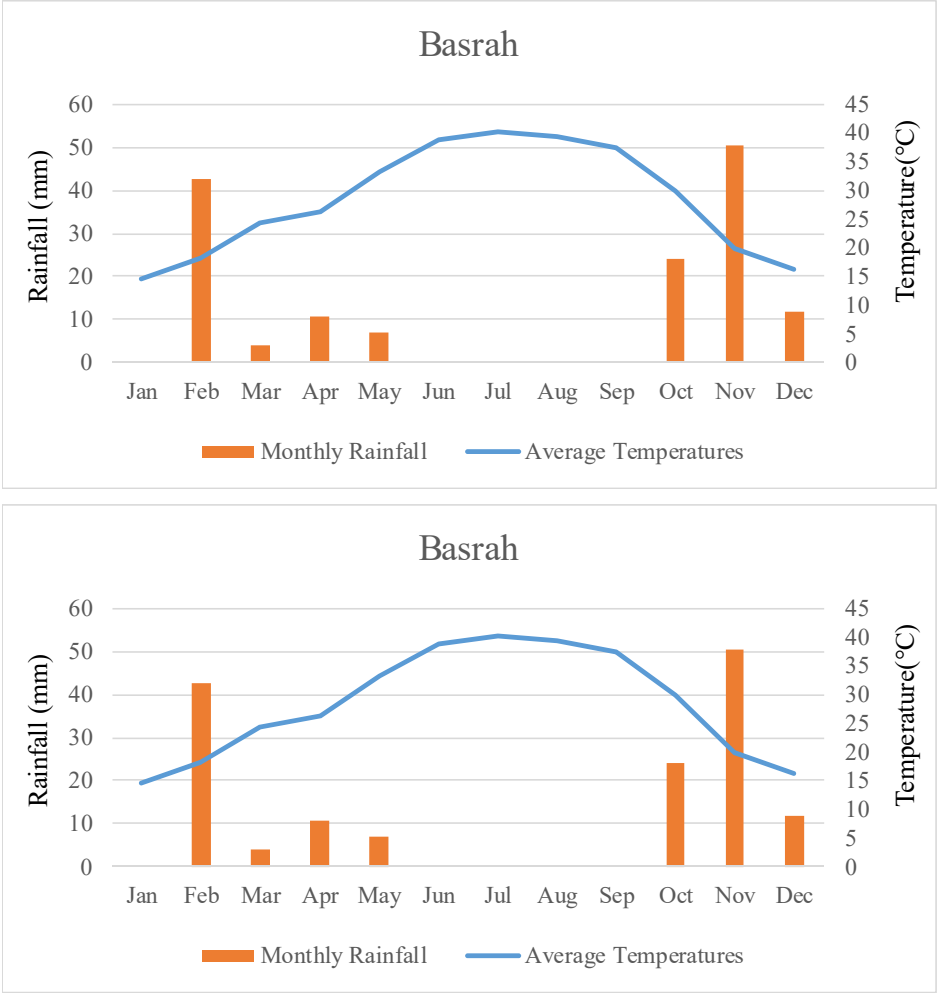
The meteorology of Iraq is classified as desert climate and therefore has very small rainfall (Fig. 2-3). The temperature and rainfall annual data (2018) of Basrah, Bagdad and Erbil are shown in Fig. 2-4. The average annual temperature is respectively; Basrah (south) 28.3℃, Bagdad (central) 24.7℃ and Erbil (north) 25.8℃. The average annual rainfalls are; Basrah 21.6mm, Bagdad 35.5mm and Erbil 81.5mm. The southern region has higher temperature and smaller rainfall than the north.



Source: UN-ESCWA-BGR, (2013)

Fig. 2-3 Annual Rainfall of Iraq



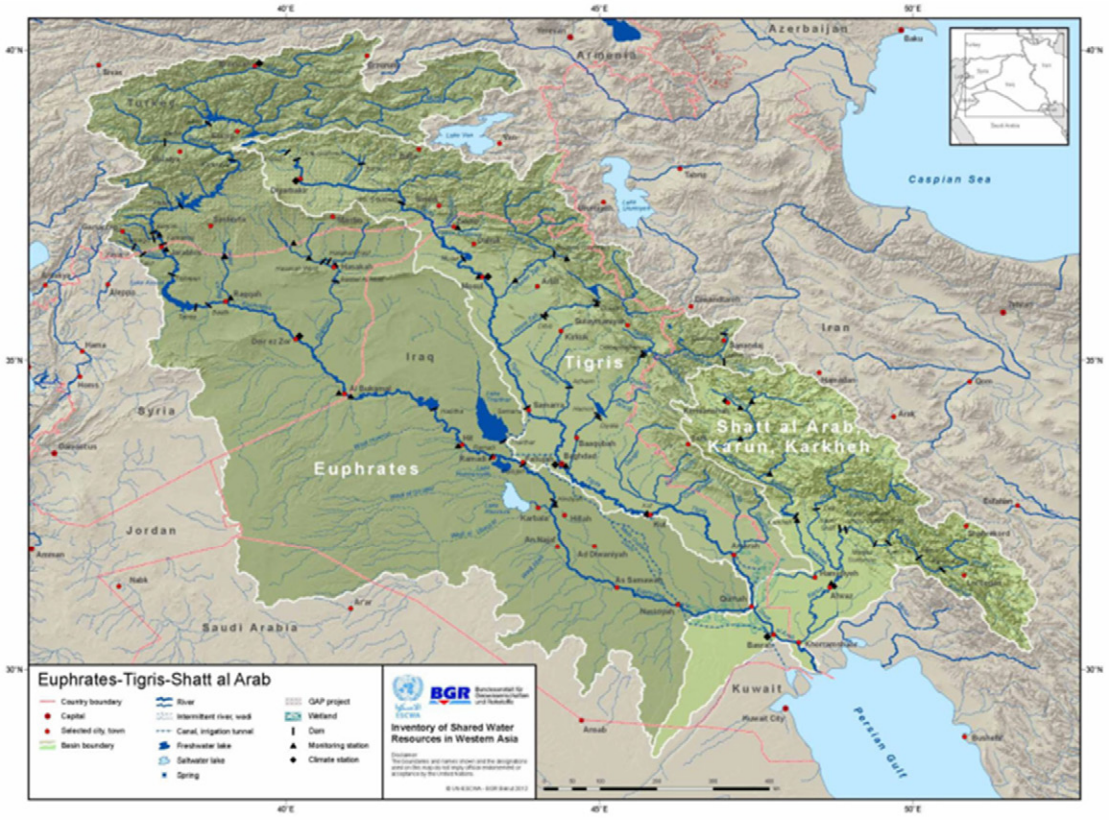


Source: CSO 2018 Iraq, KSCO Erbil

Fig. 2-4 Temperature and Rainfall of Basrah, Bagdad, Erbil

(2) Water Resources

The water supply system of Iraq is supported by the usage of limited water resources from irrigation and dams of the Tigris and The Euphrates (Fig. 2-5).



Source: UN-ESCWA-BGR, (2013)

Fig. 2-5 Basin of Euphrates, Tigris and Shatt al Arab Rivers

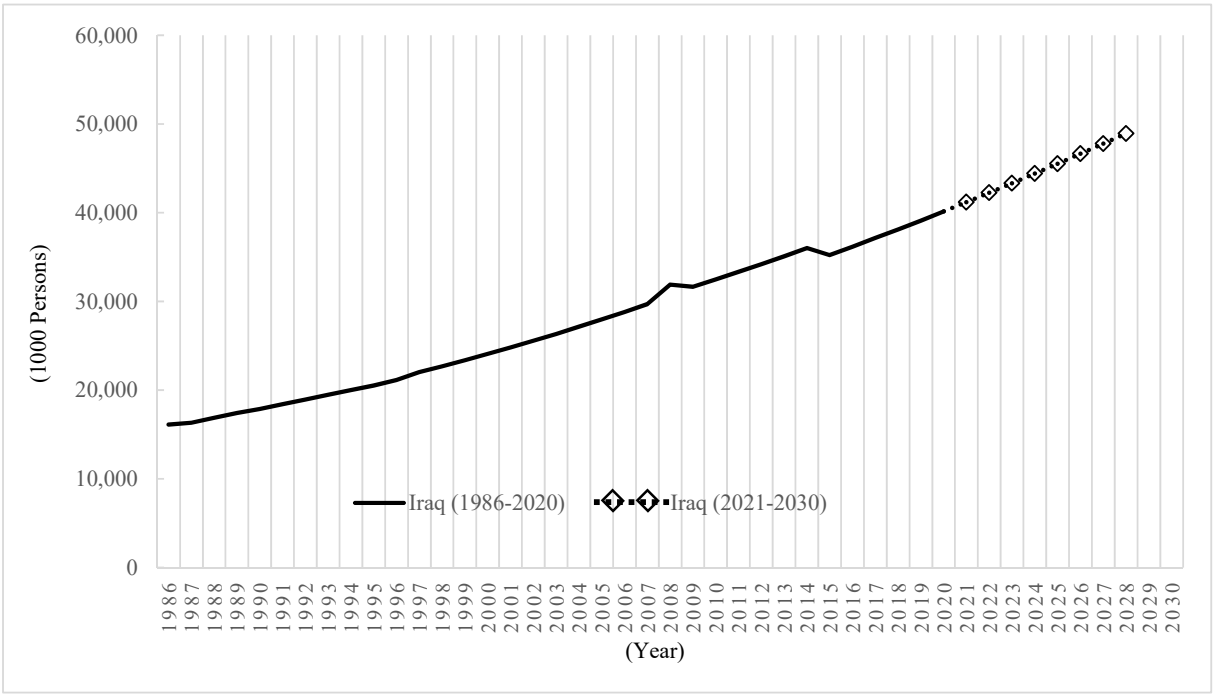
2.3 Socioeconomic Conditions

2.3.1 Population of Iraq

The population statistics are considered as important fundamentals for social and economic planning process and are expected to provide clear definitions for the population size, structure, distribution and growth which are available through censuses and sample surveys. Many censuses were carried out in Iraq since 1927, however censuses have not been carried out in recent years. The last census was in 2009 for buildings, housings, establishments and household census, and as for population, the census in 1987 is the last survey.

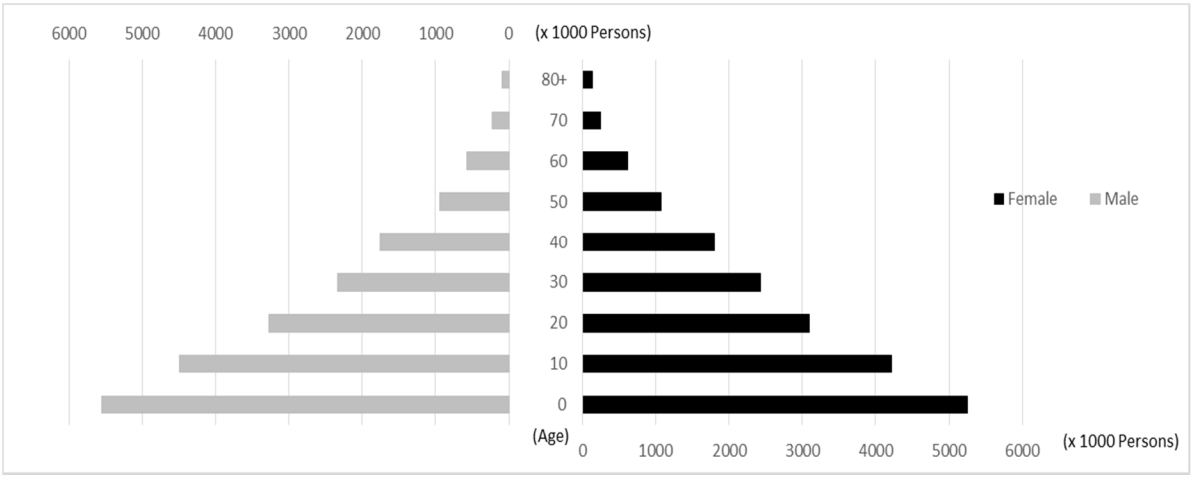
The population of Iraq as of 2020 is estimated at approximately 40 million people. The population is expected to reach 51 million people in 2030. The young age group accounts for the majority and the country has a high population growth rate. Those aged 20 and under account for approximately 51% of the total population, and therefore the country is expected to be the world's leading consumption market. Moreover, the population tends to be concentrated in capitals of the country and provinces and accordingly there is a great need for infrastructure required for responding to the increasing population.

The estimation of changes in the population of Iraq as of 2020 and the population of Iraq by age are shown in Fig. 2-6 and Fig. 2-7.



Source: Population Estimation of Iraq 2015 – 2018, (2018), CSO

Fig. 2-6 Population Forecast of Iraq



Source: Population Estimation of Iraq 2015 – 2018, (2018), CSO

Fig. 2-7 Population by Age and Gender (2018)

The numbers of households and family members are shown in Table 2-1. The number of family members per household was 6.3 persons in the urban areas and 7.8 persons in the rural areas in the population estimates conducted in 2009; however, such numbers increased by an average of 7.8 persons to 8.5 persons in the urban area and 7.5 persons in the rural area in the population statistics of 2016.

Table 2-1 Number of Households and Average Family Size

Year	2009			2016		
Item	Urban	Rural	Total	Urban	Rural	Total
Total Households	3,440,700	1,255,565	4,696,265	3,354,951	1,277,089	4,613,409
Total Population	21,844,413	9,820,053	31,664,466	25,262,782	10,906,341	36,169,123
Ave. size of Households	6.3	7.8	6.7	7.5	8.5	7.8

Source: Iraq's household and population estimation for 2009 are based on Iraq CSO 2015 – 2018, (2018). Iraq population estimation for 2016 is based on Iraq CSO 2015 – 2018, (2018), and Iraq household estimation for 2016 is based on average household size, Global Data lab, JST

The population of each governorate of Iraq in the past 4 years is shown in Table 2-2.

Table 2-2 Population of Governorates (2015-2018)

Governorates	2015			2016			2017			2018		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Ninevah	3,445,136	1,355,950	2,089,186	3,538,715	1,392,783	2,145,932	3,633,648	1,430,145	2,203,503	3,729,998	1,468,069	2,261,929
Kirkuk	1,475,853	384,944	1,090,909	1,515,950	395,406	1,120,544	1,556,618	406,011	1,150,607	1,597,876	416,770	1,181,106
Diala	1,512,192	768,173	744,019	1,553,272	789,039	764,233	1,594,942	810,208	784,734	1,637,226	831,689	805,537
Al-Anbar	1,636,357	817,915	818,442	1,680,813	840,133	840,680	1,725,914	862,677	863,237	1,771,656	885,541	886,115
Baghdad	7,506,105	938,890	6,567,215	7,710,001	964,397	6,745,604	7,916,847	990,262	6,926,585	8,126,755	1,016,521	7,110,234
Babylon	1,907,327	986,587	920,740	1,959,138	1,013,374	945,764	2,011,706	1,040,569	971,137	2,065,042	1,068,157	996,885
Karbala	1,125,646	373,011	752,635	1,156,220	383,145	773,075	1,187,245	393,429	793,816	1,218,732	403,860	814,872
Wasit	1,273,435	507,021	766,414	1,308,033	520,797	787,236	1,343,125	534,766	808,359	1,378,723	548,940	829,783
Salah AL-Deen	1,473,413	809,005	664,408	1,513,441	830,984	682,457	1,554,037	853,277	700,760	1,595,235	875,894	719,341
Al-Najaf	1,359,201	388,502	970,699	1,396,130	399,057	997,073	1,433,583	409,765	1,023,818	1,471,592	420,626	1,050,966
Al-Qadisiya	1,192,445	509,327	683,118	1,224,830	523,163	701,667	1,257,689	537,199	720,490	1,291,048	551,447	739,601
Al-Muthanna	752,176	410,585	341,591	772,603	421,734	350,869	793,343	433,054	360,289	814,371	444,538	369,833
Thi Qar	1,935,161	693,060	1,242,101	1,987,729	711,890	1,275,839	2,041,066	730,990	1,310,076	2,095,172	750,362	1,344,810
Maysan	1,027,701	268,610	759,091	1,055,612	275,906	779,706	1,083,937	283,309	800,628	1,112,673	290,820	821,853
Basrah	2,686,366	504,643	2,181,723	2,759,339	518,347	2,240,992	2,833,375	532,264	2,301,111	2,908,491	546,368	2,362,123
Erbil	1,713,132	286,970	1,426,162	1,759,659	294,762	1,464,897	1,806,871	302,667	1,504,204	1,854,778	310,687	1,544,091
Duhouk	1,193,815	309,774	884,041	1,226,250	318,196	908,054	1,259,150	326,732	932,418	1,292,535	335,400	957,135
Sulaimaniya	1,997,139	304,953	1,692,186	2,051,388	313,228	1,738,160	2,106,423	321,640	1,784,783	2,162,279	330,160	1,832,119
Iraq Grand total	35,212,600	10,617,920	24,594,680	36,169,123	10,906,341	25,262,782	37,139,519	11,198,964	25,940,555	38,124,182	11,495,849	26,628,333

Source: Population Estimation of Iraq 2015 – 2018, (2018), CSO

2.3.2 Industrial Structure

(1) Economic Trends

Table 2-3 and Fig. 2-8 show the economic trends of Iraq. GDP and GDP per capita were USD 222.4 billion and USD 5,687 billion in the latest actual data in 2019, respectively. The COVID-19 pandemic and a sharp decline in oil revenues have exacerbated Iraq's longstanding economic vulnerabilities since 2020. Real GDP contracted by an estimated 11 percent in 2020, reflecting a slowdown in non-oil activity and cutbacks in oil output as a result of OPEC decisions. Fiscal deficits of 20 percent compared to GDP, constrained the government's ability to mount an effective fiscal response to the crisis.

Iraq collects investment information and publishes it as statistical data. The National Investment Commission (NIC) and Provincial Investment Commissions (PICs) approved 1,067 investments from 2008 to 2015, for a total of USD 53.9 billion.

Table 2-3 Economy Trends

(1) Economic Growth and Prices

Items	Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
		Actual	Actual	Actual	Actual	Projection	Projection	Projection	Projection	Projection	Projection
Real GDP (percentage change)	%	2.5	15.2	-2.5	-0.6	4.6	5.3	2.6	2.3	2.1	2.1
Non-oil real GDP (percentage change)	%	-14.4	1.3	-0.6	0.8	5.4	5	4.1	3.4	2.7	2.7
GDP per capita (US$)	USD	5,047	4,843	5,263	5,882	5,728	6,017	6,172	6,326	6,486	6,666
GDP (in US$ billion)	Billion USD	177.7	175.2	195.5	224.2	224.1	241.5	254.1	267.3	281.1	296.5
Oil production (mbpd)	mbpd	3.72	4.63	4.47	4.41	4.59	4.84	4.93	5.01	5.1	5.18
Oil exports (mbpd)	mbpd	3.35	3.79	3.8	3.86	4.03	4.25	4.33	4.4	4.47	4.55
Consumer price inflation (percentage change; end of period)	End of period	2.3	-1.5	0.2	-0.1	2	2	2	2	2	2
Consumer price inflation (percentage change; average)	Average	1.4	0.5	0.1	0.4	0.8	2	2	2	2	2
Gross domestic investment	%	24.9	20.8	16.7	12.9	18.8	16.7	16	15.6	15.6	15.4
Of which: public	%	15.6	11.5	8.3	5.3	10.6	8.4	7.5	7	6.8	6.6
Gross domestic consumption	%	81.2	87	80.8	79.1	84.5	85.4	86.8	87.9	88.6	89.6
Of which: public	%	22.6	22.6	21.8	21.2	26.5	26.3	26.4	26.2	26.2	26.3
Gross national savings	%	18.4	12.5	18.6	19.8	13.6	12.5	11.7	11.1	10.3	9.4
Of which: public	%	3.1	-2	7	13.4	6.5	5.2	4.1	3.2	1.8	0.8
Saving -Investment balance	%	-6.5	-8.3	1.8	6.9	-5.2	-4.2	-4.3	-4.6	-5.3	-6
Government revenue and grants	%	30.6	26.8	33	39.8	40.5	39.6	37.9	36.5	35.5	34.6
Government oil revenue	%	27.8	22.9	28.9	36.7	37.2	36.3	34.5	33.1	32	31
Government non-oil revenue	%	2.8	4	4.2	3.1	3.3	3.3	3.4	3.4	3.5	3.5
Expenditure, of which:	%	43.4	40.7	34.6	32	44.6	43.1	41.2	40.5	40.5	40.5
Current expenditure	%	27.8	29.3	26.4	26.7	33.9	34.7	33.6	33.5	33.7	33.9
Capital expenditure	%	15.6	11.5	8.3	5.3	10.6	8.4	7.5	7	6.8	6.6
Overall fiscal balance (including grants)	%	-12.8	-13.9	-1.6	7.9	-4.1	-3.5	-3.3	-4	-5	-5.9
Non-oil primary fiscal balance, accrual basis (percent of non-oil GDP)	%	-46.5	-43.3	-39.4	-42.4	-56.9	-52.1	-49.2	-47.1	-46.2	-45.3
Total government debt (in US$ billion) 4/	Billion USD	99.9	112.5	115.2	110.4	115.3	121.9	128.5	137.5	150.7	167.3
External government debt (in US$ billion)	Billion USD	66.1	65	69.5	68.7	72.2	76.2	77.6	75.8	75.3	73.8

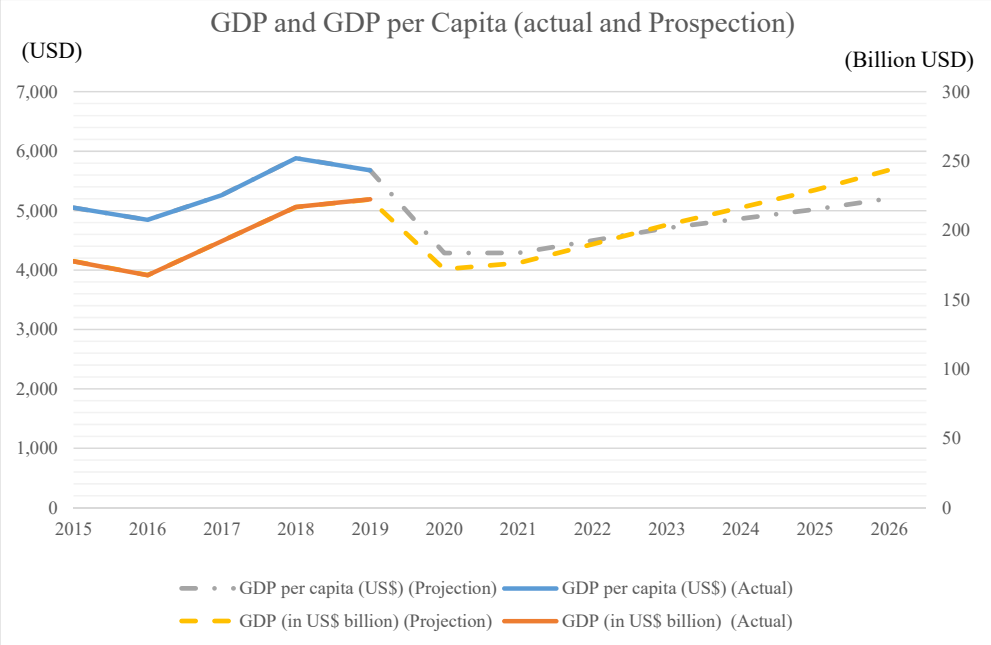
Note: mbpd: million barrel per day

(2) Budget if Central Government

Items	Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
		Actual	Actual	Actual	Actual	Projection	Projection	Projection	Projection	Projection	Projection
Revenues and grants	Trillion IQD	63.5	55.5	76.3	105.6	107.3	113.1	113.9	115.3	117.9	121.1
Revenues	Ditto	63.5	55.5	76.3	105.6	107.3	113.1	113.9	115.3	117.9	121.1
Oil	Ditto	57.7	47.2	66.7	97.3	98.5	103.6	103.7	104.4	106.3	108.7
Crude oil export revenues	Ditto	57.2	46.6	65.2	96.1	97.3	102.4	102.5	103.2	105.1	107.5
Transfers from oil-related public enterprises	Ditto	0.5	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Tax on oil company profits	Ditto	0	0.3	1.2	0.8	0.7	0.8	0.8	0.8	0.8	0.8
Non-oil	Ditto	5.8	8.3	9.6	8.3	8.8	9.5	10.2	10.9	11.6	12.4
Tax revenues	Ditto	1.4	5.2	6.7	4.9	5.2	5.5	5.8	6.2	6.6	7
Direct taxes	Ditto	1.1	3.7	3.9	2.6	2.5	2.7	2.9	3.1	3.3	3.5
Indirect taxes	Ditto	0.4	1.5	2.9	2.3	2.7	2.8	3	3.1	3.3	3.5
Non-tax revenues	Ditto	4.4	3	2.9	3.4	3.7	4	4.3	4.7	5	5.3
Grants	Ditto	0	0	0	0	0	0	0	0	0	0
Expenditures	Ditto	90	84.2	80.1	84.7	118	123.1	123.7	128	134.6	141.8
Current expenditures	Ditto	57.6	60.5	60.9	70.7	89.9	99	101	105.9	111.9	118.8
Salary and pension	Ditto	42.2	41.6	42.9	48.3	57.8	61.6	64.6	67.5	70.9	74.7
Salary	Ditto	33.1	32.3	33.4	37.7	46	49.7	52.4	55.1	58.2	61.7
Pension	Ditto	9	9.3	9.5	10.6	11.7	12	12.2	12.5	12.7	13
Goods and services	Ditto	4.7	5	7.5	8	12.4	13.5	14.6	15.3	16.3	17.4
Transfers	Ditto	9.5	12.5	8.2	10.2	15.2	15.9	16.7	17.5	18.3	19.2
Interest payments	Ditto	1.3	1.4	2.3	3.7	3	4.9	5.1	5.6	6.4	7.5
War reparations 1/	Ditto	0	0	0	0.4	1.5	3.1	0	0	0	0
Investment expenditures	Ditto	32.4	23.7	19.2	14	28.1	24.1	22.6	22.2	22.7	23

Note: IQD:Iraqi Dinar

Source: IMF Country Report, “Iraq : 2020 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Iraq “ (2020)



Source: IMF Country Report, "Iraq: 2020 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Iraq " (2020)

Fig. 2-8 GDP Trend and GDP per Capita

(2) Industrial Segments

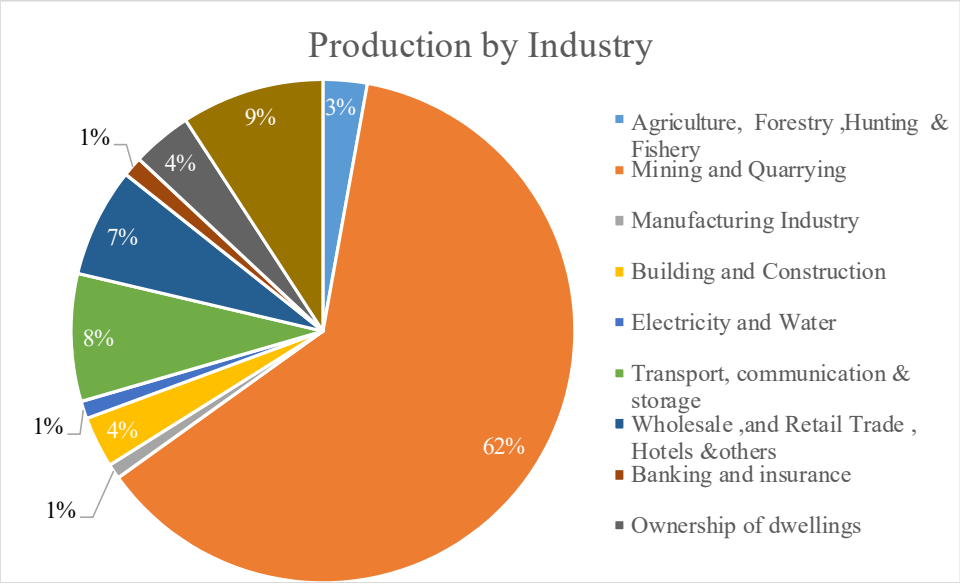
Table 2-4 shows the industry breakdown by production for 2019. According to the data, agriculture, forestry, and fishery produce 3% of GDP, the service sector produces 31% while the mining and manufacturing industry produces 67%. GDP of Industry related to crude oil accounts for 93.6% of its Mining and quarrying industry.

Table 2-4 Production per Industry (Breakdown) in 2019

Unit: Million IQD

Industry	Production by Industry	%
Agriculture, Forestry, Hunting & Fishery	6,048,361	3%
Industry		67%
Mining and Quarrying	132,964,663	62%
Manufacturing Industry	2,059,863	1%
Building and Construction	7,033,532	3%
Service		31%
Electricity and Water	2,410,026	1%
Transport, communication & storage	17,496,546	8%
Wholesale ,and Retail Trade , Hotels &others	14,977,808	7%
Banking and insurance	2,729,528	1%
Ownership of dwellings	8,210,628	4%
Social and personal services	19,597,529	9%
Total	213,528,484	100%

Source: Statistical Group –Industrial Statistics, (2018-2019), CSO



Source: Statistical Group –Industrial Statistics, (2018-2019), CSO

Fig. 2-9 Production by Industry in 2019

(3) Foreign Exchange and International Trade Balance

Inflation in the IMF Report 2020 has been estimated to rise from 0.1% in 2019 to 11.5% by the end of 2021. However, since 2020, food prices have fallen due to crude oil exports and falling oil prices.

The currency Iraq Dinar has weakened due to the instable political situations, the increasing debt of State Own Enterprises (hereinafter "SOE"), and the monetary policy of the central bank for increasing foreign currency deposits. The total government debt has been estimated to increase from USD 107.9 billion as of the end of 2019 to USD 146.6 billion as of the end of 2021.

The trade balance also has been maintaining a surplus, which is supported by increasing export of crude oil, and the increase in the ratio of investment by expenditures in the Federal Government.

(4) Foreign Direct Investment and Industry Development

Past records of the monthly foreign direct investment are shown in Fig.2-10. Foreign direct investments have been stagnant up to 2017 due to instable law enforcement, and security problems[4]. However, the investment condition has been improved since middle of 2018 because of the improved security situation. Since 2020, the foreign direct investment has been volatile because of Covid-19 and it was 13 trillion IQD in June 2021.

[4] Data Collection Survey for the Water Supply and Sewerage System Development Plan in Southern Iraq, Final Report, 2016

Source: Economic & Statistic Data CBIESD, Central Bank of Iraq

Fig. 2-10 Past record of Foreign Direct Investments

2.4 National and Local Government Layers

2.4.1 Federal Government

The Constitution approved on 15 October 2005 stated in Article (1): "*The Republic of Iraq is a single federal, independent and fully sovereign state in which the system of government is republican, representative, parliamentary, and democratic, and this Constitution is a guarantor of the unity of Iraq*".

The Federal Government (also called Central Government) is composed of the executive, legislative, and judicial Departments, as well as numerous independent commissions.

The Council of Ministers (which is part of the executive Departments) is composed of the Prime Minister as head of government and his cabinet. The President of Iraq names the nominee of the Council of Representatives bloc with the largest number to form the Cabinet. The Prime Minister is the direct executive authority responsible for the general policy of the State and the commander-in-chief of the armed forces, directs the Council of Ministers, and presides over its meetings and has the right to dismiss the Ministers on the consent of the Council of Representatives.

The cabinet is responsible for overseeing their respective ministries, proposing laws, preparing the budget, negotiating and signing international agreements and treaties, and appointing undersecretaries, ambassadors, the Chief of Staff of the Armed Forces and his assistants, Division Commanders or higher, the Director of the National Intelligence Service, and heads of security institutions.

(1) General Secretariat of the Council of Ministers

General Secretariat of the Council of Ministers was founded in 2003 after the announcement of the formation of the Iraqi Governing Council as the official representative of the Iraqi government to take on the administrative reorganization of the Iraqi state through its departments and has the following functions:

1. Ensure coordination of policies, procedures and government programs, and the transfer of government policies for key persons.
2. Support for Prime Minister in the ceremonies and foreign visits. And ensure that he receives from the Council of Ministers and its committees the best possible advice inspired by the General secretariat's experience through all levels of government.
3. Preparation for the meetings of the Council of Ministers and the organizing and presentation of

administrative services and coordination, putting down an effective mechanism of action in organizing transcripts of sessions and documentation.

4. The formation of the Council of Ministers' committees and supporting them. In addition; monitoring the implementation of the Council of Ministers resolutions and their follow-up, as well as the government's plans and projects.
5. Providing opinion and legal advice to the Prime Minister, the Council of Ministers, and the ministries.
6. Managing State Property Department efficiently, represented in real estates, sources of funds and property belonging to the Secretariat or that fall under management, and conservation, and documenting information about real estate ownership and conservation, and follow-up leasing transactions, authorization, customization and estimate fixed assets as well as land acquisition for the purposes of public interest and in accordance with legal regulations and relevant instructions governmental.
7. Solving conflicts before forwarding them to the Council of Ministers and conferencing views, to secure a positive proactive relationship, between the Prime Minister and members of the Council of Ministers on the one hand, and the Council of Ministers and the Presidency of the Republic and the Council of Representatives and independent bodies on the other.
8. Have a handle on citizen requests of, and their complaints and delivering them to the competent authorities in all ministries and following them up.
9. Support civil society organizations and encouraging them to active participation in the political decision-making and government programs, through educating citizens with moderate national culture raising morals and direct behavior to country service.
10. Relentless pursuit for optimal performance within the Secretariat to reach excellence achieving works and duties through improving management of human and financial resources; with technical assistance to enable them to develop efficient administrative apparatus of the state and independent bodies by raising the efficiency of the human elements, and preparing leadership and administrative development skills, abilities and change their behavior. Preparation of administrative cadres specialized in their respective fields. Identifying training and development needs and the development of action plans to improve corporate performance also; the preparation of studies and research, presenting political, organizational and administrative consulting.

The current cabinet includes 21 ministries as follows:

1. Ministry of Interior
2. Ministry of Finance
3. Ministry of Foreign Affairs
4. Ministry of Defense
5. Ministry of Oil
6. Ministry of Agriculture
7. Ministry of Communications
8. Ministry of Culture
9. Ministry of Construction, Housing, Municipalities and Public Works
10. Ministry of Electricity
11. Ministry of Education
12. Ministry of Health and Environment

13. Ministry of Higher Education and Technology
14. Ministry of Industry & Minerals
15. Ministry of Labor & Social Affairs
16. Ministry of Migration
17. Ministry of Planning
18. Ministry of Trade
19. Ministry of Transportation
20. Ministry of Water Resources
21. Ministry of Youth & Sport

2.4.2 Kurdistan Regional Government

The Constitution stated in Article 117: "*First: This Constitution, upon coming into force, shall recognize the region of Kurdistan, along with its existing authorities, as a federal region.*"

The Kurdistan Regional Government (hereinafter referred to as "KRG") is the official executive body of the autonomous Kurdistan Region of northern Iraq.

The cabinet is selected by the majority party or list who also select the prime minister of the Iraqi Kurdish polity. The president is directly elected by the electorate of the region and is the head of the cabinet and chief of state who delegates executive powers to the cabinet. The prime minister is traditionally the head of the legislative body but also shares executive powers with the president.

There are currently 19 ministries in KRG

1. Ministry of Justice
2. Ministry of Peshmerga Affairs
3. Ministry of Interior
4. Ministry of Finance and Economy
5. Ministry of Natural Resources
6. Ministry of Health
7. Ministry of Education
8. Ministry of Construction and Housing
9. Ministry of Municipalities and Tourism
10. Ministry of Higher Education and Scientific Research
11. Ministry of Planning
12. Ministry of Labor and Social Affairs
13. Ministry of Culture and Youth
14. Ministry of Martyrs and Anfal Affairs
15. Ministry of Agriculture and Water Resources
16. Ministry of Trade and Industry
17. Ministry of Transport and Communications
18. Ministry of Endowment and Religious Affairs
19. Ministry of Electricity

This is in addition to 5 departments:

1. Department of Foreign Relations
2. Department of Media and Information
3. Department of Coordination and Follow-Up
4. Department of Information Technology
5. Department of Non-Governmental Organization

And 6 other Entities

1. Board of Environmental Protection and Improvement
2. Board of Investment
3. General Board for Kurdistani Areas Outside the Region
4. Mine Action Agency
5. High Council of Women Affairs
6. Kurdish Academy

2.4.3 Responsibility and Relationship among Federal Gov., Governorate, City etc.

The federal system in the Republic of Iraq is made up of a capital, regions, and governorates, as well as local administrations.

After adopting a federal system in 2003 following the invasion by the US-led coalition, the Republic of Iraq's Constitution of 2005 and Law 21 of 2008 furthered the reform process by establishing a model of decentralized political and administrative government through devolution of power to eighteen provinces (governorates). But many challenges remain, in particular the devolution of authority related to services and an inter-governmental policy on the transfer of revenues to local governments from oil and other resources.

The legal framework set by Law 21 provided an important first step in the decentralization process but the details of the functional and territorial assignments between federal and local government still need to be agreed.

Iraq's Constitution of 2005 established a parliamentary system of government with a two-tier system: a federal government headed by a Prime Minister and his cabinet of appointed ministers, and a system of local government through the eighteen governorates (provinces). Three of the governorates have special status: Erbil, Sulaymaniyah and Duhok in Kurdistan have elected governors and councils (governing 60 municipalities each) and together form KRG. Article 117 of the Constitution recognizes KRG as autonomous and therefore entitled to have all the hallmarks of a government: its own constitution, its own parliament and its own ministries. Its relationship to the Federal Government in Baghdad is federal in nature, and as befits federal relationships is defined constitutionally. For instance, other than a few exclusive powers retained by the Federal Government in Article 110 (like national security and foreign policy, see below), the KRG is expected to share policy-making authority with Baghdad with respect to water, education and health, but enjoys decentralized decision making with respect to all other public services.

Law 21 of 2008 – the Law of Governorates Not Incorporated into a Region– as its name implies is applicable to the rest of the governorates which do not form part of the Kurdistan region. The exception is Kirkuk, which is awaiting a decision on whether it will form part of the Kurdistan region and so currently Law 21 applies to 14 governorates (provinces). This law sets out the procedures for the formation of local councils at the governorate level and at levels below (the *qadha* and *nahiya* councils which function as district councils) as well as defining the powers and duties of local councils. Law 21

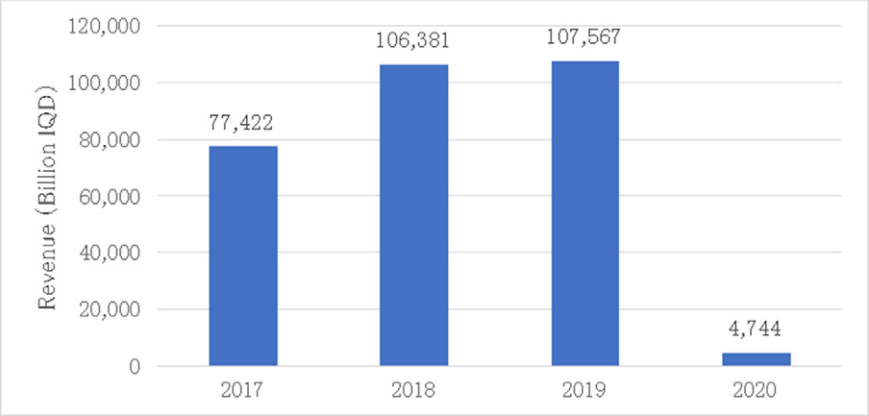
provided for a major conceptual shift for Iraq with the character of governorate councils changing to a body composed of department heads, presided over by the governor.

It is worth noting here that following the demonstrations that took place in 2019 and upon the request of the demonstrators, the Local Councils have been put on hold and the Supreme Court has recently issued a statement clarifying that the work of Local Councils is not legal and accordingly Local councils have to be dismantled.

2.5 Financial Conditions

(1) Trends in revenue

Trends in Iraq's revenue are shown in Fig. 2-11. Revenue in 2018 and 2019 hovered at 100 trillion IQD, but declined significantly in 2020 due to the drop in oil prices and export volumes caused by COVID-19. In Iraq, oil export revenue accounts for more than 90% of total revenue, and the decline in oil revenue is directly linked to the significant decline in total revenue.



Source: Ministry of Finance, Iraq (2020)

Fig. 2-11 Trends in Revenue

(2) Trends in expenditure

The actual expenditures of Iraq are shown in Table 2-5. This table shows the actual expenditures related to the Federal Government, including ministries and the Presidency, as well as the actual expenditures of each province, divided into investment and ordinary budgets. Despite the fact that the amount of revenue in 2018 and 2019 is almost the same, the amount of expenditure is approximately 40% higher in 2019 than in 2018. Due to the political unrest that occurred in 2019 in Iraq, the 2020 budget was not formulated and approved. As a result, in early 2020, the 2019 budget was carried forward to fund a minimum ordinary budget, which resulted in a significant increase in 2019 budget expenditures. In addition, in 2020, with a significant drop in revenue, expenditure was drastically reduced, especially the investment budget, which was hardly spent.

The budgets for the provincial governments are prepared by the Ministry of Planning and the Ministry of Finance according to the population estimates and poverty levels of each province, in accordance with Law No. 6 of 2019, "Federal Financial Management Law." The budget for FY2021 provides for the allocation of funds to each province, including the Kurdistan Region, and was approved by the Iraqi Council in April 2021[5].

[5] https://auis.edu.krd/iris/sites/default/files/20210516-IER2-Final.pdf

Table 2-5 Budget by Ministry during 2018 to 2020

Unit: Billion IQD

Item	2018			2019			2020		
	Investment Budget	Ordinary Budget	Total	Investment Budget	Ordinary Budget	Total	Investment Budget	Ordinary Budget	Total
Federal Government	13,038	55,245	68,283	22,741	70,880	93,621	88	5,629	5,717
MCHPWM	-	1	1	-	2	2	-	-	-
Province	791	11,806	12,597	1,681	16,421	18,102	60	3,193	3,255
Anbar	-	1	1	277	366	643	32	7	40
Babil	29	840	869	0	983	983	-	74	74
Baghdad	102	2,640	2,742	299	2,910	3,209	-	228	228
Basra	361	951	1,312	611	1,144	1,755	19	70	89
Diwaniya	25	573	598	12	679	691	1	51	53
Diyala	19	734	753	84	842	926	-	60	60
Kerbala'a	36	518	554	96	626	722	8	49	57
Kirkuk	-	-	-	-	-	-	-	-	-
Mesan	5	402	407	28	459	487	-	31	31
Muthana	17	267	284	10	337	347	-	25	25
Najaf	36	605	641	81	714	795	-	54	54
Nineveh	-	1	1	36	147	183	-	8	8
KRG	-	2,860	2,860	-	5,444	5,444	-	2,402	2,402
Salah Al-Din	-	2	2	-	166	166	-	4	4
Thi Qar	125	873	998	107	1,003	1,110	-	78	78
Wasit	36	539	575	40	601	641	-	52	52
Total	13,829	67,051	80,880	24,422	87,301	111,723	148	8,822	8,972

Source: Ministry of Finance, Iraq (2020)

(3) Budget Issues between Federal Government and KRG

The Federal Government allocates a certain percentage of the federal budget to the KRG as a return for its contribution in oil exports. The Federal Government and the KRG discuss the percentage of the budget to be allocated every year, but there is a conflict over the allocation, which has worsened the relationship between the two sides. The two sides are seeking to resolve this conflict over budget allocation on the basis of the constitution. However, they fundamentally disagree on the state structure stipulated in the constitution. The Kurdish parties interpret the constitution as providing for a loose federal system that delegates power and decision-making authority to local governments. The non-Kurdish parties, on the other hand, interpret the constitution as placing state power and decision-making in the Federal Government[6].

[6] https://auis.edu.krd/iris/sites/default/files/20210516-IER2-Final.pdf

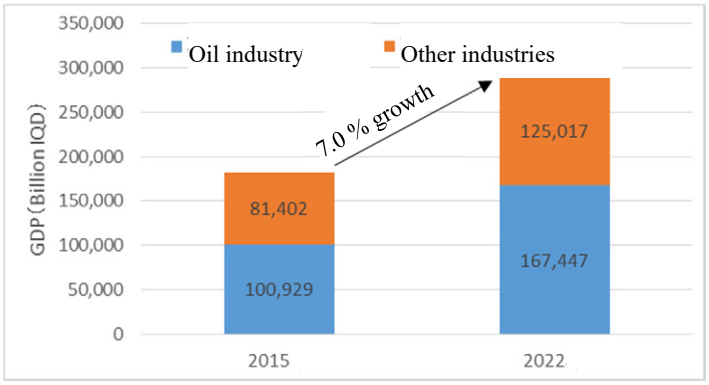
In 2014, the Federal Government suspended budget allocations from the federal budget to the KRG; in response, the KRG conducted its own oil exports to generate independent revenue. However, the region's revenues from its independent oil exports were not sufficient to cover the full expenditures of the KRG, and KRG had to negotiate again with the Federal Government for budget allocation. In the absence of the Federal Government transfers between 2014 and 2017, the KRG's revenues were not enough to cover expenditures, especially salaries and pension payments to the KRG's enormous public sector. In 2018, despite the fact that KRG had not fulfilled its promised oil exports (250,000 bpd) with the Federal Government, the Federal Government started to remit part of its budget allocation to the KRG (the part related to salaries and pensions). Even today, this issue remains unresolved, and the KRG's budget shortfall has become a serious problem, which is having a significant impact on waste.

Chapter 3 National Level Solid Waste Management

3.1 SWM plans and Strategies at the National Level

3.1.1 National Development Plan 2018-2022

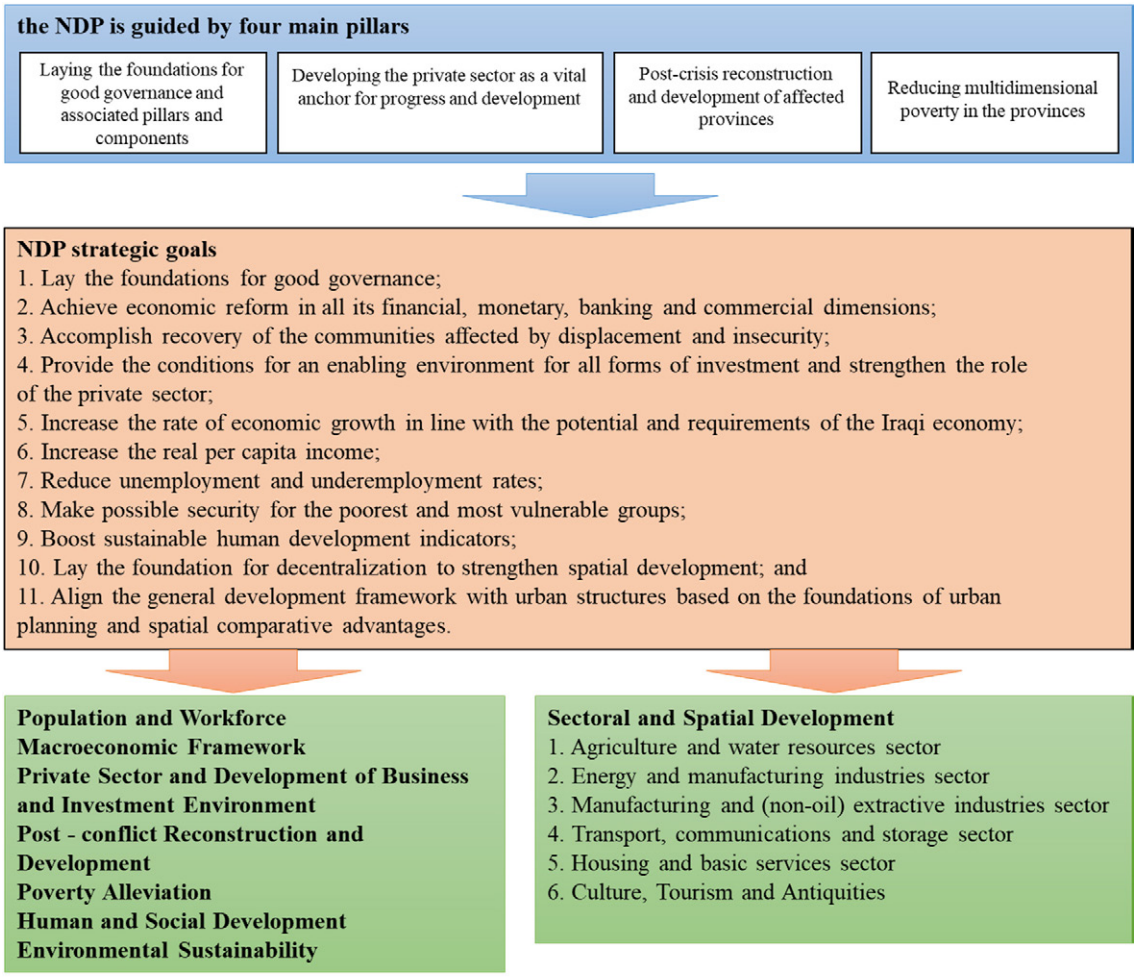
The National Development Plan (2018-2022) was formulated in 2018 to recover and develop from repeated war damages. The preconditions envisioned by the plan are that the population will grow at an annual rate of 2.5%, reach 42 million in 2022, and the annual GDP growth rate for 2018-2022 will be 7% (oil Industry 7.5%, other industries 6.1%), as shown in Fig. 3-1.



Source: National Development Plan (2018-2022)

Fig. 3-1 Base line (2015) and Target GDP in 2022

Under the above preconditions, the plan had four pillars and 11 strategic goals. Individual policies and plans have been prepared to achieve these goals. Throughout the plan, "strengthening governance," "reconstruction," and "reducing poverty", and not only public support but "the involvement of the private sector" were also emphasized as the methods.



Source: National Development Plan (2018-2022)

Fig. 3-2 Basic Framework of National Development Plan 2018-2022

From the solid waste management viewpoint, the background and objectives are summarized as follows.

(1) Objectives for Securing Environmental Sustainability

Objective 1: Ensure availability and sustainable management of water and sanitation service

- Protect and improve water quality
- Develop liquid waste management systems
- Conserve maritime and coastal environment
- Reduce oil pollution
- Implement water harvesting projects Systematically exploit ground water

Objective 2: Reduce air pollution and its impacts

- Protect and improve air quality
- Control oil pollution
- Implement projects to reduce electricity pollution
- Develop the waste management system
- Develop energy and environment units
- Reduce radioactive pollution
- Introduce integrated management of hazardous substances
- Ensure relevant institutional framework and legislation

Objective 3: Protect, restore and increase the sustainable use of ecological systems

- Reduce land deterioration and desertification
- Preserve biodiversity
- Develop the use of alternative sources in agriculture and opt for clean agriculture

Objective 4: Address climate change and its effects

- Protect and improve air quality
- Develop the waste management system
- Reduce radioactive pollution
- Introduce integrated management of hazardous substances
- Ensure relevant institutional framework and legislation
- Take steps to mitigate and adapt to the effects of climate change

3.1.2 National Solid Waste Management Master Plan in 2007

The federal government formulated the National Waste Management Master Plan in 2007 and indicated the waste management policies for 20 years from 2007.

(1) Key Objectives of the Plan

Key objectives of the plan were as follows:

- To minimize current and future public health risks and environmental impacts from waste

management
- To establish a functioning waste collection and sanitary disposal system as the highest priority
- To develop a waste management system based on internationally accepted principals of good waste management practice
- To create a legal framework to enforce the key objectives of the Plan.
- To generate reliable data on waste in Iraq to enable adequate planning for equipment, infrastructure, staff and budgets for waste management.
- To raise public awareness of public health and environmental risks and the need for responsible waste management in order to gain public engagement in, and national support for improvements in waste management.
- To create drivers which promote the waste hierarchy i.e. reduction in wasteful use of resources, responsible management of wastes, re-use and recycling where appropriate and sanitary disposal
- To develop Iraq's institutions to support reliable and appropriate and sustainable waste management
- To identify, priorities and address significant remedial requirements related to past waste management practice.
- To create budgets and funding mechanisms required for waste management in Iraq.
- To establish the training and development required to build and operate the waste management system.
- To introduce Private Finance Initiative (PFI)/ Public Private Partnership (PPP) principals to waste management procurement by stimulating and encouraging private investment.
- At the planning stage, restoration proposals must be considered and decided by appropriate authorities.
- The Iraq government has ratified the objectives of the 'Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal' broadly committing the country to the non-transportation of untreated wastes across national boundaries. However, to date Iraq has not formally signed up to the convention or any other international Treaties.

(2) Planning Period

The total planning period is 20 years, divided into phases;

Short-term phase < 5 years; Medium-term phase 5 – 10 years; Long-term phase 10 – 20 years.

(3) Action Identified by the Plan and their Progress

The actions planned in the National Waste Management Master Plan are shown in Table 3-1. Regarding the progress and achievement of the activities, MCHMPW replied that all activities during the short term had been completed.

Table 3-1 Actions Indicated by National Waste Management Master Plan

Item		Short-term (5years) 2008～2012	Mid-term (5～15years) 2013～2022	Long-term (15～20years) 2023～2027
Legislation	Priority Legislation	Identification Responsibilities, Classification of Wastes Waste Treatment and Disposal Standards, Establishmant of Environmental Protection Directorate (EPD)		
		Environmental Protection Legislation		
		Record Keeping		
	Development of Main Frameworks	Registration of Carriers		
			Waste Management Planning, Provisions for Special Waste Streams, Development Planning, Waste Management Licensing	
	Higher Environmental Governance			Waste Management Financing Legislation, Recycling and Re-use Legislation, Compliance with International Conventions
Institutional Capacity	Priority Operational Issues	Decentralization, Identification and Appointment of Responsibilities, Civic Buildings and Points of contract, Establishment of EPD		
	Capacity Development	Regional Lines of Communication	Regional Waste Management Forums	
		National Lines of Communication	National Waste Management Forums	
		Staff Training	Training for Trainers, Training Schedule and Budget	
	Best Value and Good Practice	Community Engagement		
				Comprehensive Review of Progress
Technical and Operational	Data Collection	Waste Generation / Waste Collection / Waste Disposal / Site Assesment / Needs Assesment	Interim	Formal Data Collection (Returns System)
	Structure / Planning	Regional Solid Waste Management Plans (SWMP)		Emergency SWMP
	Collection / Transport	Municipal Collection / Transfer Station	Collection Centre Points and Hazardous Waste Transfer Stations	Civic Amenity Centres
	Disposal	Sanitary landfill		Further Development, Alternative Disposal
	Recycling / Re-use	Planning		Infrastructure and Implementation
Social and Education	Education	Teacher Training (for primary, Secondary and Technical Level)	Teacher Training for Vulnerable Members of Society	
		Primary and Secondary Programs	Develop Interactive Programmes	
		Technical Colleges for Waste Operatives		Formal Environmental Training in all
	Public Awareness/ Moral Responsibility	Specific Environmental Management Groups / Community Programs (Urban)	Community Programs (Rural)	
			Recycling Awareness and Training	
	Media	School Exhibitions / Newspaper and TV	Recycling and Re-use Promotion	Promotion of Civic Amenity Centre Benefits
Economics	Budget Calculations	Initial	Revisions, Landfill Tax	
	Economic Instruments	Replacement Policy		
				Recycling Benefits
			Virgin Material Taxation	
		Direct Charging		
	Alternative Funding	Intersection Subsidisation		
		Revenue - Fines, etc		
		Funds - Loans		Private Sector Investment / Privatization

Source: National Waste Management Master Plan (2007)

3.1.3 Cabinet Resolution No. 341 of 2019

The federal government issued Cabinet Resolution No 341 in 2019 which including the following article

for facilitating private sector's investment into the solid waste management. This resolution promotes the private sector investment in solid waste treatment and recycling activities.

> Article 11:
> Improving municipal and environmental services and encouraging small industries that use waste recycling products, as follows:
> 1) The Baghdad Mayoralty and the governorates to undertake contracting procedures with investors to establish waste treatment and recycling plants using modern methods
> 2) The Ministry of Electricity shall purchase all electrical energy produced from waste treatment, if any, at promotional prices.

3.2 Laws and Regulations on SWM and Other Related Sectors

As an environmental policy, Iraq has formulated the Iraqi National Development Plan 2018 – 2022 to promote sustainable development. Fundamental environmental strategic policy was declared as a national plan.

Law No. 37 of 2008 was established for the legislation on environmental administration such as establishment of Iraqi Ministry of Environment (MOE: Currently it is the "Ministry of Health and Environment".), and Law No. 27 of 2009 was established for nationwide environmental protection. For the pollution control of air, water and noise etc., relevant federal laws enacted before the year 2000 are still in effect, and also new laws have been enacted in regional government. On the social aspects such as land tenure, expropriation and preservation of archeological sites, the above-mentioned Iraqi Constitution or relevant federal laws regulate their legal and institutional requirements. However, since new laws are not adequately adjusted with existing laws and legislations, there are overlaps of articles. For example, water resource management is led by Ministry of Water Resources (MOWR), Ministry of Environment (MOE), and Ministry of Health (MOH) in multiple laws. No law on noise and vibration has been established. Table 3-2 lists laws and regulations on environmental and social considerations. In this section, summaries of the major laws and regulations listed will be introduced.

Table 3-2 List of Laws and Regulations on Environmental and Social Considerations

Issue	Laws and Regulations No.	Name
1. Constitution	-	Iraqi Constitution
2. National Plan / Policy	-	National Development Plan 2018-2022
3. Water Supply and Sewerage Service	Law No. 27 of 1999	General Authority for Water and Sewerage Law
4. Environmental and Social Issues		
4.1 Establishment of Ministry of Environment	Law No. 37 of 2008	Law on Establishment of Ministry of Environment
4.2 Environmental Conservation	Law No. 27 of 2009	Law on Environmental Protection and Improvement
4.3 Environmental pollution	Law No. (8) of 2008	Law of Protection and Improvement of the Environment in the Kurdistan Region
4.4 Protection of Water Source	Regulation No. 2 of 2001	Regulation on Conserving of Water Resources
4.5 Water Quality	Law No. 25 of 1967	Law on protection of rivers and other water source systems from water pollution
4.6 Management of irrigation canal and drainage channel	Law No. 12 of 1995	Law on irrigation canal and drainage channel
4.7 Air Quality	Regulation No. 471 of 2012	Regulation on Air quality
4.8 Waste Management		
(1) **Management of Urban Waste**	**Notification No. 2 of 2014**	**Notification on the management of Urban Waste**
(2) **Environmental regulation to construct projects and**	**Instruction No. 3 for the year 2011**	**Categorization of the development project Regulating environmental requirement to the project including facility for SWM**

Issue	Laws and Regulations No.	Name
monitor their development		
(3) **Solid Waste Collection**	**Resolution No. 133 for the year 1996**	**The resolution determines the responsibilities of solid waste collection in Baghdad governorate**
(4) **Debris Management**	**Law No. 29 of 2009**	**Law on the management of debris**
(5) **Responsibilities of Municipalities on SWM**	**Amendments of No.6/1993**	**Municipalities Directive Act in KRG**
4.9 Ecosystem		
(1) Conservation of Forest	Law No. 30 of 2009	Law on forests and nurseries
(2) Flora and Fauna	Law No. 1 of 2010	Law on protection of wild animals and birds
4.10 Public Health	Law No. 89 of 1981	Law on Public Health
5. Social Environment		
5.1 Land Type	Law No. 55 of 1932	Law on categorizing land types in Iraq
5.2 Land Acquisition	Law No. 12 of 1981 (Revised No. 6 of 1998)	The Republic of Iraq's Acquisition Law
5.3 Land acquisition for farming	Law No. 117 of 1970	Law on development of farmland
5.4 National Heritage	Law No. 55 of 2002	Law on antiquities and heritage
6. Others		
6.1 Global Warming	Law No. 7 of 2008	Law on ratification of convention on climate change and Kyoto protocol
6.2 World Heritage Sites	Law No. 12 of 2008	Law on ratification of convention on protection of the world cultural and natural heritage
6.3 Ramsar convention	Law No. 12 of 2008	Law on ratification of Ramsar Convention
6.4 Biological diversity	Law No. 31 of 2008	Law on joining the convention of biological diversity
6.5 Responsibilities of Ministry of Municipality and Tourism	Law No. 2 (2007)	Establishment of KRG Ministry of Municipality and Tourism
7. Environmental Standards		
7.1 Water quality Standards	Notification No. 80406 of 1980	Notification for the Prevention of Water Pollution
7.2 Effluent Standards		
7.3 Standards for Sewage Sludge for Farming	EU Council Directive 86/278/EEC	Standards for Sewerage Sludge for farming (for reference)

Source: JST

3.2.1 Iraq Constitution

Iraqi Constitution was enacted firstly in1921 and has been revised and updated eight times since then. Article 112 of the Constitution states that Iraq shall adopt a federal political structure. Iraq is composed of 3 political regions: Kurdistan in the north, central region of Sunnis majority and the southern Shiite majority, where each region has its autonomous establishment.

According to Article 114 of the Constitution, in contrast, the administrative jurisdiction on the following issues is shared between the federal and regional governments:

- Regional custom / ordinance
- Control on electrical power generation and its distribution
- Environmental policy to ensure environmental protection
- Development policy, plan and these implementation plans
- Public health
- Education
- Water resources management / policy of domestic watercourse originating domestic river basin

According to Article 113 of the Constitution, antiquities, archeological sites and cultural assets are

considered as national property under the jurisdiction of the federal authorities and are managed in cooperation with the regional governments. Article 23 stipulates that a landowner shall have a right to benefit, exploit and dispose of private property within the limits of the constitution and that expropriation is not permissible except for the purpose of public benefit in return for just compensation. It also states that citizens have a right to live in a safe environment, the Federal Government is responsible for conservation of environment and biodiversity in Iraq (Article 33), and every citizen should be protected in accordance with the constitution (Article 125).

3.2.2 Law and Regulation Related to SWM

SWM sector in Iraq is suffering from a severe shortage in the laws, regulations, and technical guidelines on SWM. This is applicable for both the Federal Government and the Kurdistan regional government where despite the fact that a draft Solid waste Management law has been prepared in the Iraqi Parliament and another Law for KRG prepared by MOMT a couple of years ago, neither law has been put into force up to this date.

The current laws and regulations applicable can be summarized as follow:

3.2.2.1 Federal Government

(1) Resolution No. 133 for the Year 1996

The resolution determines the responsibilities of solid waste collection as follows:

Article 1: Mayoralty of Baghdad and Municipalities shall collect and transport solid waste from residential houses and compounds at their own expenses.

Article 2: The occupants of non-residential real estates and the hawkers in the places they operate shall clean the streets, collect and transport wastes at their own expenses and in a way determined or acceptable by the Ministry of Interior or Mayoralty of Baghdad in Baghdad city.

Article 3: The Mayoralty of Baghdad and the Municipalities shall clean the streets and areas where it is difficult to implement article 2 above, and collect and transport wastes and collect fees from occupants of non-residential real estates and hawkers in the area.

Accordingly, Baghdad Mayoralty and municipalities cannot collect SWM fees from the residents. Article 1 provides no financial incentive to the residents for minimizing their waste generated and may undermine the municipalities' financial sustainability for SWM.

(2) Environmental Protection and Improvement Law No. 27 of 2009

The law identified environmental pollutants as any solid, liquid, or gaseous substances, noise, vibration, radiation, heat, glow or the like, or biological factors that lead directly or indirectly to environmental pollution.

The law has identified Waste: Solid, liquid, or gaseous materials that are not usable or recyclable resulting from various types of activities.

Hazardous Waste: Waste that causes, or is likely to cause, because of its material contents, serious harm to humans or the environment.

The Law mentioned in section 2 – Article 14 – Third: it is forbidden to throw solid waste, animal droppings and their remains or their waste into water resources.

The Law included a complete section No. 6 for Hazardous materials and waste management specifying the methods of dealing with hazardous wastes.

(3) Law No. 67 of 1986 and Law No. 29 of 2009 on Debris Management

These laws define the preparation of collection sites for construction debris and that the sites should be located in remote areas. Those who generate construction debris are to deliver the debris to the collection site within 10 days of the agreed schedule with the mayoralty/municipality or have the mayoralty/municipality remove and transport the waste for a price three times of the transportation cost in accordance with Article 2 of Law No.67. Article 4-b of the law states that contractors for delivering construction debris are subject to a penalty of six months of imprisonment or a fine of 600,000 dinar at maximum in case of inappropriate operation.

(4) Instruction No. 3 for the Year 2011 (environmental regulation to construct projects and monitor its development)

This instruction stipulates the environmental requirements to any construction projects including solid waste management facilities. Environmental requirements related to solid waste management are summarized below.

Article 2 and Article 3 categorize development projects into the following categories:

Category A : Projects involving significant environmental influences such as negative impacts on ecosystem, requirement of resettlement, and extensive influences

Category B : Projects involving partly irreversible influences on ecosystem

Category C : Projects involving little or no influences

Article-15-Landfill sites for hazardous (Category A): sites allocated for waste disposal of hazardous and toxic materials from the diverse projects need to satisfy the following:

- Establishing the landfill at a distance of not less than (15) fifteen kilometers outside the boundaries of the municipality and communities.
- It should be at least (5) five kilometers away from water resources.
- The groundwater level should be low, and the soil should be impermeable.
- The topography and geology of the area should be considered.
- Operation according to the scientific principles and international specifications in the sites and operations of landfilling for hazardous waste, and lining the site with a material that does not allow the leakage of waste, especially liquid ones.
- Erecting a fence around the site from construction materials, with a height of not less than (2) two meters and indicated by distinctive signs.
- Providing all security requirements for the purpose of controlling sudden accidents that may occur on the site and lead to pollution of the neighboring area.
- Drilling at least four closed monitoring and control wells.

Article 24 landfill sites for municipal waste (Category B): sites allocated for waste disposal of solid waste (non-hazardous) and unusable materials shall follow what comes hereafter

- To be located outside the municipal boundaries, with a distance of not less than (2) kilometers from municipal borders and (1) one km from population centers and a distance of not less than (1) one km of the right-of-way of public roads and at a suitable location .
- Operate according to scientific principles used for operations of waste landfilling.
- Fencing the sites before starting the operation, with the necessity of afforestation of the sides of the

site as much as possible.

- Construction of roads inside and outside the site to facilitate the movement of vehicles.
- Providing the necessary heavy equipment and machinery for the landfill operation in the in the right manner.
- Closing the site after completion of the operation by leveling the surface of the soil as green areas.
- Treatment of the soil surface settlement after an appropriate period has passed.
- Equipping the site with pipes to drain the leachate generated from the decomposition of waste and lining the site with impermeable material.
- Providing the site with vent pipes to the atmosphere for the gas resulting from the organic decomposition of waste.

Article 48 sorting and recycling plants of waste (Category B): places of assembly of municipal waste and sorting of materials that can be used as a normally recycled and transfer what is left of them to landfill sites shall be as follows:-

- Establishing the plants outside the municipality's boundaries and keeping them at a distance of no less than (1) one km from the population centers.
- Paving the site with concrete.
- Waste storage in tight and controlled roofed compartments according to a specific design.
- Carrying out unloading and loading operations inside roofed compartments.
- Constructing septic basins that are sufficient to accommodate the amount of water discharged from human uses, cleaning the plant floors and collecting and transporting the remaining waste (residue) daily and transporting it to landfill sites.
- Surrounding the site with a fence of construction materials whose height is not less than (2) two meters.

Article 74 Municipal waste transfer stations (Category C): Sites to collect municipal solid waste without sorting. It does not include health care waste, hazardous waste, slaughterhouse waste, and any waste containing liquids. Its establishment must be as follows:

- Set up within the municipal boundaries and within the allocated (public services areas) and away from population centers, hospitals, health centers and educational facilities of all kinds by a distance of not less than (250) two hundred and fifty meters and (100) m one hundred meters from main roads.
- Paving the site with concrete and using salt- resistant cement, and the site streets with concrete or concrete asphalt.
- Waste storage within roofed and controlled compartments according to a specific design.
- Carrying out unloading and loading operations inside controlled compartments.
- Establishment of septic tanks commensurate with the amount of drained water from human uses, cleaning the floors of the station and transferring it to sewage treatment plants.
- Fencing the site with a fence whose height is not less than (2) two meters of construction materials with a gate for entry and another for exit.
- Securing a source of water and transporting the waste daily to sanitary landfill sites.
- Providing a weighbridge for measuring the incoming waste and documenting the weights.

1) Findings

It is stipulated in the instruction that disposal facility and recycling facility should be located outside the municipality's boundaries. This stipulation may be contradictory to the "Proximity Principle and Self Sufficiency" of Key Principles of National Solid Waste Management Master Plan mentioned in 3.1.2. In case of construction of a disposal facility outside the municipality, the land of the construction site may not belong to the municipality. It is not easy for the municipality which constructs the disposal facility to obtain consent from the residents adjacent to the construction site when it is outside the municipality. This requirement makes it difficult for the municipality to construct the disposal facility. It is difficult for residents living in a municipality to accept waste generated from another municipality to be disposed of in their neighborhood.

There is no requirement of compaction machine in the transfer station in the Article 74. However, the definition for Formal Transfer Station provided in the CSO's environmental report stipulates that only Transfer Station with compaction are formal Transfer Station which is contradictory to Article 74. It is necessary to revise the definition of the CSO's environmental report in accordance with this law.

(5) Instruction of Environmental Protection from Municipal Waste No.2/2014

This instruction defines that the Ministry of Municipalities and Public Works and the Mayoralty of Baghdad take responsibility for SWM in their respective areas. It describes the regulations on waste management and disposal, and stipulates the disposal/collection site, collection time, trash bin installation, transfer station, treatment method, disposal facility, garbage bag distribution, etc. The Ministry of Environment is responsible for waste treatment methods, inspection/management /operation guidelines, awareness raising, etc., and approval by the Ministry of transfer stations and landfills is also stated. It also mentions waste treatment facilities for treatment of construction and agricultural wastes. There is a classification of open dumping, but there is no provision regarding penalties. Besides, special provisions are established for waste weighing more than 50 kilograms and for farm owners and investors in farming. A responsible institution organizes and deploys landfill facilities and transfer stations in coordination with the Ministry of Environment requirements.

3.2.2.2 Kurdistan Region

(1) Municipalities Directive Act in KRG, Iraq with Amendments of No.6/1993

This law provides for the establishment and abolition of municipalities in KRG, as well as the authority of municipalities. The letter of the law includes municipal obligations to collect waste and keep the city clean. The law is a draft of waste management policy in the Kurdistan region.

(2) Law No. (8) of 2008 Law of Protection and Improvement of the Environment in the Kurdistan Region

The law identifies environmental pollutants as any solid, liquid, or gaseous substances, noise, vibration, radiation, heat, glow or the like, or biological factors that lead directly or indirectly to environmental pollution.

The law identifies Waste: Solid, liquid or gaseous materials that are not usable or recyclable resulting from various types of activities.

Hazardous Waste: Waste that causes, or is likely to cause, as a result of its material contents, serious harm to humans or the environment.

The law included a specific section No. 5 for Hazardous materials and waste management specifying the methods of dealing with hazardous wastes.

(3) Law No. 2 (2007) – Establishment of KRG Ministry of Municipality and Tourism

This law specifies under Article 2 the following:

First: to local and municipal services to provide residents needs of clean water, and to provide the requirements for sewerage and storm water management, construction of roads and bridges and tunnels within city borders and to enhance the quality and quantity of different municipal services to cover the cities, districts, and villages and to secure residents needs of playgrounds and parks.

Second: Planning, management and implementation in a way that contributes to creating local economic development through effective policies in land use and urban planning.

Third: prepare the suitable atmosphere to sustain a clean and healthy Environment and to manage green areas in cities and districts.

3.2.2.3 Category of Waste

According to the several laws, definitions of the waste category are shown in below.

- Residue(المخلفات): Solid, liquid or gaseous materials that are generated from various activities and include biodegradable waste, commercial waste, household waste, agricultural waste, industrial waste, oily waste, municipal waste, inert waste, hazardous waste, special waste, environmentally acceptable waste.
- Waste (النفايات) : Solid, liquid or gaseous materials that are not usable or recyclable resulting from various types of activities.
- Medical waste: It is the waste resulting from various medical activities, which is a source of transmission of epidemics and diseases.
- Hazardous waste: It is a type or mixture of types of waste whose quantities, concentration or properties cause a danger to human health and the environment, including radiological and chemical medical waste.
- Industrial waste: Any solid, semi-solid, liquid or gaseous materials resulting from various industrial activities, including sludge resulting from industrial water treatment plants.
- Agricultural Residues: Materials resulting from various agricultural activities that can be returned to the soil in its original form or after being treated as fertilizer and do not include pesticide and herbicide residues.
- Sludge (liquid waste): water deposits resulting from industrial water treatment plants or sewage water

3.2.2.4 Solid Waste Management Law to be formulated

USAID is currently involved in supporting the solid waste management sector through a project titled the Iraq Governance and Performance Accountability (IGPA/TAKAMUL) Project. Under this project a solid waste management law is being developed. The draft of the solid waste management law has the following contents;

- To establish a National Waste Management Authority chaired by the President with members from the representatives of related ministries, Baghdad Mayoralty, and National Investment Commission,
- To regulate to formulate the National Plan for Waste Management and Local Plan for Waste Management,
- To develop legal framework for licenses for waste treatment and collection,
- To set roles and responsibility among the stakeholders, related ministries, Baghdad Mayoralty, municipalities' directorates in the governorates and whoever handles waste treatment and manages

the disposal facility.

3.2.3 Law on Environmental Protection and Improvement

(1) Law No. 37 of 2008 on the Establishment of Ministry of Environment

This law addresses the establishment of Ministry of Environment (MOE) and its responsibility on the protection of natural environment, ecosystem, and natural heritage. According to Article 8, MOE is involved in project site selection, and identification of environmental limitation. MOE issues licenses to EIA consultants and environment analysis institutions in accordance with Article 22.

(2) Law No.27 of 2009 on Environmental Protection and Improvement

This law addresses the following major regulations:

- An establishment of the Environmental Protection Council / Office which inspects and monitors the implementation of environmental protection nationwide
- Project proponent obligation of conducting EIA for projects that may cause impact on the environment; The EIA shall cover the following assessment:
    - Estimation of the positive and negative impacts of the project on the surrounding environment
    - Mitigation measures to avoid and treat the causes of the pollution to comply with national and regional regulations
    - Estimation of incidental and probable incident cases of pollution and their precautionary measures to avoid them
    - Possible alternatives to utilize technology with lower environmental burden and more energy saving
    - Consideration of 3R (Reduce, Reuse and Recycle) approach to solid wastes
- Pollution control for air, soil, ecological system, and hazardous waste management.

The law also regulates that the proponents who prepare development plans and implement projects with the possibility of environmental impact shall prepare EIA. The law is applied to the EIA of projects for social infrastructures development.

(3) Regulation No. 2 of 2001 on Water Resources Conservation

This regulation prescribes the regulations of general water utilization including conservation of water sources, and the regulations of water resource development. The law states that a license required for drainage into public water bodies should be obtained from the Environmental Protection and Implementation Authority (EPIA), which is a part of MOE. The law states that the license is only valid for one year and must be renewed on an annual basis. The EPIA should respond to an application for a license within 30 days. If the EPIA fails to respond to an application or rejects the application, then the applicant has 15 days to appeal; the appeal should be placed with the head of the department. The department can cancel or revoke a license under the following conditions:

- If the effluent or waste damages the environment or threatens the public health.
- If the terms of the license are violated, or if the license is used for any purpose other than those stated in the license.

This regulation defines that individual and corporate bodies that discharge effluent to public water bodies have to adopt the best available facility for filtering the effluent and provide a report of their operation activities to the EPIA.

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

This law prescribes the regulations relating to water discharge to public water areas and sewerage systems and includes national standards for water quality and drainage. Article 7 prohibits the discharge of polluted wastewater to public water areas. Articles 8 and 9 state the conservation mechanism of water pollution to be caused by the discharge of polluted wastewater. Article 10 prohibits open dumping of solid and liquid waste such as carcasses of animals, dung, and rotten materials to public water areas.

The law states that in Iraq, all the rivers, lakes, ponds, marshes, swamps and groundwater are public water bodies. No one can dump or drain anything into these water bodies without a license from the MOH (Ministry of Health). To obtain a license, a person concerned must apply to the MOH along with an application attached with two maps showing the area where the project proponent plans to dump or get permission for drainage to enter the water. MOH should respond to the application within 60 days. MOH has the authority to approve or reject the application and specify exactly the type of the effluent and its discharge amount which can be discharged into the public water bodies.

MOH has a right to reject a license when the effluent discharge generates in a sensitive area where aquatic life inhabits, or its water is used for swimming or drinking purposes. MOH also has a right to enforce these rules and to confirm that individual and corporate bodies are adhering to the rules. MOH sets the following conditions for granting the license for discharging such effluent:

- The concentration of the effluent shall not exceed the allowable level of the national standards,
- The effluent shall not contain hydrogen sulfates, other toxic substances, or any chemicals that may react with substances that already exist in the public water bodies,
- The effluent shall not exceed temperatures that would affect the public water bodies, and
- The effluent shall not violate any other conditions imposed by MOH.

(5) Law No. 12 of 1995 on the Management of Agricultural Water and Drainage Channel

This law defines responsibility structure for operation and management of irrigation canals and drainage channels to provide agricultural water and prevent high concentration of effluents. Revised article 5 states that Irrigation Department, Ministry of Water Resources and irrigation department of each directorate takes charge of management of rivers, canals, and drainage channels for agricultural water, and Article 6 states that farm owners have responsibility for management of canals and drainage channels on their land.

(6) Regulation No. 471 of 2012 on the Preservation of Air Quality

This law defines that responsibility for preserving and improving air quality is on MOE. According to the law, MOE establishes monitoring program for air quality nationwide, records the results, and evaluates emission status from certain sources. However, Iraqi standards for air quality have not yet been established.

(7) Laws on Preservation of Ecosystem

1) Law No. 30 of 2009 on Forests and Nurseries

This law is a federal law which aims to prevent logging in order to protect canals and springs. It attempts to create a balance between protecting the environment and green spaces on one hand, and it also aims to conserve water resources. Article 9 states that tree cutting by private sector is prohibited unless it has technical necessity or in return of a fair compensation.

2) Law No. 1 of 2010 on Wild Animals and Birds

This law aims to promote Iraq's wildlife protection. While this law provides a rough outline of hunting procedures, it does not address the issue of wildlife trade within the country and between neighboring states.

3.2.4 Laws on Social Environment

(1) Law No. 12 of 1981 on Land Acquisition

The law prescribes a property acquisition and relevant specified rights of project proponents to implement a development project. Article 1 sets the rules and basic requirements for fair compensation for possessing properties without prejudices. The law applies to all properties, including agricultural, non-agricultural lands and orchards stipulated by another law, and expropriating these ownerships or cancelling these disposal rights (Article 2).

The law regulates the following three types of acquisition:

- agreement acquisition in which directorates, social and joint sectors having the right to possess property can agree with the property owner or the landowner to possess the property by an agreement either in kind or in cash depending on the price estimated by the commission established pursuant to this law (Article 4 - 8)
- juridical acquisition in which government departments, social and common sectors of having the right to legally possess a property can request to possess any property (Article 9 - 21)
- administrative acquisition in which the property shall be possessed administratively, and the compensation is determined by the parties' agreement if the property or the real estate right requested for acquisition is owned by government departments or the social or common sectors (Article 22 - 28)

The law also regulates three methods of compensation, namely, real compensation, cash compensation and property compensation. The real compensation is made to the property owner for the land or orchard at the same value of the Administrative Unit of the land or orchard requested for acquisition if the property requested for acquisition is land or an orchard (article 29 - 30). The cash compensation is executed when the value of the land is estimated by dunum (unit of measurement) and with the prices by referring to the selling procedures of the Land Registry Office (article 31 - 32). The property compensation is executed when the values of residential, industrial, commercial properties and land for constructing buildings are estimated according to the prevailing prices during inspection and estimation of their value after implementing the project (article 33 - 36). This law does not include consideration of alternative sites for deployment of public land.

(2) Law No. 117 of 1970 on Development of Farmland

This law defines the maximum extent of rentable or acquirable farmland, and states that the extent varies depending on the condition of rain, irrigation, and richness of the land. Section 2 defines the maximum extent of farmers rent, and other articles address agricultural cooperation and organization. Article 9 states that an agricultural committee can acquire farmland in case the land is needed for public benefit.

(3) Law No. 55 of 2002 on Historical and Heritage Sites

This law addresses all movable and immovable antiquities and archaeological properties in Iraq. It regulates that communication channels between the public and the authorities for each type of contact between the public and the discovered and undiscovered archaeological sites should be established. Regulations governing contact with archaeological sites extend also to encompass developmental activities such as road construction and rehabilitation wherever these developmental activities lie within archaeological or heritage vicinity.

(4) International Agreements on Gender Equality

International agreements regarding gender equality which Iraq is a member are as follows.

Table 3-3 International Agreements on Gender Equality

International agreement	Adaptation	Entry into force	Status	Year
The Convention on the Elimination of All Forms of Discrimination against Women (CEDAW)	14 May 1954	7 August 1956	Ratification	14 May 1954
The SDGs, including Goal 3 on gender equality	18 September 2000	18 September 2000		
The Declaration on Elimination of Violence Against Women	18 December 1979	18 December 1979	Accession	13 Aug 1986

Source: Profile on Environmental and Social Considerations in Iraq, (2011), JICA

In Iraq, before the Gulf War, it is said that the rights of women were legally and practically better protected compared with other Arab countries. However, after the war, it is considered that women's conditions (e.g. livelihood, social position, and domestic and social violence) became worse because Hussein's regime utilized the Islamic and Tribal culture as the tool for governing people and the economic condition declined due to the economic sanctions. As a result, recently, the preparation of domestic violence bill has been processed both in the Iraqi Federal Government and the Kurdistan Regional Government. In Iraq, State Ministry of Women's Affairs is responsible for gender equality. The prime minister of Kurdistan Regional Government declared the elimination of the violence against women and FGM in November 2010 and Ministry of Culture and Youth are considering preparing the law to assure the gender equality in terms of art and culture.

3.2.5 Environmental Standards

(1) Water Quality Environmental Standards

Based on the law No. 25 of 1967, Notification No. 80406 of 1980 defines water quality standards for public water bodies. These values are shown in Table 3-4 together with the standards of Japan and WHO "Guidelines for Drinking-Water Quality", as references. The Iraqi standards include environmental items such as BOD and COD, with differences by type of water bodies (BOD5 and Phosphate).

Table 3-4 Iraqi Water Quality Environmental Standards

No.	Parameter	Unit	Iraq				Japan	WHO
			River	Irrigation canal	Lake, pond	Spring, well, groundwater	Environmental Standards etc.	Guidelines for Drinking-Water Quality
1	Color	—	Normal	Normal	Normal	Normal	—	No health guideline
2	Suspended Solid (SS)	mg/L	—	—	—	—	25 (Natural environment of river)	—
3	pH	—	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5 (Natural environment of river)	No health guideline
4	Dissolved Oxygen (DO)	mg/L	> 5.0	> 5.0	> 5.0	> 5.0	≥7.5 (Natural environment of river)	No health guideline
5	BOD_5	mg/L	< 3.0	< 3.0	0.02	< 3.0	<1.0 (Natural environment of river)	—
6	COD (Cr_2O_7 method)	mg/L	—	—	Trace	—	≤8 (Preservation of ocean environment)	—
7	Cyanide (CN^-)	mg/L	0.02	0.02	0.02	0.02	Not measurable (as total Cyanide)	No health guideline
8	Fluoride (F^-)	mg/L	2.0*	2.0*	2.0*	2.0*	0.8	1.5
9	Free Chlorine	mg/L	Trace	Trace	Trace	Trace	—	5 For effective disinfection, there should be a residual concentration of free chlorine of ≥ 0.5 mg/l after at least 30 min contact time at pH < 8.0.
10	Chloride (Cl^-)	mg/L	200*	200*	200*	200*	200 (Water Supply Act)	No health guideline
11	Phenol	mg/L	0.005	0.005	0.005	0.005	0.005 (Water Supply Act)	—
12	Sulphate (SO_4^{2-})	mg/L	200	200	200	200	—	No health guideline
13	Nitrate (NO_3^-)	mg/L	15	15	15	15	10 (as NO_3-N and NO_2-N)	50 (Short time exposure)
14	Phosphate (PO_4^-)	mg/L	0.4	0.1	0.4	0.4	—	—
15	Ammonium (NH_4^+)	mg/L	1.0	1.0	1.0	1.0	—	No health guideline
16	DDT	mg/L	Nil	Nil	nil	nil	—	0.001
17	Lead	mg/L	0.05	0.05	0.05	0.05	0.01	0.01
18	Arsenic	mg/L	0.05	0.05	0.05	0.05	0.01	0.01
19	Copper	mg/L	0.05	0.05	0.05	0.05	1.0 (Water Supply Act)	2

No.	Parameter	Unit	Iraq				Japan	WHO
			River	Irrigation canal	Lake, pond	Spring, well, groundwater	Environmental Standards etc.	Guidelines for Drinking-Water Quality
20	Nickel	mg/L	0.05	0.05	0.05	0.05	0.01 (Target value of Water Supply Act)	0.07
21	Selenium	mg/L	0.01	0.01	0.01	0.01	0.01	0.04
22	Mercury	mg/L	0.001	0.001	0.001	0.001	0.0005 (as total mercury)	0.006
23	Cadmium	mg/L	0.005	0.005	0.005	0.005	0.03	0.003
24	Zinc	mg/L	0.5	0.5	0.5	0.5	1.0 (Water Supply Act)	No health guideline
25	Chromium	mg/L	0.05	0.05	0.05	0.05	0.05 (as chromium hexavalent)	0.05
26	Aluminum	mg/L	0.1	0.1	0.1	0.1	0.2 (Water Supply Act)	A health-based value of 0.9 mg/l could be derived, but this value exceeds practicable levels based on optimization of the coagulation process in drinking-water plants using aluminum-based coagulants: 0.1 mg/l or less in large water treatment facilities and 0.2 mg/l or less in small facilities
27	Barium	mg/L	1.0	1.0	1.0	1.0	—	0.7
28	Boron	mg/L	1.0	1.0	1.0	1.0	1.0	2.4

Source: JST

(2) Effluent Standards Discharged into Public Water Bodies

Notification No. 80406 of 1980 based on law No. 25 of 1967 defines standards of effluent discharged into public water body and sewerage system, shown in Table 3-5, with Japanese standards for discharge to public water body as a reference.

Table 3-5 Effluent Standards (Iraq and Japan)

No.	Parameter	Unit	Iraq		Japan
			Discharge to public water body	Discharge to sewerage system	Discharge to public water body
1	Temperature	deg C	< 35.0	45	―
2	Suspended Solid (SS)	mg/L	60.0	750	200 (Average 150/day)
3	pH	―	6.0 - 9.5	6.0 - 9.5	5.8 – 8.6 (other water bodies) 5.0-9.0 (sea)
4	BOD_5	mg/L	< 40.0	<1000	160 (Average 120/day)
5	COD (Cr_2O_7 method)	mg/L	< 100.0	-	160 (Average 120/day)
6	Cyanide (CN^-)	mg/L	0.05	0.5	1.0
7	Fluoride (F^-)	mg/L	5.0	10	8 (other water bodies) 15 (sea)
8	Free Chlorine	mg/L	Trace	100	―
9	Chloride (Cl^-)	mg/L	Cf. *1	―	―
10	Phenol	mg/L	0.01 – 0.05	0.5	5.0
11	Sulphate (SO_4^{2-})	mg/L	Cf. *2	―	―
12	Nitrate (NO_3^-)	mg/L	50	―	100 Cf. *3
13	Phosphate (PO_4^-)	mg/L	3.0	―	―
14	DDT	mg/L	nil	―	―
15	Lead	mg/L	0.1	0.1	0.1
16	Arsenic	mg/L	0.05	0.2	0.1
17	Copper	mg/L	0.2	―	3.0
18	Nickel	mg/L	0.05	0.1	―
19	Selenium	mg/L	0.005	―	0.1
20	Mercury	mg/L	0.001	―	0.005 (as total mercury)
21	Cadmium	mg/L	0.2	0.1	0.03
22	Zinc	mg/L	0.1	0.1	2.0
23	Chromium	mg/L	5.0	0.1	2.0
24	Aluminum	mg/L	20	40	―
25	Barium	mg/L	0.1	1.0	―
26	Boron	mg/L	―	1.0	10 (other water bodies) 230 (sea)

Notes:

1) Chlorine ion, Cl-: a) The concentration in the source is allowed to be increased by 1% before discharging for the case that the ratio of the amount of the discharged water to the amount of the water of the source is less than 1:1,000, b) The concentration in the discharged water shall not exceed 600 mg/L for the case that the ratio of the amount of the discharged water to the amount of the water of the source is equal to or more than 1:1,000, c) If the concentration in the source is less than 200 mg/L, then the evaluation depends on the case.

2) Sulfide ion, SO_4^{2-}: a) The concentration in the source is allowed to be increased by 1 % before discharging for the case that the ratio of the amount of the discharged water to the amount of the water of the source is less than 1:1,000, b) The concentration in the discharged water shall not exceed 400 mg/L for the case that the ration of the amount of the discharged water to the amount of the water of the source is equal to or more than 1:1,000, c) If the concentration in the source is less than 200 mg/L, then the evaluation depends on the case.

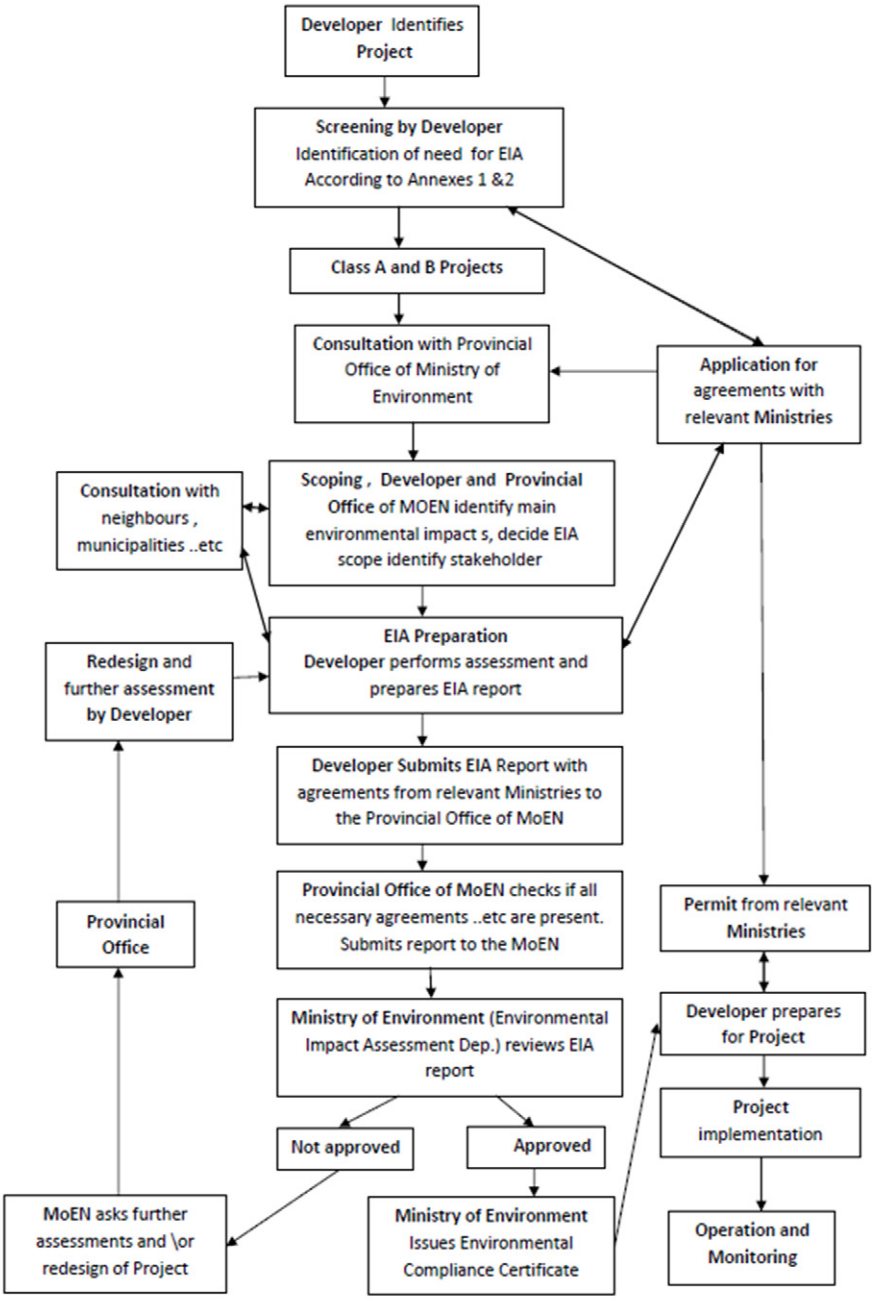
3) As ammonium, ammonium compounds, nitrites and nitrates

Source: JST

3.2.6 EIA System (Process of Environmental Clearance)

3.2.6.1 Federal Government

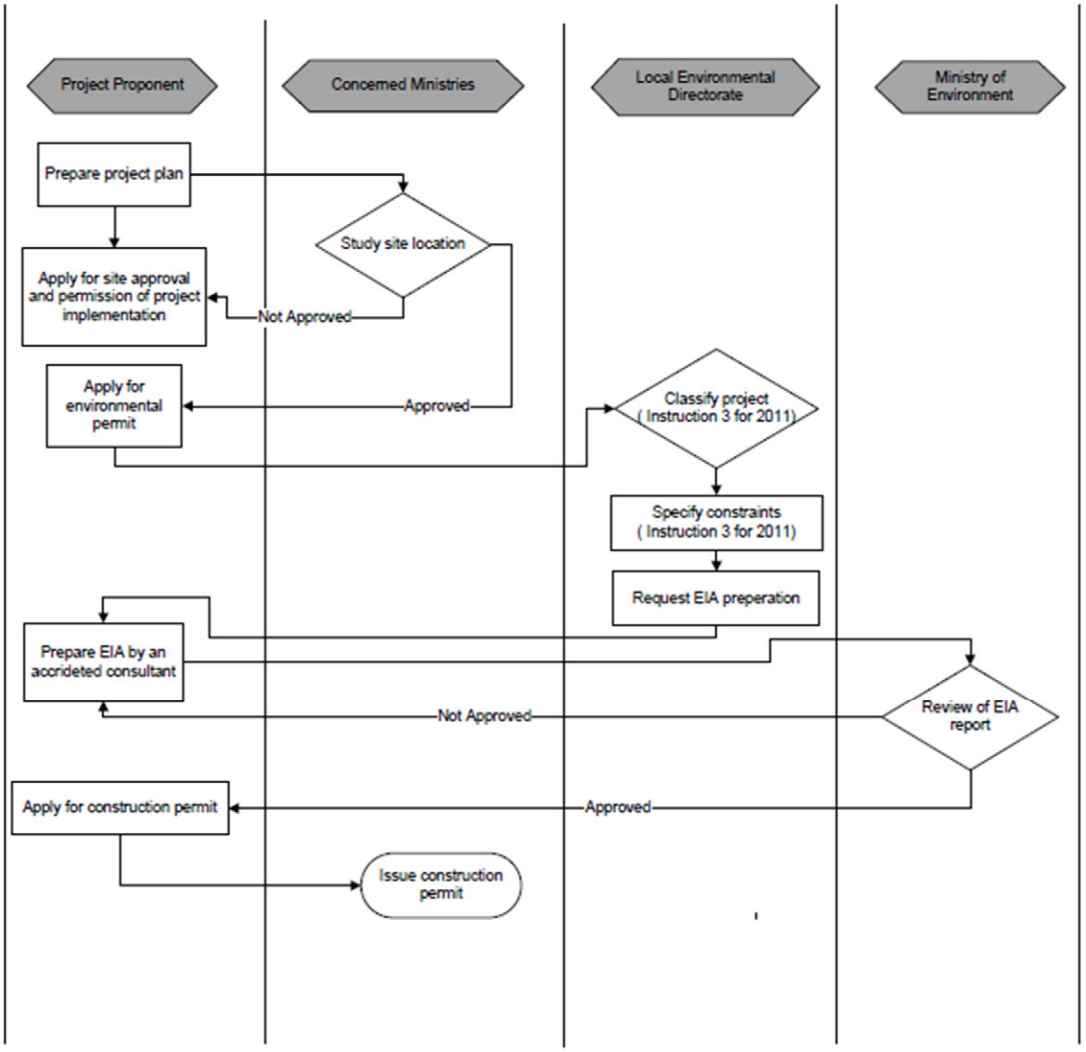
Definitions of project classification for EIA system are already mentioned in 3.2.2.1, Instruction No. 3 for the year 2011. According to this law, there are categories A, B and C depending on the degree of impact of project execution on the environment. EIA process for category-A/B projects in Iraq (Federal government) is shown in Fig. 3-3, EIA process for category-C projects in Iraq (Federal government) is shown in Fig. 3-4.



Source: UNECE

Fig. 3-3 Federal Government EIA Process Category-A/B[7]

[7] https://unece.org/fileadmin/DAM/env/eia/documents/WG14_MOS3_nov2010/Diagram_EIA_process_in_Iraq.pdf, November 2021 accessed

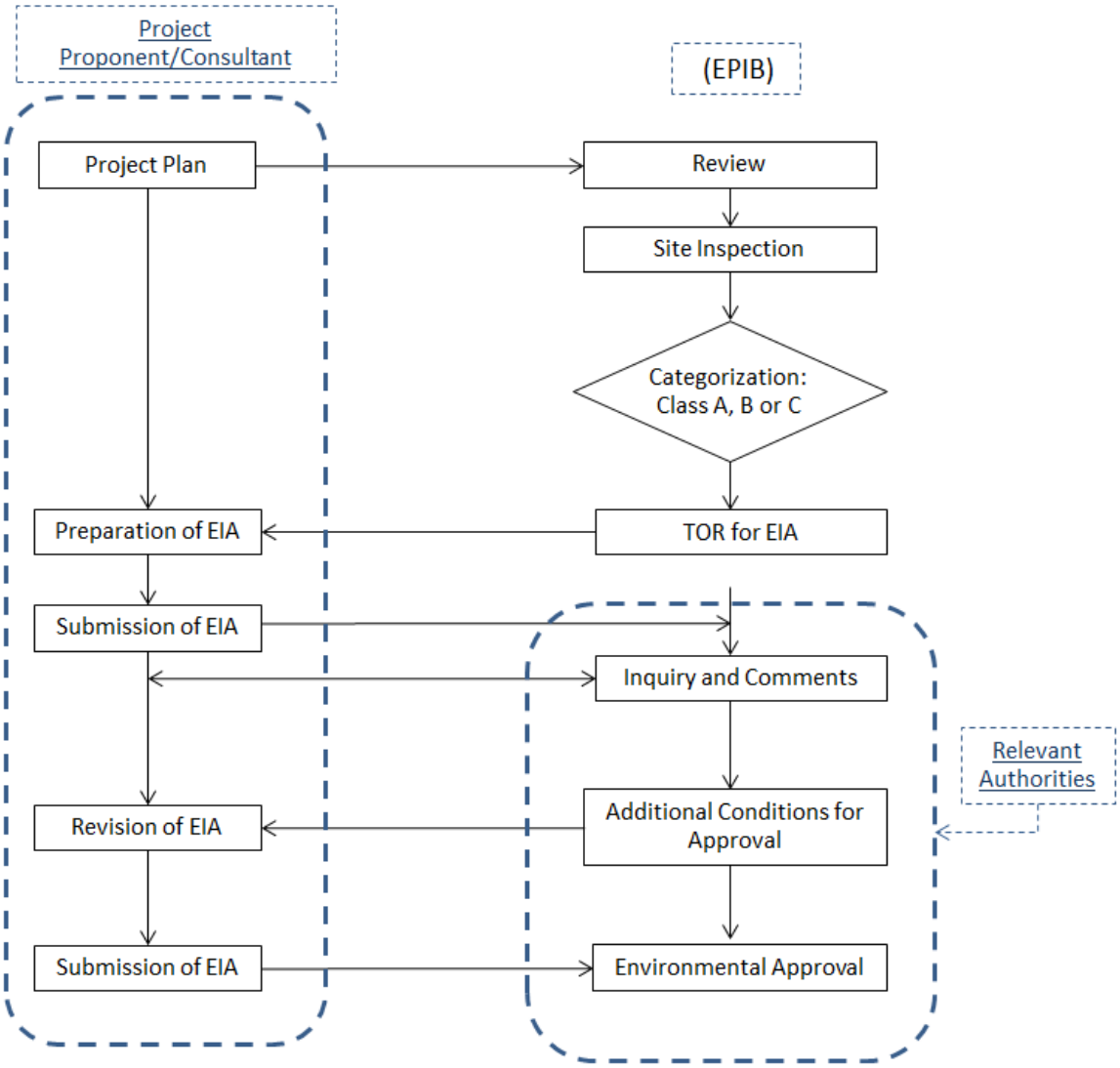


Source: Data Collection Survey for the Water Supply and Sewerage System Development Plan in Southern Iraq (JICA, 2016)

Fig. 3-4 Federal Government (Muthanna Environmental Directorate (MED)) EIA Process Category-C

3.2.6.2 Kurdistan Region

The EIA process (Figure below) starts with planning the project and preparing the EIA by the consultant. Project planning involves the review of the project components, the baseline environmental conditions and the existing environmental laws and regulations. According to Instructions 1/2013, the project is classified into Class A, B, or C and accordingly the EIA is prepared and submitted to EPIB (Environment Protection and Improvement Board) which reviews and gives it comments and inquiries. The EIA is revised and resubmitted to the EPIB which issues its final environmental approval. The EPIB does not define a time limit required from the initial application to the final approval process.



Source: Answers of the JST questionnaire

Fig. 3-5 Kurdistan Regional Government EIA Process

3.3 Roles and Responsibility of the Related Organizations and Stakeholders

3.3.1 Related Government Organization

(1) Federal Government

There are some organizations related to waste management in Iraq except for Kurdistan Region, namely Ministry of Construction, Housing and Municipalities and Public works (hereinafter referred to as MCHMPW), Ministry of Health and Environment (hereinafter referred to as MOHE), Ministry of Science and Technology (hereinafter referred to as MOST), as well as the governorates, etc.

Regarding municipal solid waste, MCHMPW is responsible for overall policy of SWM, and the governorates are responsible for the allocations of budget and management of SWM activities performed by municipalities. Municipalities are responsible for collection, transportation, and final disposal. Table 3-6 shows the roles among the related government organizations from the operation viewpoint. In addition, Ministry of Electricity is responsible to identify the tariff for WtE project. The Ministry of Planning is responsible for overall budget allocation for each ministry and governorate.

Table 3-6 Role on SWM among the Related Government Organizations

Waste	Law / Regulation	Collection and Transportation	Intermediate treatment	Final disposal	Supervision
General waste (Municipal waste)	MCHMPW	Municipal institutions			Governorate
Construction waste					
Agricultural waste					
Industrial waste	Ministry of Industry				
Medical waste	Ministry of Health and Environment (MOHE) Ministry of Science and Technology (MOST)				Governorate, MOHE, MOST
Hazardous waste					
E-waste					

Source: Answers of the JST questionnaire

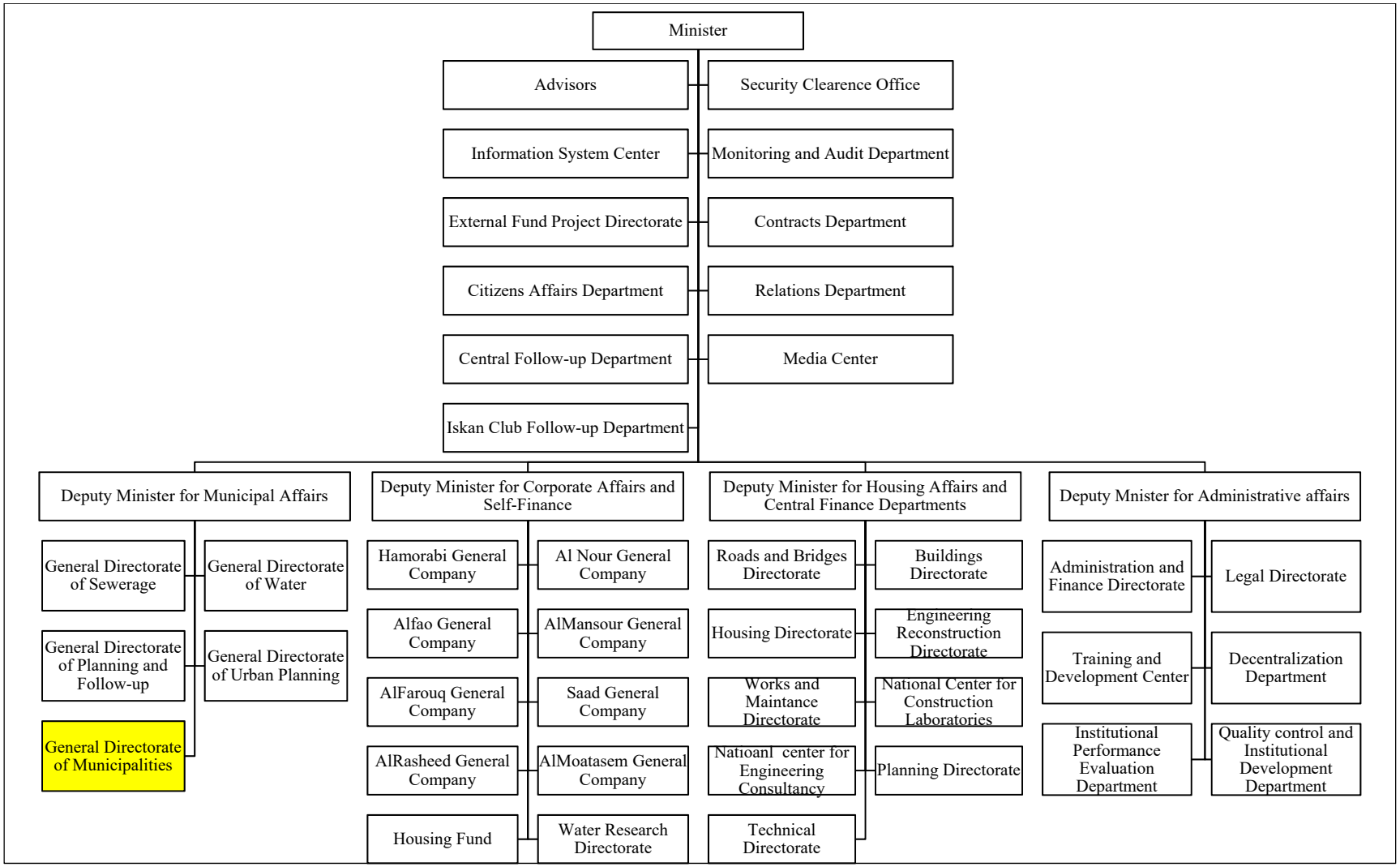
The table below shows the main stakeholders and their respective responsibilities.

Table 3-7 Responsibility of the Main Organizations for SWM in the Federal Government

Stakeholder	Directorate	Responsibility
Federal Government (MCHMPW)	General Directorate of Municipalities	• General Policies and Plans • Laws, Regulations, Standards, Fees, Fines and indicators • Treatment and similar type of projects and their specifications • Strategic projects such as Sanitary Landfills and Intermediate Treatment facilities
Governorates	Directorate of Municipalities	▪ Financing and implementation
Municipality		▪ Database ▪ Collection of wastes ▪ Operation of facilities

Source: Answers of the JST questionnaire

Organization structure of MCHMPW is shown in Fig. 3-6. General directorate of municipalities under MCHMPW is the responsible directorate for SWM.



Source: Answer of the JST questionnaire (MCHMPW)

Fig. 3-6 Organization Structure of MCHMPW

(2) Kurdistan Region

There are some organizations related to waste management in Kurdistan Region as shown in Table 3-8, namely Board of Environmental Protection, Ministry of Municipalities and Tourism (MOMT), Ministry of Natural Resources (MNR), Ministry of Health (MOH), etc..

Table 3-8 Role on SWM among the Related Government Organizations

Waste	Law / Regulation	Collection and Transportation	Intermediate treatment	Final disposal	Supervision
General waste (Municipal waste)	Board of Environmental Protection	MOMT			
Construction waste					
Industrial waste	MNR	Contractors of MNR	NA	Contractors of MNR	MOMT
Medical waste	MOH				
Hazardous waste	MNR				

Source: Answer of the JST questionnaire (MOMT)

The main stakeholders for SWM at the Kurdistan Region were identified to be Ministry of Municipalities and Tourism (MOMT) who are responsible to set the general policies and plans for the SWM projects. Table 3-9 shows the main stakeholders and their respective responsibilities.

Table 3-9 Responsibility of the Main Organizations for SWM in Kurdistan Region

Stakeholder	Directorate	Responsibility
KRG (MOMT)	Directorate of Services, Environment Protection and Solid Waste Treatment	• General Policies and Plans • Laws, Regulations, Standards, Fees, Fines and indicators • Treatment and similar type of projects and their specifications • Strategic projects such as Sanitary Landfills and Intermediate Treatment facilities
	Directorate of Municipalities	▪ Financing and implementation ▪ Database ▪ Collection of wastes ▪ Operation of facilities

Source: Answers of the JST questionnaire

3.3.2 Waste Generator

Residents' cooperation is indispensable for waste management, and especially the active involvement of women who are generally in charge of household chores is important.

3.4 Current Status of National Level SWM

3.4.1 Municipal Solid Waste Management Basic Data

Table 3-10 shows Major Indicators for Municipal services sector for the year 2019. The table shows Indicators for a total number of 265 municipal institutions in all governorates (excluding Kurdistan Region) for the year 2019.

Table 3-10 Major Indicators for Municipal Services Sector for the Year 2019

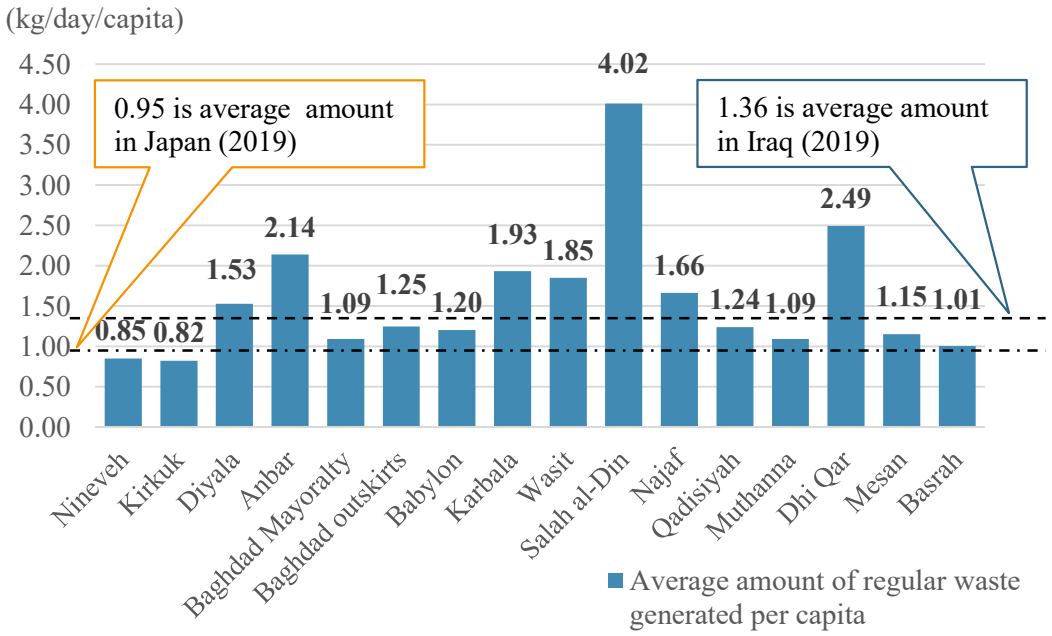
Indicator	Value
Number of Municipal Institutions	265
Percentage of population served by Waste Collection Service in Urban (%)	88.7

Indicator	Value
Percentage of population served by Waste Collection Service in Iraq (%)	63.6
Amount of collected waste (waste, rubble, scrap) (Million ton / year)	17.3
Amount of municipal waste collected (Million ton / year)	10.6
Amount of Rubble (residue of demolishing and construction) collected (Million ton / year)	5.9
Average generated waste per person (kg/cap/day)	1.36
Amount of Hazardous Waste collected (ton/year)	3,218.7
Percentage of regular waste from total waste collected (%)	61.1
Main method for regular waste disposal in governorates is through disposal in disposal facilities which do not have Environmental Approvals (%)	87.5
Number of Disposal facilities with Environmental Approval	67
Number of Disposal facilities without Environmental Approval	157

*Exclude Kurdistan Region
*Urban: It means the areas (neighborhoods) located within the boundaries of the municipalities or within the boundaries of Baghdad Mayoralty. It includes the population (males, females) living in these areas
*Rural: means the areas outside the boundaries of the municipalities or outside the boundaries of Baghdad Mayoralty. The population includes (males, females) who live in these areas
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

3.4.2 Waste Generation and Composition

Fig. 3-7 shows the Average amount of municipal waste generated per capita in 2019. The unit generation rate in Iraq (excluding Kurdistan Region) is 1.36 kg/capita/day in 2019. The unit generation rate is calculated by dividing the waste collection amount by the population served by waste collection service.



*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector (2019), CSO
Recyclable Solid waste materials Management in Erbil (2019)
Waste management in Japan (edition of 2019)

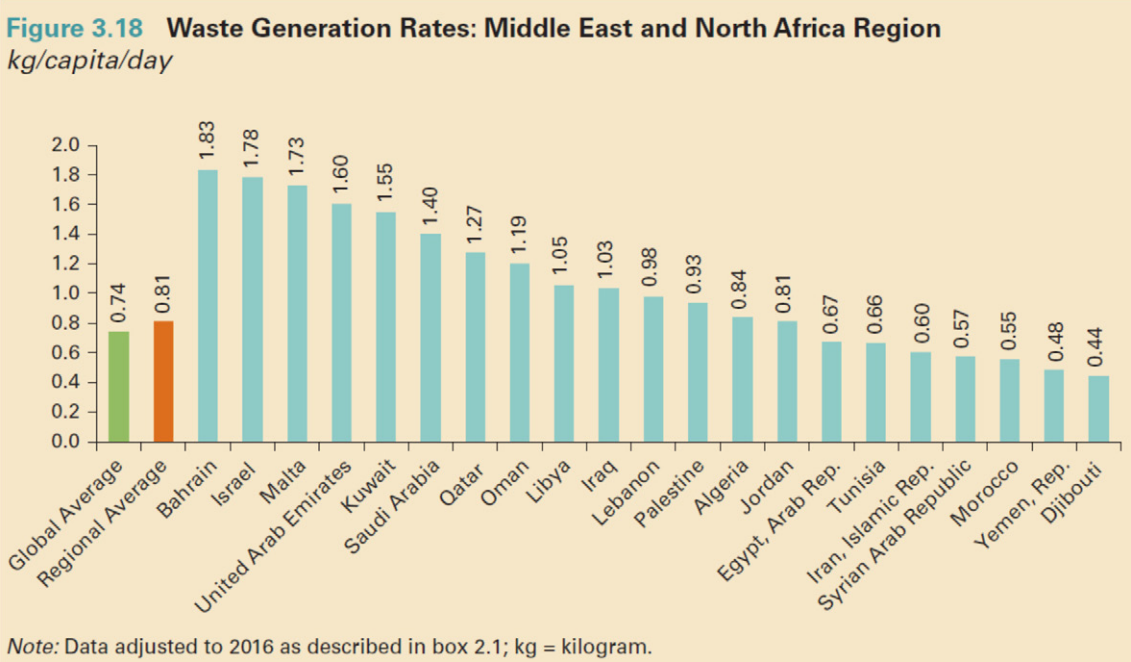
Fig. 3-7 Average Amount of Municipal Waste Generated per Capita

The unit generation rates in Anbar and Salah al-Din provinces are higher than those in other provinces. The Data Book explains that both provinces implemented waste collection campaigns and also collected a large amount of MSW accumulated during the civil war, which resulted in extremely high waste generation. The Data Book further explains that Dhi Qar, Wasit and Diyala governorates collect waste

from agricultural areas as well as from areas of informal housing, and that Karbala and Najaf governorates collect waste generated by the influx of large numbers of visitors to the holy shrines.

Comparing to other countries referred to in "What a Waste 2.0", the waste generation rate of Iraq is higher than the global average (0.75 kg/day/capita) and the regional average of Middle East and North Africa (0.81 kg/day/capita). Iraq's waste generation rate is comparable to that of other oil-producing countries but is also as high as that of developed countries (Japan: 0.95 kg/person, US: 2.25 kg, UK: 1.33 kg, Italy: 1.34 kg Canada: 1.94 kg, Germany: 1.72 kg, France: 1.38 kg).

What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050 (World Bank, 2018)



3.4.3 Waste Collection and Transportation

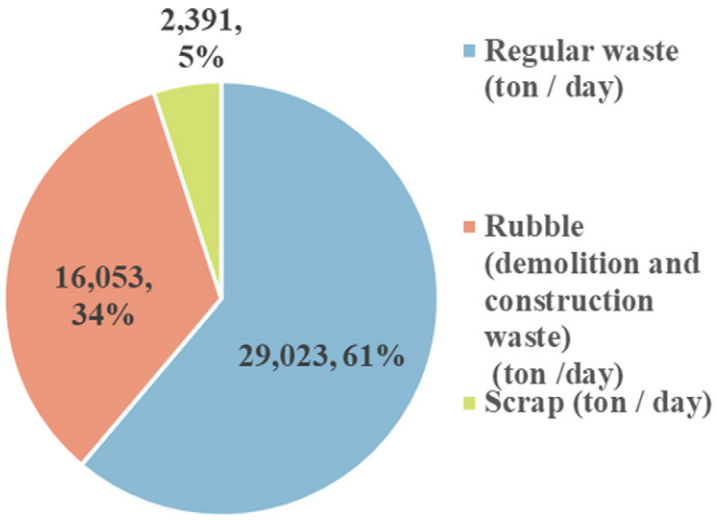
(1) Waste Collection for Municipal (Regular) Waste/ Rubble/ Scrap

There are three types of solid waste collected and defined in the CSO's environmental report (terms in brackets are the usual SWM terminology) as Regular (Municipal) waste, Rubble (construction and demolition waste) and Scrap (Metal scraps and junk that are recycled), in Iraq.

The Results of Table 3-11 show that the amounts of wastes collected in 2019 which include regular waste, rubble and scrap. As for amount of collected waste by all municipal institutions in Iraq (excluding Kurdistan Region), total amount of wastes was about 47,468 thousand ton/day, and separate amounts of each of Regular waste, Rubble waste and Scarp waste were 29,023 ton/day, 16,053 ton/day, and 2,391 ton/day respectively in 2019.

As for the amount of Scrap, the General Secretariat for the Council of Ministers instructions stated below were noted:

- Scrap shall be segregated from the rest of wastes and shall be collected in designated areas set by MCHMPW and to be far from the disposal facilities.
- No scrap is allowed to enter the disposal facilities and the board of governorate shall be responsible for scrap transportation to designated areas and to inform the Ministry of Industries and Minerals to lift it as per the responsibility notified to it.



*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Fig. 3-8 Amount of Solid Waste Collected by Type (Municipal (Regular) Waste/ Rubble/ Scrap) for 2019

Table 3-11 Amount of Waste Collected by Governorate for the Year 2019

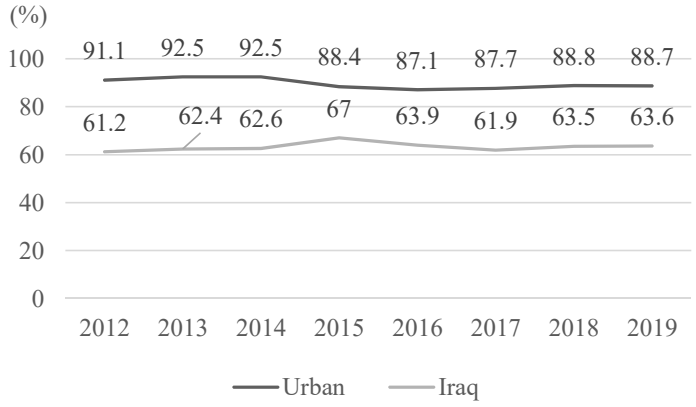
Governorate	No. of municipal institutions	Regular waste (ton / day)	Rubble (demolition and construction waste) (ton /day)	Scrap (ton / day)	Total amount of waste collected (ton / day)
Nineveh	31	1,737	602	0	2,339
Kirkuk	12	981	681	1	1,662
Diyala	22	1,122	738	1,611	3,472
Anbar	21	1,723	5,221	386	7,329
Baghdad Mayoralty	15	6,382	501	0	6,884
Baghdad outskirts	16	1,191	305	28	1,524
Babylon	16	1,121	402	5	1,528
Karbala	7	1,769	1,317	36	3,122
Wasit	19	1,466	855	85	2,406
Salah al-Din	18	1,925	2,229	10	4,165
Najaf	10	1,679	1,535	4	3,218
Qadisiyah	15	718	410	5	1,134
Muthanna	12	422	140	0	563
Dhi Qar	20	3,138	190	1	3,329
Mesan	15	1,058	179	70	1,307
Basrah	16	2,590	749	148	3,487
waste collected by type	265	29,023	16,053	2,391	47,468

*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

(2) Waste Collection and Transportation for Regular (Municipal) Solid Waste

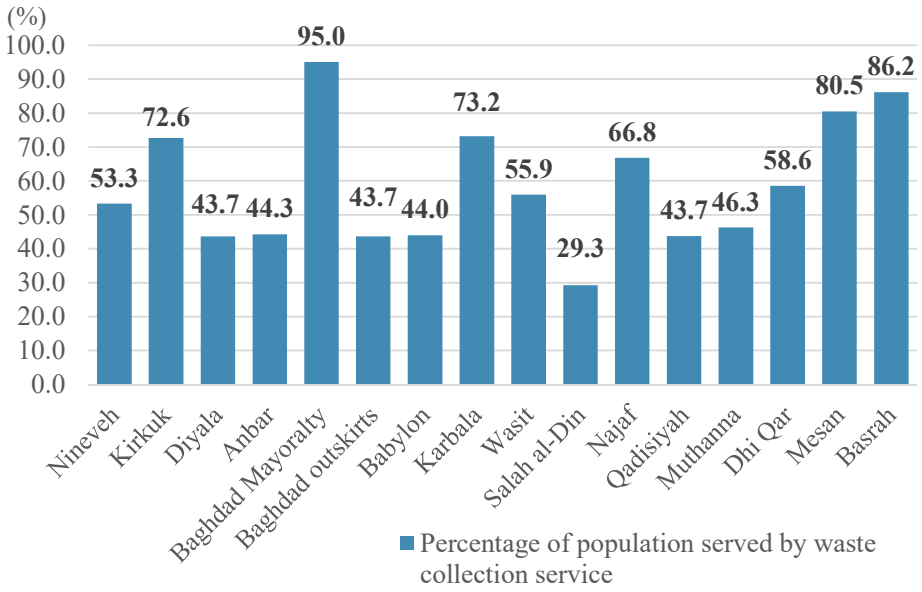
Fig. 3-9 shows the change in the percentage of population served by regular waste collection service. The figure shows that the percentage of population served with solid waste collection service in Iraq was 63.6% where the percentage was 88.7% in urban areas in 2019. In addition, percentage of population

served by waste collection service per governorate is shown in Fig. 3-10. Fig. 3-11 shows the annual amount of regular (municipal) waste discharged by governorate excluding Kurdistan Region. Detailed data of the waste collection is summarized in Table 3-12. The Amount of municipal waste collected excluding Kurdistan Region in 2019 was 29,023 ton/day of which the highest amount was recorded in Baghdad Mayoralty to be 6,382 ton/day.



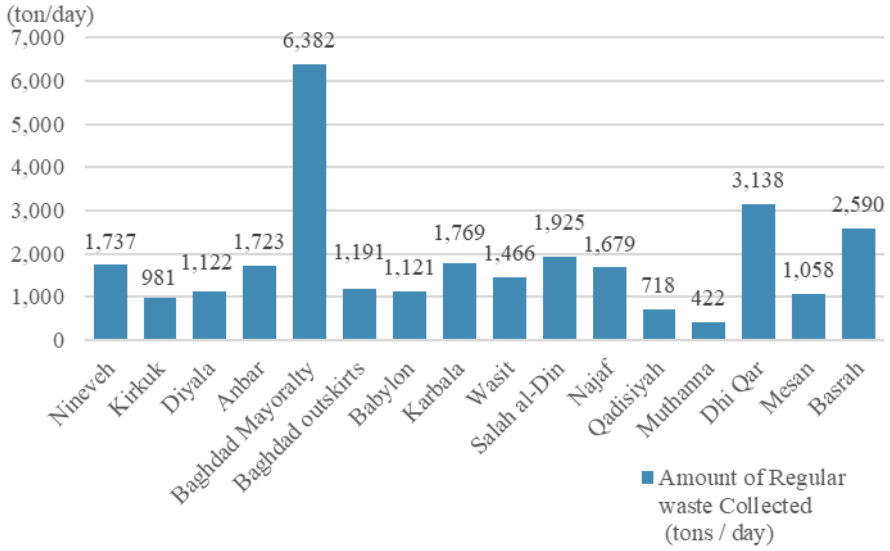
*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Fig. 3-9 Percentage of Population Served by Waste Collection Service



*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Fig. 3-10 Percentage of Population Served by Waste Collection Service per Governorate



*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Fig. 3-11 Amount of Municipal (Regular) Waste Collected by Municipal Institutions by Governorate

Table 3-12 Population and Amount of Municipal Solid Waste Collected by Governorate for the Year 2019

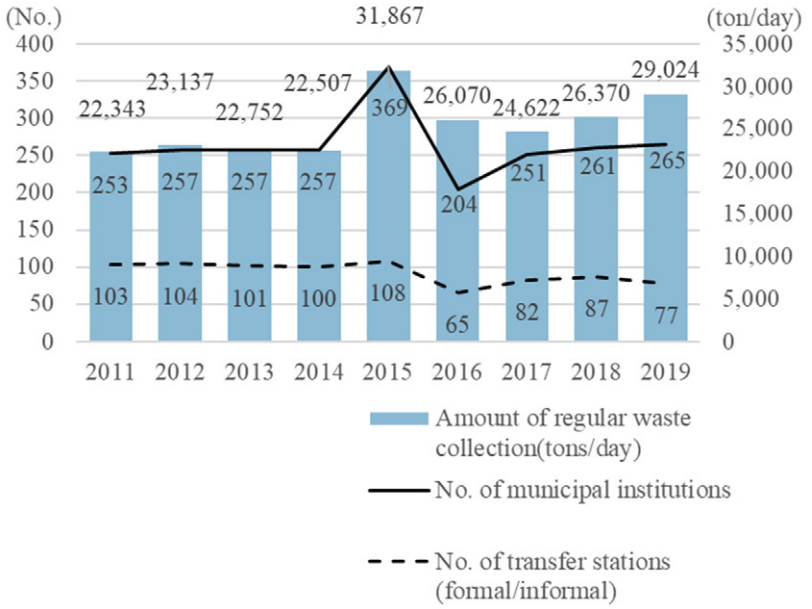
Governorate	Percentage of Population served by the waste collection service	Population served by the waste collection service	Total Population	Amount of Regular waste collected (ton / year)	Amount of Regular waste Collected (ton / day)
Nineveh	53.3	2,041,945	3,828,197	634,014	1,737
Kirkuk	72.6	1,190,777	1,639,953	357,909	981
Diyala	43.7	733,607	1,680,328	409,561	1,122
Anbar	44.3	804,896	1,818,318	628,825	1,723
Baghdad Mayoralty	95.0	5,843,287	6,150,828	2,329,578	6,382
Baghdad outskirts	43.7	956,191	2,189,883	434,650	1,191
Babylon	44.0	931,918	2,119,403	409,331	1,121
Karbala	73.2	915,260	1,250,806	645,735	1,769
Wasit	55.9	791,684	1,415,034	535,270	1,466
Salah al-Din	29.3	479,540	1,637,232	702,769	1,925
Najaf	66.8	1,008,833	1,510,338	612,870	1,679
Qadisiyah	43.7	579,600	1,325,031	262,057	718
Muthanna	46.3	386,570	835,797	154,197	422
Dhi Qar	58.6	1,259,156	2,150,338	1,145,200	3,138
Mesan	80.5	919,599	1,141,966	386,175	1,058
Basrah	86.2	2,572,072	2,985,073	945,436	2,590
Total	63.6	21,414,935	33,678,525	10,593,577	29,023

*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

(3) Transfer Station and Disposal Facility

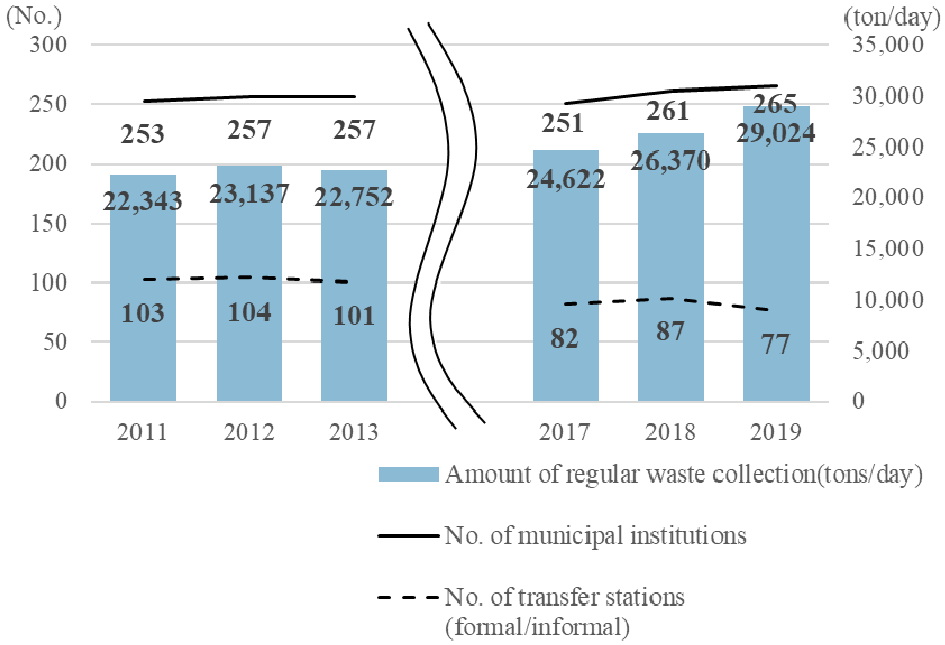
The Summary of situation on municipal waste management in Iraq excluding Kurdistan Region Indicators for the period of 2011 to 2019 is shown in Fig. 3-12. Since data collection was not carried out in all local governorates from 2014 to 2016, it is not possible to simply compare by year. Therefore, the

data excluding 2014 to 2016 are described below for reference. The amount of regular waste collected is increasing year by year. In addition, the number of transfer stations is decreasing, which is presumed to be due to the abolition of informal transfer stations.



*Exclude Kurdistan Region from 2011 to 2014, from 2016 to 2019
*Exclude Nineveh and Anbar governorates in 2014, 2015, 2016,
*Exclude Salah al-Din governorate in 2014
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

[Reference: Summary of Municipal Services Indicators for the Years in Iraq (Data from 2014 to 2016 were deleted)]



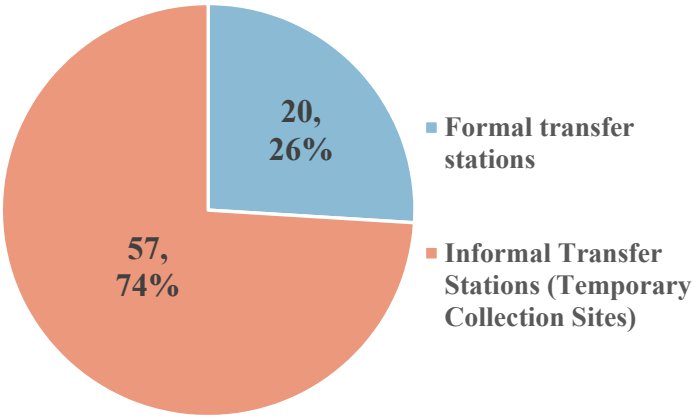
*Exclude Kurdistan Region from 2011 to 2014, from 2016 to 2019
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Fig. 3-12 Summary of Municipal Services Indicators for the Years in Iraq

Fig. 3-13 shows the number of transfer stations in Iraq excluding Kurdistan Region. The number of formal transfer stations was about one-fourth of the total transfer stations in 2019.

Definitions in the CSO's environmental report:
Formal Transfer Stations: These are intermediate solid waste collection places that have facilities to weigh the collected waste and compact it by mechanical equipment, then load the compacted waste into large-sized container trailers for transport to sanitary landfills.

Informal Transfer Stations: are open sites which serve as temporary collection sites where the waste is transported to by collection trucks and temporarily stored there until the waste is transported to disposal facilities, and which mostly do not satisfy the environmental requirements.



*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Fig. 3-13 Number of Transfer Stations

Table 3-13 shows that the number of formal transfer stations by governorate for the year 2019 reached 20 stations of which 17 stations had environmental approvals.

Table 3-13 Number of Transfer Stations by Governorate for the Year 2019

Governorate	Formal transfer stations	Informal Transfer Stations (Temporary Collection Sites)
Nineveh	1	0
Kirkuk	2	0
Diyala	0	6
Anbar	0	6
Baghdad Mayoralty	9	13
Baghdad outskirts	0	0
Babylon	1	5
Karbala	1	4
Wasit	0	0
Salah al-Din	0	1
Najaf	5	4
Qadisiyah	0	14
Muthanna	0	0
Dhi Qar	0	0
Mesan	0	2
Basrah	1	2
Total	20	57

*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

(4) Waste Collection and Transportation in Kurdistan Region

Collection coverage is considered good in the three governorates of the Kurdistan Region, as it ranges between 90-95% in the urban areas and it decreases in rural areas within a range of between 80-90%, while the collection does not include many villages in remote areas because of their remoteness.

3.4.4 Solid Waste Treatment (Intermediate treatment and final disposal)

There are six prevalent methods of disposing the collected solid wastes in practice in Iraq, namely (1) in environmentally approved disposal facilities, (2) environmentally unapproved disposal facilities, (3) open dumping sites, (4) facilities for recycling and reuse, (5) incineration, and (6) composting.

The numbers of governorates that were applying each method (Disposal Facilities) were surveyed in 2019 and Table 3-14 shows the result.

(1) Environmentally approved disposal facilities: 12 governorates reported operating them, representing 75% of the total governorates.

(2) Environmentally unapproved disposal facilities: 14 of the 16 governorates reported operating them, which accounted for 88% of the total governorates surveyed.

(3) Open dumping sites: 8 governorates, 50% of total governorates reported disposing of their wastes in open dumping sites.

(4) Recycle or reuse: The governorates of Baghdad Outskirts and Dhi Qar reported they are recycling or reusing.

(5) Incineration: Salah al- Din reported they are applying the incinerating method.

(6) Compost: Baghdad Mayoralty reported they are applying the composting method, although there are no related energy transfer or sales of the products. This information refers to the CSO's environmental report (2019) and in the JST survey (reported by the counterpart) of the present conditions such activities were not being implemented, as discussed in Chapter 4 (the survey for Baghdad Mayoralty in 2021 by JICA Study Team).

Definitions in CSO's environmental report:
Environmental Approval: It is the authorization provided to the project owner to start the project in accordance with applicable laws and regulations and Environmental regulations. For facilities with no Environmental approval, MCHMPW gives directions to them collaborating with relevant directorates and closes these facilities due to violations of environmental instructions.

Environmentally approved disposal facilities: These are the sites that provide cheap land and are among the least costly, most convenient, and most common methods of dumping solid waste in the world. Each site is split into cells where each cell is covered by soil after being filled with wastes and then a new cell is opened. The bed of the cell is covered by an impermeable layer and equipped with a pipe network to collect the leachate generated from the waste. There are two types of leachates:

- Rainwater that percolates from the surface through the waste layers to the bottom layer.
- Water formed due to aerobic and anaerobic biodegradation of the disposed wastes.

The waste is covered by thin layer of soil at the end of each day and when the cell is full it is covered by a thick layer of soil and disposal operation moves to a new location.

Disposal facilities that do not have environmental approval: are open yards or depressions in which waste is dumped in an irregular and uncontrolled manner and do not satisfy any environmental requirements.

Open dumping sites: These are yards or plots of land outside the municipality's borders used to store the collected waste and are not controlled or managed.

Table 3-14 Percentages of Governorates Hosting the Various Disposal Facilities by Type for the Year 2019

Regular waste disposal methods	Number of Governorates	Names of Governorates
(1) Environmentally approved disposal facilities	12	All governorates except Diyala, the outskirts of Baghdad, Karbala and Salah al-Din, Kurdistan Region
(2) Environmentally unapproved disposal facilities	14	All governorates except Babylon and Muthanna, Kurdistan Region
(3) Open dumping sites	8	Nineveh, Diyala, Anbar, the outskirts of Baghdad, Karbala, Salah al-Din, Najaf and Muthanna
(4) Recycle or reuse	2	The outskirts of Baghdad and Dhi Qar
(5) Incineration	1	Salah al-Din
(6) Compost	1	Baghdad Mayoralty
Converted into energy	0	NA
Sale	0	NA
Others	0	NA

*Exclude Kurdistan Region, "Number of Governorates" are not include the facilities which are still under construction.
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

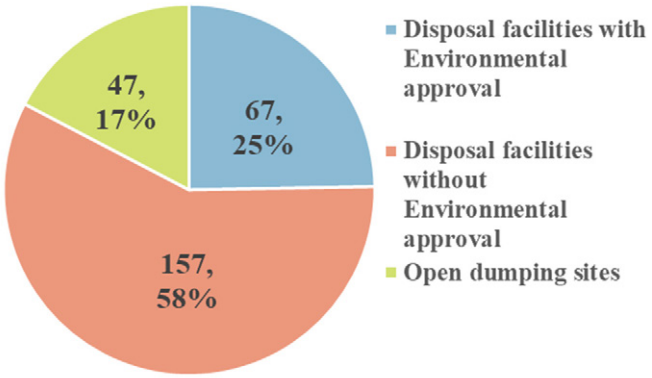
Number of waste sorting and recycling plants for the year 2019 is shown in Table 3-15. Currently, Baghdad outskirts governorate and Dhi Qar governorate have plants. In addition, 2 plants are under construction in Baghdad Mayoralty.

Table 3-15 Number of Waste Sorting and Recycling Plants for the Year 2019

Location	Governorate	Sorting from the amount of waste (%)	Recycled quantity (ton/day)	Number of working days (days/year)	Current operational status
A plant on the Karkh side, and a plant on the Rusafa side	Baghdad Mayoralty	0	0	0	Under construction
Mahmudiyah District / Yusufiya sub-district	Baghdad outskirts	10.0	Average 31 (95per working day) (11,495 ton/year)	121	Working
Nasiryah District / District Center	Dhi Qar	-	-	-	Working
Total	-	10.0	Average 31	121	-

*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Table 3-16 shows the number of the final disposal facilities by category. The 67 disposal facilities with Environmental approval were 25% of the total number of disposal facilities, and there were 47 open dumping sites having a share of about 17% in Iraq excluding Kurdistan Region in 2019. For the numbers of Baghdad and Basra regarding disposal facilities, the CSO's environmental report (2019) and in the JST survey (the current situation reported by the counterparts in the two cities) of the present conditions do not match.



*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Fig. 3-14 Number of Disposal Facilities for the Year 2019

Table 3-16 Number of Disposal Facilities by Governorate for the Year 2019

Governorate	Disposal facilities with Environmental approval	Disposal facilities without Environmental approval	Open dumping sites	Total disposal facilities by governorate
Nineveh	4	28	2	34
Kirkuk	2	10	0	12
Diyala	0	19	9	28
Anbar	7	15	0	22
Baghdad Mayoralty	1	2	2	5
Baghdad outskirts	0	13	18	31
Babylon	8	0	0	8
Karbala	1	2	1	4
Wasit	13	2	0	15
Salah al-Din	1	18	8	27
Najaf	3	2	6	11
Qadisiyah	5	7	0	12
Muthanna	11	0	1	12
Dhi Qar	5	12	0	17
Mesan	4	12	0	16
Basrah	2	15	0	17
Total disposal facilities by type	67	157	47	271

*Exclude Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

(1) Kurdistan Region

Regarding intermediate treatment plants, there are only three SWM treatment plants in the Kurdistan Region, two located in Dohuk Governorate, and one in Sulaymaniyah and their production capacity is considered low in comparison to the amount of solid waste produced per day in Kurdistan Region. Currently 1,100 ton/day in Sulaymaniyah and 800 ton/days in Duhok are treated, and these are smaller than the amount of solid waste produced per day of around 7,600 tons.

As for final disposal, there are currently 92 dumping areas in Kurdistan Region where waste is disposed of in open sites and the waste is mixed (medical, municipal, hazardous and construction waste) [8].

Out of the 92 dump sites, the largest 9 sites receive almost 67% of the total quantity of solid wastes where the rest of dump sites have a low capacity and thus should be closed.

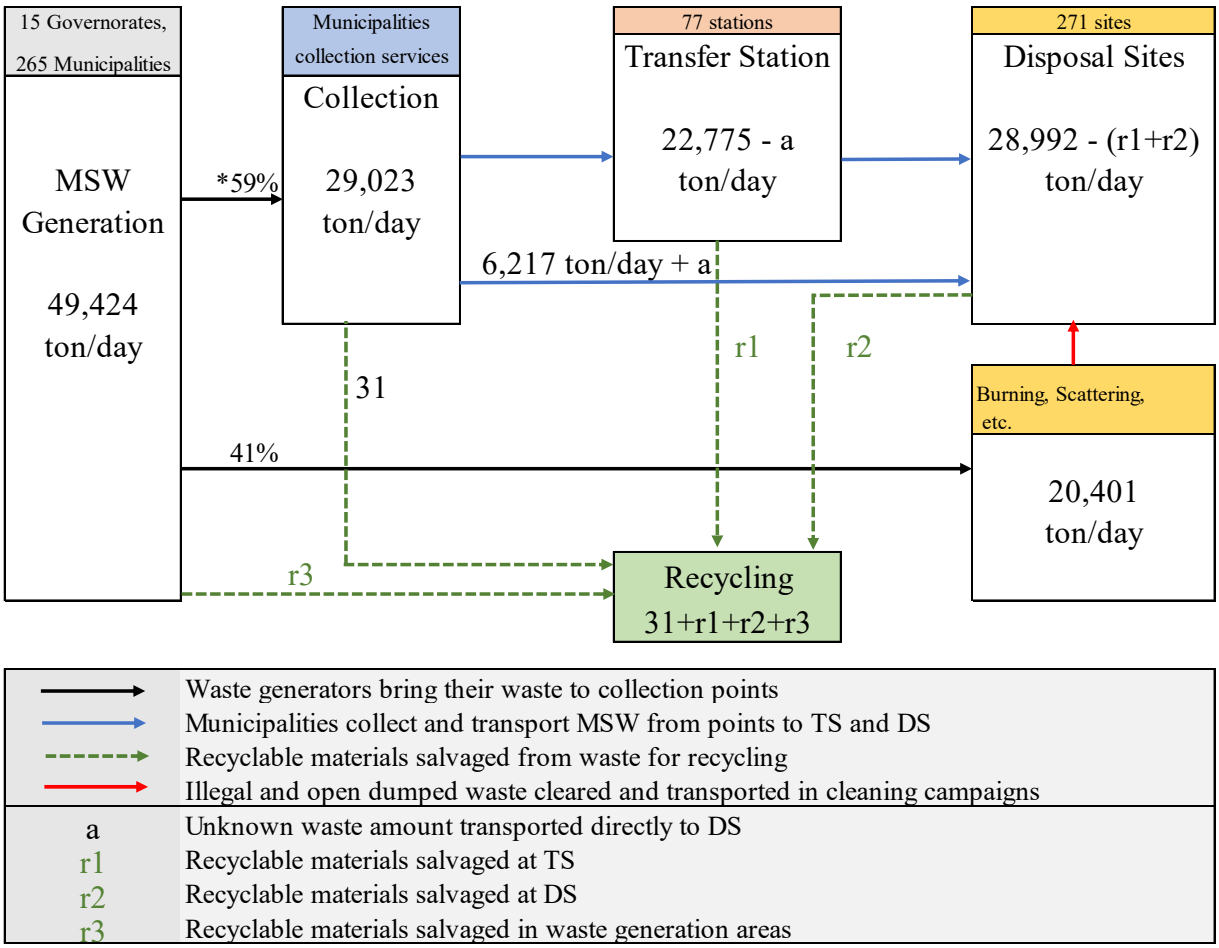
3.5 SWM Material Flow and Future Projection of the Municipal Solid Waste

3.5.1 SWM Material Flow

The data collected and analyzed by the Central Statistics Organization (CSO) has been used as the basis to develop the MSW flow in 16 governorates of Iraq for the year 2019. The three governorates of Dahuk, Sulaimanyiah and Erbil of Kurdistan Region were not included in the CSO data collection and analysis exercise. Accordingly, the analysis presented in this section excludes Kurdistan Region.

(1) Municipal Solid Waste Flow

The MSW flow is shown in Fig. 3-15 below.



*: The share of collected MSW amount in ton per day from the total generated MSW amount
Source: JST

Fig. 3-15 MSW Waste Flow

[8] Draft KRG Solid Waste Management Policy (2017)

CSO provided information on MSW amounts collected from each governorate (29,023 ton/day), the population served by the collection services, and the unit generation rates (Unit generation rate) in each governorate. Multiplying the Unit generation rate in each governorate by the total population in that governorate, it was possible to obtain the generation amount of MSW, shown as 49,424 ton/day. It should be noted here that JST did not consider separate Unit generation rates for each of urban and rural populations and assumed the same Unit generation rate for both.

The share of collected MSW amount in ton per day from the total generated MSW amount was 59%. In the previous section, 3.4.3 the population receiving collection service was identified as 63.6%. The slightly higher rate of population served, compared with waste amount collected indicates that the positive tendency to provide collection service to as many people as possible, even those generating lesser amounts of waste.

The total number of transfer stations (TS) was given as 77 stations. However, the CSO report did not show the amount of waste arriving at each station, which is needed to be able to estimate the MSW being directly transported to the disposal facilities and the amount being transported to transfer stations for further transfer to the disposal facilities. On the other hand, the CSO report showed that for four governorates (Baghdad Outskirts, Wasit, Muthana and Dhi Qar) there were no transfer stations and so the total MSW collected in these four governorates (6,217 ton/day) is directly transported to the DS. But since the direct transport cannot be calculated for the other governorates where there are transfer stations, and it is not known how much of the waste collected from these governorates goes to these stations, JST has added “a” as an unknown amount in the direct transport.

Most reports indicate that recycling amounts in Iraq are exceptionally low, possibly not exceeding 5%. One separation and recycling plant is operated in Baghdad Outskirts and 31 ton/day of recyclable materials are recovered there, as indicated in the flow. However, waste pickers are known to be active at the transfer stations, disposal facilities and in the city streets and while no information is available on the amounts they recover in those three locations, these amounts have been indicated as “r1”, “r2” and “r3”.

3.6 Basic Information on Healthcare Waste, Industrial Waste and Other Hazardous Wastes

The standards/Regulations that Ministry of Health and Environment use for the Medical Waste Management is Regulation No. 1 for 2015 – Hazardous Waste Management and EPA Medical Waste Management Guidelines. Ministry of Health and Environment established a committee to study environmental protection caused by medical liquid and solid waste in 2018 in accordance with Decree No. 99 of the Ministry of Health and Environment. The ministry had not collected generation amount of the medical wastes. The committee has implemented an expanded survey on current status of the medical liquid and solid wastes from August 2019 to January 2020. The results of the committee's survey have not yet been made public, but the preliminary figures for the amount of medical solid waste generated nationwide in 2021 are shown in Table 3-17. Medical solid wastes are, in principle, disposed of in incinerators and other facilities in hospitals, but most of the incinerators and other facilities are outdated. In order to prevent environmental pollution caused by medical solid wastes, it is essential to monitor their generation and treatment, which is what Iraq has started to do.

Table 3-17 Amount of Medical Solid Waste Generated by Governorate (Preliminary figures: 8/2019 – 1/2020)

No.	Governorate	Medical Solid Waste (kg/day)
1	Baghdad	67,641
2	Basrah	17,609
3	Thi Qar	6,392
4	Ninevah	29,965
5	Karbala	18,460

No.	Governorate	Medical Solid Waste (kg/day)
6	Al-Najaf	6,536
7	Babylon	22,638
8	Al-Muthanna	1,047
9	Maysan	4,006
10	Wasit	10,533
11	Al-Anbar	4,143
12	Salah AL-Deen	12,603
13	Diala	17,941
14	Kirkuk	13,461
15	Al Diwanyah	18,023
Total		**250,998**

Source: Ministry of Health and Environment

According to "The Impact of COVID-19 on Environmental Sustainability in Iraq (February 2021)" conducted by UNDP, although data support is lacking, the impact of COVID-19 has led to an increase in the use of disposable medical protective equipment such as gloves, face shields, masks and gowns, resulting in an increase in non-recyclable plastic waste. Furthermore, according to several estimates and surveys, there is an increase of 1 to 3 kg of waste per hospitalized patient than usual. This has led to an increase in the amount of medical solid waste generated. However, no data has been confirmed to show the specific amount of waste increase and how it was disposed of. Based on this premise, this report is concerned that the increased amount of medical solid waste will be disposed of improperly or burned in the open, causing secondary infections and adverse effects on the ecosystem.

Table 3-18 shows that the Amount of Hazardous waste collected. There was no Hazardous waste collection in Baghdad and Basrah governorates in 2019 and 2018. As for amount of collected Hazardous waste by all municipal institutions (excluding Kurdistan Region) in Iraq, the total amounts of Hazardous waste were 11,921 kg/year in 2019 and 3,432 kg/year in 2018.

Table 3-18 Amount of Hazardous Waste Collected by Governorate for the Year 2019

Governorate	Total amount of hazardous waste collected in 2019 (kg / day)	Total amount of hazardous waste Collected in 2019 (kg / year)	Total amount of hazardous waste collected in 2018 (kg / day)	Total amount of hazardous waste Collected in 2018 (kg / year)
Nineveh	0	0	0	0
Kirkuk	0	0	0	0
Diyala	0	0	0	0
Anbar	0	0	0	0
Baghdad Mayoralty	0	0	0	0
Baghdad outskirts	0	0	0	0
Babylon	8,571	2,314,170	0	0
Karbala	0	0	0	0
Wasit	0	0	0	0
Salah al-Din	0	0	32	8,748
Najaf	0	0	0	0
Qadisiyah	1,750	472,500	1,800	486,000
Muthanna	1,600	432,000	1,600	432,000
Dhi Qar	0	0	0	0
Mesan	0	0	0	0
Basrah	0	0	0	0
Total amount of waste collected by type	11,921	3,218,670	3,432	926,748

*Excluding Kurdistan Region
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Iraq has recently joined the update of Basel Convention related to the transportation of Hazardous Materials. The following main provisions are valid for countries that are members of the Basel Convention. Iraq government agrees with the intent of the treaty, but has not officially signed it so far.

(1) The export of hazardous waste and other waste specified in the Convention (hereinafter referred to as "waste") requires the written consent of the importing country (Articles 6 from 1 to 3).

(2) Parties minimize domestic waste generation and ensure to dispose these wastes at domestic disposal facilities as much as possible for appropriate waste disposal in an environmentally friendly manner (Article4.2 (a) and (b)).

(3) Illegal waste transactions are recognized as criminal and measures are taken to prevent and punish acts that violate this Convention (Articles 4.3 and 4).

(4) In principle, the import and export of waste with non-parties is prohibited (Article 4.5).

(5) The export of waste to the Antarctic region is prohibited (Article 4.6).

(6) Only authorized persons can transport and dispose of waste (Article 4.7 (a)).

(7) The transfer of waste across national borders requires the attachment of appropriate transfer documents stipulated by the Convention (Article 4.7 (c)).

(8) If the cross-border transfer of waste cannot be completed as contracted, the exporting country shall take appropriate measures, including taking back the waste (Article 8).

(9) If the cross-border transfer of waste results in an illegal transaction as a result of the actions of the exporter or generator, the exporting country shall take appropriate measures, including taking back the waste (Article 9.2).

(10) Parties will provide technical international cooperation, mainly to developing countries for appropriate waste disposal in an environmentally friendly manner (Article 10).

(11) Bilateral or multilateral agreements on the cross-border transfer of waste can be entered into with non-parties, as long as it does not violate the intent of the Convention (Article 11).

3.7 Extended Problem Analysis on the CSO's Environmental Report

3.7.1 Analysis on the Main SWM Indicators and the Questionnaires of Environmental Statistics of Iraq

The main SWM indicators provided by CSO for 2018 and 2019 are shown in Table 3-19. It should be noted that data for the three governorates located in Kurdistan Region are not included.

It is worthwhile to note that the CSO's environmental report (2019) was compared with CSO's similar data for 2018. Percentage of total population receiving waste collection service slightly increased from 63.5% to 63.6%, and Collected MSW amount increased by 2,722 ton/day (100 million ton/year). On the other hand, the disposal facilities that do not have environmental approvals also increased from 149 sites to 157 sites. Collection service coverage is measured by the population served and the amount of waste collected in relation to generated waste amount. This shows that the improvement of waste collection is progressing compared to the construction and operation of sanitary landfills, and there may be more emphasis by the municipalities on improving waste collection over improvement of disposal facilities.

Table 3-19 Main SWM Indicators Provided by CSO for 2018 and 2019

SN	Indicator	Unit	2018	2019
1	No. of Municipal Institution	No.	261	265
2	Percentage of urban population receiving waste collection service	%	88.8	88.7
3	Percentage of total population receiving waste collection service	%	63.5	63.6

SN	Indicator	Unit	2018	2019
4	Amount of solid waste(1) collected	Mln. ton/year	18.1	17.3
		ton/day(2)	49,589	47,397
5	Amount of municipal waste collected	Mln. ton/year	9.6	10.6
		ton/day	26,301	29,023
6	Amount of Construction and Demolition wastes (C&D waste) collected	Mln. ton/year	8.2	5.9
		ton/day	22,530	16,053
7	Unit generated waste per capita	Kg/cap/day	1.3	1.4
8	Amount of Hazardous Waste collected	ton/year	926.7	3218.7
		ton/day	2.54	4.43
9	Percentage of municipal waste of total waste collected	%	53.1	61.1
10	Major method to dispose of municipal waste in governorates is through disposal in disposal facilities not having environmental approvals	%	93.8	87.5
11	Number of disposal facilities with Environmental Approval	No.	64	67
12	Number of disposal facilities without Environmental Approval	No.	147	157
Notes: (1) includes municipal, C&D and scrap waste, (2) CSO values provided in ton/year and converted to ton/day by JST				

Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Important indicators were as follows:

- In 2019, 36% of the population, mostly residing in rural areas were not receiving waste collection services.
- In 2019, collected amount of hazardous waste represented less than 0.02% of total solid waste collected. And the 2019 hazardous waste amount collected was more than three times the amount collected in 2018.
- Although there was a small improvement in the reduction of number of disposal facilities without environmental approvals from 2018 to 2019, still a significant majority (88 %) of the disposal facilities are unapproved disposal facilities.
- Total disposal facilities in 2019 were 224. Thirteen (13) new disposal facilities were added from 2018 to 2019, however 3 had environmental approvals and the rate of disposal facilities with environmental approvals was maintained at roughly 30% of the total disposal facilities.

3.7.2 Needs Analysis on SWM to be Improved

In the CSO's environmental report, questionnaires were sent out to relevant federal and local authorities asking them to provide "yes" or "no" replies to 21 SWM issues they may be facing. The 21 issues are shown in the following Table 3-20, grouped into 4 components based on their subject matter by the JICA team. The original serial numbers as listed by CSO have been maintained for reference.

Table 3-20 21 SWM Issues for Relevant Federal and Local Authorities

SN	A PUBLIC AWARENESS	SN	B COLLECTION, TRANSPORT AND DUMPING	SN	C. FINANCIAL	SN	D. INSTITUTIONAL
9	Lack of environmental awareness and citizens' lack of commitment to timelines to collect waste, which leads to disruption of the collection and transportation system of waste.	1	Limited number of machinery (compactors, etc.) for collection and transport	5	Poor financial allocations for implementation of cleaning projects, as these works are within the budget of the governorate.	12	Poor coordination between the supporting departments that give basic approvals for landfill projects and transfer stations.
10	The random dumping of waste by citizens and shops, in non-designated locations	2	Unavailability of specialized machinery for collection and transport	7	Low wages of waste workers.	18	Expansion of the geographical area of cities and horizontal extension and the resulting large generation of waste that is not commensurate with the existing mechanical and human effort (self and rented) for all municipal institutions to cover the required services.
16	Lack of a waste source segregation, lack of use of the bags by the citizens, and the lack of use of them in the collection of waste.	3	Poor maintenance of machinery and their insustainability	17	Free cleaning services for residential areas and the resulting indifference of the recipient of the service, insufficient understanding of the impact of the negative response of the citizen and the lack of cooperation between the service provider and its recipient.	19	Spread of informal settlements in areas designated for agricultural use, which significantly affects the level of service provided, including cleaning services, and the frequent infringement on lands designated for public services (such as schools, health centers, hospitals, parks and other services) and thus reducing the spaces allocated to these vital activities.
13	Failure to use bags designated for garbage collection and distributed to citizens, and poor standards set for monitoring cleaning work.	4	Scarcity of spare parts needed for waste machinery.	11	The weak institutional performance of the governorates in allocating funds for the implementation of waste recycling plants projects within the regions' development budget.	21	Others
		6	Small number of workers allocated to the number of machineries for collecting and transporting waste.				
		20	limited availability of containers for waste collection and the lack of modern specialized containers due to their damage as a result of use and delaying compensation for those affected.				
		8	The lack of supplies (bags) for waste collection.				
		14	Difficulty of covering the typical transfer stations for all municipal institutions, the problems of random dumping of waste, and the insufficiency of their availability to cover the actual need for the daily segregated quantities.				
		15	Lack of studies and research related to the cleaning services sector to set a sound mechanism for waste management, the weakness of the local private sector specialized in this field, as well as the weak participation of the specialized sector of international companies specialized in this field.				

Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

The following Table 3-21 shows the replies of each governorate on the 21 issues. A "Yes" reply by a governorate means that this governorate is affected by the issue, while a "NA" reply means that the governorate does not consider that issue is affecting its SWM operations.

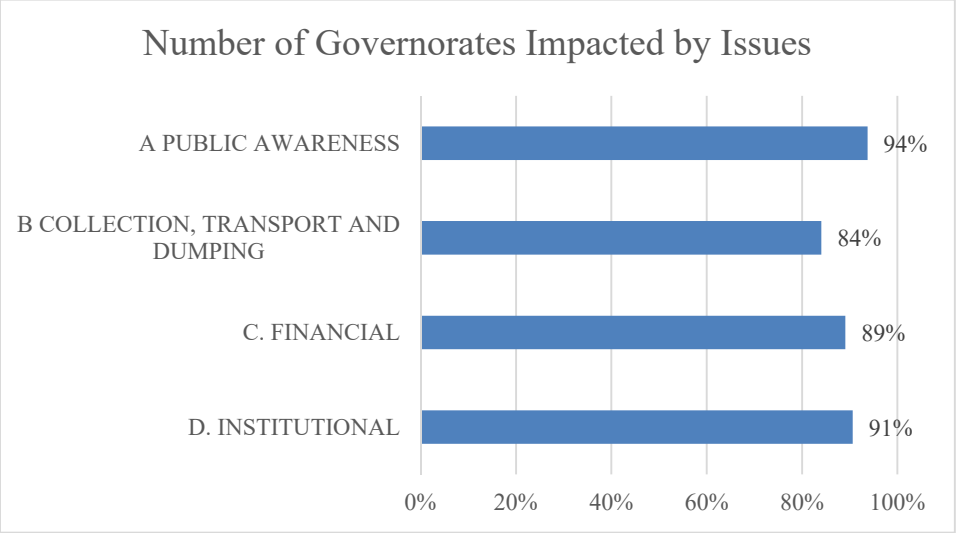
Table 3-21 Replies of Each Governorate on the 21 Issues

SN	Issues grouped by Component	Nineveh	Kirkuk	Diyala	Anbar	Baghdad Mayoralty	Baghdad outskirts	Babylon	Karbala	Wasit	Salah al-Din	Najaf	Qadisiyah	Muthanna	Dhi Qar	Mesan	Basra
	A PUBLIC AWARENESS	100%	100%	100%	100%	50%	100%	100%	100%	100%	100%	100%	100%	75%	75%	100%	100%
9	Lack of environmental awareness and citizens' lack of commitment to timelines to collect waste, which leads to disruption of the collection and transportation system of waste.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	The random dumping of waste by citizens and shops, in non-designated locations.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16	Lack of a waste source segregation, lack of use of the bags by the citizens, and the lack of use of them in the collection of waste.	Yes	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13	Failure to use bags designated for garbage collection and distributed to citizens, and poor standards set for monitoring cleaning work.	Yes	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	NA	Yes	Yes
	B COLLECTION, TRANSPORT AND DUMPING	100%	100%	78%	100%	11%	100%	78%	100%	56%	78%	100%	100%	89%	78%	100%	78%
1	Limited number of machinery (compactors, etc.) for collection and transport.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Unavailability of specialized machinery for collection and transport.	Yes	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA
3	Poor maintenance of machinery and their insustainability.	Yes	Yes	NA	Yes	NA	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Scarcity of spare parts needed for waste machinery.	Yes	Yes	NA	Yes	NA	Yes	Yes	Yes	NA	NA	Yes	Yes	Yes	NA	Yes	Yes
6	Small number of workers allocated to the number of machineries for collecting and transporting waste.	Yes	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
20	limited availability of containers for waste collection and the lack of modern specialized containers due to their damage as a result of use and delaying compensation for those affected.	Yes	Yes	Yes	Yes	NA	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	The lack of supplies (bags) for waste collection.	Yes	Yes	Yes	Yes	NA	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14	Difficulty of covering the typical transfer stations for all municipal institutions, the problems of random dumping of waste, and the insufficiency of their availability to cover the actual need for the daily segregated quantities.	Yes	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	NA	Yes	Yes
15	Lack of studies and research related to the cleaning services sector to set a sound mechanism for waste management, the weakness of the local private sector specialized in this field, as well as the weak participation of the specialized sector of international companies specialized in this field.	Yes	Yes	Yes	Yes	NA	Yes	NA	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	NA
	C. FINANCIAL	100%	75%	100%	100%	50%	100%	100%	100%	50%	75%	100%	75%	100%	100%	100%	100%
5	Poor financial allocations for implementation of cleaning projects, as these works are within the budget of the governorate.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes
7	Low wages of waste workers.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17	Free cleaning services for residential areas and the resulting indifference of the recipient of the service, insufficient understanding of the impact of the negative response of the citizen and the lack of cooperation between the service provider and its recipient.	Yes	NA	Yes	Yes	NA	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	Yes	Yes	Yes
11	The weak institutional performance of the governorates in allocating funds for the implementation of waste recycling plants projects within the regions' development budget.	Yes	Yes	Yes	Yes	NA	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	D. INSTITUTIONAL	100%	75%	100%	100%	75%	100%	100%	100%	75%	100%	75%	100%	75%	75%	100%	100%
12	Poor coordination between the supporting departments that give basic approvals for landfill projects and transfer stations.	Yes	Yes	Yes	Yes	NA	Yes	Yes	Yes	NA	Yes	Yes	Yes	NA	Yes	Yes	Yes
18	Expansion of the geographical area of cities and horizontal extension and the resulting large generation of waste that is not commensurate with the existing mechanical and human effort (self and rented) for all municipal institutions to cover the required services.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
19	Spread of informal settlements in areas designated for agricultural use, which significantly affects the level of service provided, including cleaning services, and the frequent infringement on lands designated for public services (such as schools, health centers, hospitals, parks and other services) and thus reducing the spaces allocated to these vital activities.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
21	Others	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	Yes

Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Shares of governorates impacted by the issues by issue group are depicted graphically in Fig. 3-16.

Issues of Components A (Public Awareness) and D (Institutional) are reported to have the highest effects on SWM, while Component B (Collection, Transport and Dumping) is the lowest. However, the four components do not vary widely.



Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Fig. 3-16 Number of Governorates Impacted by Issues

Table 3-22 summarizes the results for each governorate and includes data on SWM facilities for each. There appears to be some correlation between the collection service coverage rates and the replies to the issues. Baghdad Mayoralty has the highest collection rate of 95% and has answered NA to 8 of the 9 issues grouped in Component B. On the other hand, the three governorates of Ninevah, Anbar and Baghdad Outskirts that replied affirmatively to all the 21 issues, have low collection coverage rates of 44% to 53%. However, the correlation fades away for Wasit governorate having an overall low collection rate but answering NA to most of the issues and the two governorates of Karbala and Mesan that have high collection rates but have replied affirmatively to all the 21 issues. Salah Al-Din governorate is an anomaly; the collection coverage rate was very low, at 29% however the governorate officials did not reply affirmatively to all the issues.

While this is a particularly good exercise it is necessary to define the issues more specifically to have a common understanding and provide uniform replies. It is also unfortunate that there were not enough questions/issues related to disposal facilities, given that the rate of environmentally approved disposal facilities overall is only 30%. This may indicate that SWM officials are more concerned about collection and less so when it comes to disposal and intermediate treatment.

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Table 3-22 Results Regarding SWM for Each Governorate

Governorate	Unit	Nineveh	Kirkuk	Diyala	Anbar	Baghdad Mayoralty	Baghdad outskirts	Babylon	Karbala	Wasit	Salah al-Din	Najaf	Qadisiyah	Muthanna	Dhi Qar	Mesan	Basra	Total
1. POPULATION																		
Total Population 2019	cap	3,828,197	1,639,953	1,680,328	1,818,318	6,150,828	2,189,883	2,119,403	1,250,806	1,415,034	1,637,232	1,510,338	1,325,031	835,797	2,150,338	1,141,966	2,985,073	33,678,525
Urban population	cap	2,321,479	1,212,210	826,745	909,458	6,150,828	1,146,604	1,023,123	836,316	851,628	738,274	1,078,638	759,071	388,176	1,380,216	843,494	2,424,321	22,890,581
Rural population	cap	1,506,718	427,743	853,583	908,860	0	1,043,279	1,096,280	414,490	563,406	898,958	431,700	565,960	447,621	770,122	298,472	560,752	10,787,944
2. MSW COLLECTION																		
Collected municipal waste amount	ton/year	634,014	357,909	409,561	628,825	2,329,578	434,650	409,331	645,735	535,270	702,769	612,870	262,057	154,197	1,145,200	386,175	945,436	10,593,577
Collection service coverage - total population	%	53.3	72.6	43.7	44.3	95.0	43.7	44.0	73.2	55.9	29.3	66.8	43.7	46.3	58.6	80.5	86.2	63.6
Collection service coverage - urban population	%	88.0	98.2	80.5	81.3	95.0	70.2	91.1	89.0	93.0	51.6	89.0	76.4	99.6	91.2	95.0	90.0	88.7
Collection service coverage - rural population	%	0.0	0.0	8.0	7.2	0.0	14.5	0.0	41.3	0.0	10.9	11.2	0.0	0.0	0.0	39.6	69.5	10.3
3. SWM FACILITIES																		
Formal Transfer Stations	unit	1	2	0	0	9	0	1	1	0	0	5	0	0	0	0	1	20
Informal Transfer Stations	unit	0	0	6	6	13	0	5	4	0	1	4	14	0	0	2	2	57
Total transfer stations	unit	1	2	6	6	22	0	6	5	0	1	9	14	0	0	2	3	77
Landfills with environmental approval	unit	4	2	0	7	1	0	8	1	13	1	3	5	11	5	4	2	67
Landfills without environmental approval	unit	28	10	19	15	2	13	0	2	2	18	2	7	0	12	12	15	157
Illegal dumpsites	unit	2	0	9	0	2	18	0	1	0	8	6	0	1	0	0	0	47
Total landfills + dumpsites	unit	34	12	28	22	5	31	8	4	15	27	11	12	12	17	16	17	271
4. Number of governorates impacted by SWM Issues																		
A. Public Awareness Issues	%	100%	100%	100%	100%	50%	100%	100%	100%	100%	100%	100%	100%	75%	75%	100%	100%	94%
B. Collection, Transport and Dumping Issues	%	100%	100%	78%	100%	11%	100%	78%	100%	56%	78%	100%	100%	89%	78%	100%	78%	84%
C. Financial Issues	%	100%	75%	100%	100%	50%	100%	100%	100%	50%	75%	100%	75%	100%	100%	100%	100%	89%
D. Institutional Issues	%	100%	75%	100%	100%	75%	100%	100%	100%	75%	100%	75%	100%	75%	75%	100%	100%	91%

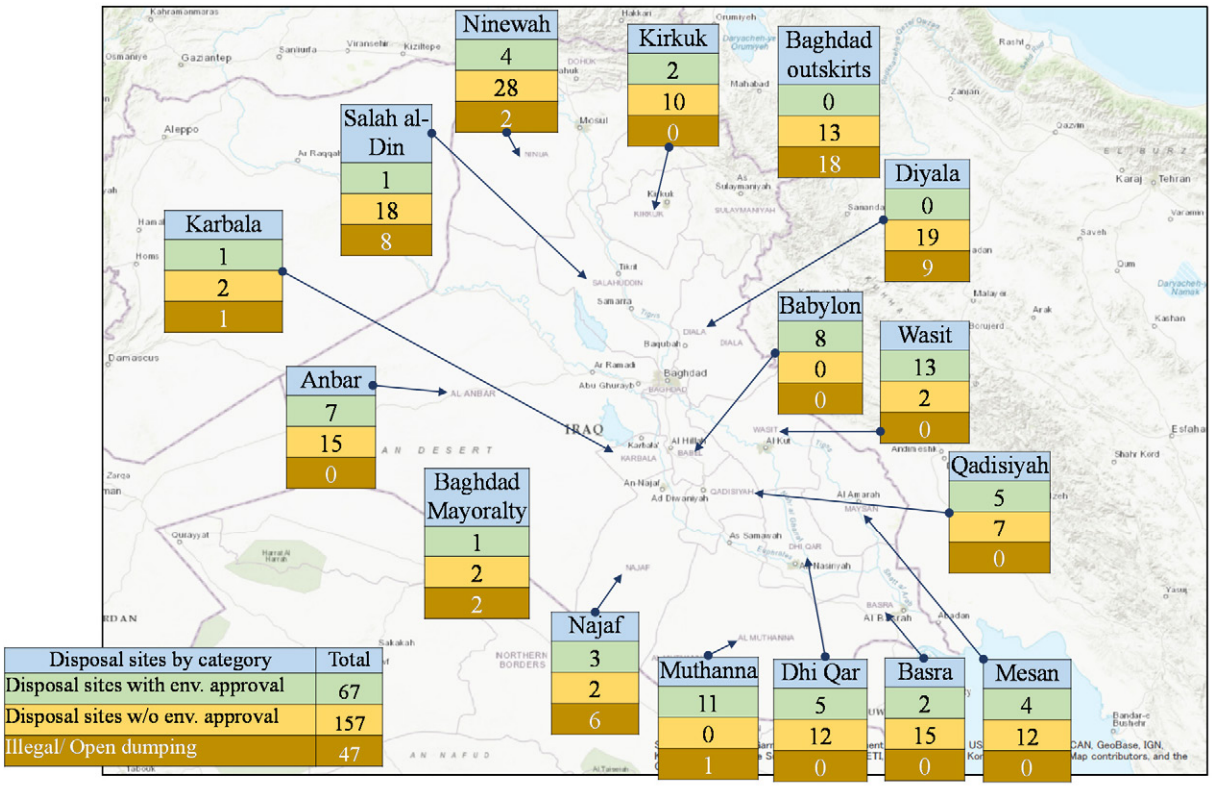
Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

3.7.3 Considerations on Disposal Facilities and Grouping by Governorates

The CSO collected information from the governorates on the number of disposal facilities by category, 1) Environmentally approved disposal facilities, 2) Disposal facilities that do not have environmental approval, 3) Open dumping sites.

Unfortunately, the CSO's environmental report does not include data on the actual waste amounts being disposed of in each disposal facility category, the sizes of these sites and the areas they receive waste from. However, it is quite possible that such data exists at the governorate level and hopefully it will be collected and reported on in future CSO reports.

Fig. 3-17 shows the number of disposal facilities by category in each of the surveyed governorates.

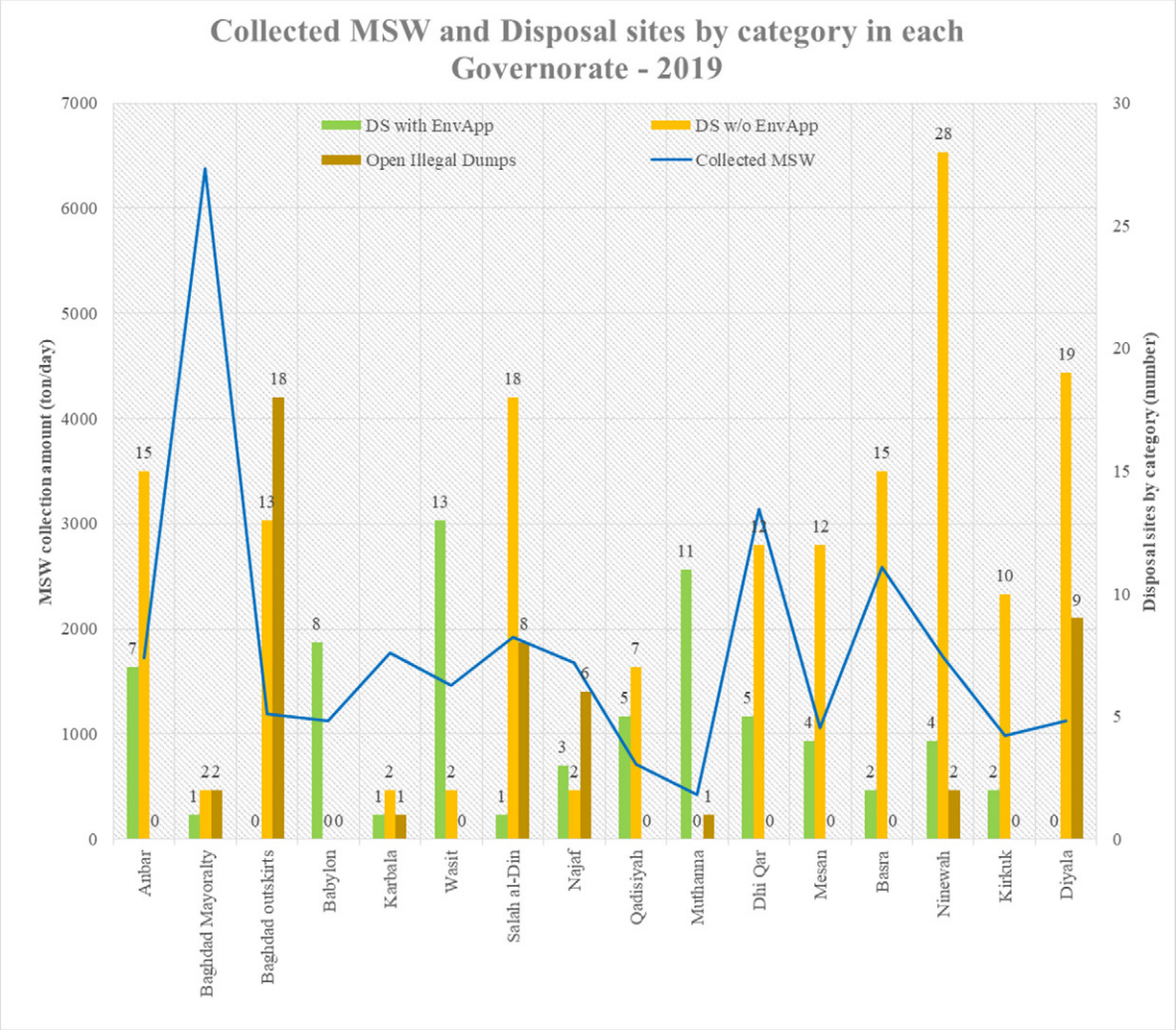


Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Fig. 3-17 Distribution of Disposal Facilities by Category

There are 271 sites in total, of which 67 disposal facilities (25%) have been environmentally approved. On the other hand, 17% of the sites in use are illegal open dumping sites. It should be noted that the one environmentally approved disposal facility indicated for Baghdad Mayoralty is still under construction and disposal operations are expected to commence in early 2022.

Fig. 3-18 is a graphical presentation of the number of disposal facilities in each governorate against the amount of waste collected in these governorates in ton/day.



Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Fig. 3-18 Graphical Presentation of Disposal Facilities and Collected MSW Amounts by Governorate

Based on both figures it was possible to group the governorates into five groups as shown in Table 3-23.

Table 3-23 Analysis of Number of Disposal Facilities in the Governorates

Group	Unit	Group 1	Group 2	Group 3	Group 4	Group 5
1. Governorates	Gov.	Baghdad Mayoralty	Salah al-Din, Najaf	Anbar, Qadesiyah, Dhi Qir, Mesan, Basra, Kirkuk, Ninewah	Babylon, Muthana, Wasit	Baghdad Outskirts, Diyala
2. Group attributes						
2.1 Urban population share	%	100%	58%	66%	52%	51%
2.2 Collected MSW	ton/day	6,382	3,604	13,713	3,010	2,313
2.3 MSW collection rate	%	95%	40%	72%	49%	44%

Group	Unit	Group 1	Group 2	Group 3	Group 4	Group 5
2.4 Share of tot. MSW collected	%	22%	12%	47%	10%	8%
3. Disposal facilities (DF) by category						
3.1 DF with env. approval	number	1	4	30	32	0
3.2 DF w/o env. approval	number	2	20	101	2	32
3.3 Open dumping sites	number	2	14	3	1	27
3.4 Share of tot. DF	%	2%	14%	49%	13%	22%

Source: Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

The following table shows characteristics and problems of each group, the severity of the problem, and the proposed policy for future actions. Groups 2 and 5 have low collection rates and a large number of open dumping sites, which is considered to be a more serious situation than the other groups. Groups 1 and 3 have similar characteristics with high collection rates but with the majority of waste being disposed of in disposal sites without environmental approvals. On the contrary, Group 4 has a low collection rate and a high percentage of disposal sites with environmental approvals. If the collection rate improves and the disposal volume increases, there is concern that open dumping and other activities will increase.

Table 3-24 Characteristics and Proposed Policy for Future Actions in Each Group

Group	Characteristics and problems	Severity	Proposed policy for future actions
1	● It has the peculiarity of being the capital city and having the entire population living in the urban area. ● The waste collection rate is overwhelmingly high at 95%. ● There is only one environmentally approved landfill[9], and most of MSW is disposed at disposal sites without environmental approvals.	Middle	To improve disposal sites without environmental approvals and bring them closer to sanitary landfills. To construct landfills with environmental permits.
2	● The waste collection rate is as low as 40%. ● Approximately 30% of open dumping sites are found in this group.	High	To strengthen the waste collection capacity and close open dumping sites. Note that if the collection rate is improved, there is a concern that open dumping and illegal dumping will increase.
3	● The waste collection rate is relatively high at 72%. ● 67% of disposal sites without environmental approvals are found in this group.	Middle	To improve disposal sites without environmental approvals and bring them closer to sanitary landfills. To construct landfills with environmental permits.
4	● The waste collection rate is low at 49%. ● The percentage of disposal sites with environmental approvals is the highest.	Middle	To expand collection services while maintaining little to no open dumping or disposal sites without environmental approvals.
5	● It is geographically adjacent to Baghdad City and accepts wastes from Baghdad City (see	High	To strengthen the waste collection

[9] In fact, this landfill site is under construction (as of September 2021) but has not been changed in the CSO database.

Group	Characteristics and problems	Severity	Proposed policy for future actions
	Chapter 4). ● The collection rate is low at 44%. ● 57% of open dumping sites are located in this area.		capacity and close open dumping sites. To consider the development of a regional landfill site used with Baghdad City.

Source: JST

3.8 National Level SWM Issues

JST summarized the national level solid waste management issues in Table 3-25 from three viewpoints, 1) Policy and Plan, 2) Institutional system and 3) Operation.

Table 3-25 National Level Current Situation and Issues on SWM

Sector	Issues
1. Policy and Plan	
① Master Plan	Present situation: The National SWM plan prepared in 2007 outlined policies for the short, medium and long terms. MCHMPW stipulated that although the present time coincides with the mid-term of NSWMP there has been progress only in the activities stipulated for the short term. Issue: Regarding the formulation of plans such as for recycling and reuse, which are medium-term activities, there is an urgent need to consider and formulate them. Issue: There are no detailed programs or activities related to environmental education or dissemination and enlightenment. In the future, awareness-raising activities for recycling and reuse will be important. Issue: The latest population census was carried out in 1987. There is only population projection from 1988.
2. Institutional system	
① Basic law on SWM	Present situation: Regulations related to waste management are stipulated in various laws and regulations, such as Resolution No. 133 for the year 1996. Currently, with USAID support, a solid waste management law is being formulated. Issue: Resolution No. 133 for the year 1996 prohibits local governments from collecting waste disposal fees from residents. It is necessary to secure financial resources in order to sustain the SWM activities of the municipalities providing the waste management services and to deepen the understanding of the residents on SWM issues and motivate them to reduce the waste they generate. It is preferable, therefore, to review the relevant laws and permit the municipalities to levy and collect waste management fees from the residents who are the waste generators. Issue: Regarding Instruction No. 3 for the year 2011 (environmental regulation to construct projects and monitor their development), disposal facility and recycling facility shall be located outside the municipality's boundaries. The stipulation may be contradictory to the "Proximity Principle and Self Sufficiency" which are Key Principles of the National Solid Waste Management Plan (2007).
② Specific laws and systems related to recycling	Present situation: As mentioned above, basic regulations for SWM activities of collection, transportation, and disposal have been enacted, but it was not possible to find any laws and regulations related to recycling. Issue: As stated earlier in 1. Policy and Plan, it is necessary to urgently formulate policies and plans for recycling and reuse and to enact individual laws for their implementation.

Sector	Issues
③ Technical standards for treatment, disposal, etc.	Present situation: Not all individual technical standards have been formulated but technical classification proposals have been made for final disposal sites in the National Solid Waste Management Plan. Issue: There are no standards, etc. for intermediate processing facilities. In particular, regarding WtE facilities, which are in increasing demand, it is required to establish standards from the viewpoint of promoting environmental protection and investments by private companies. Possible criteria include combustion temperature and period, method for treating ash produced from the incineration, and selling price of waste generated electric power. Issue: Concerning the final disposal facility, there is a technical classification plan but there are no specific design standards. In particular, regarding liner systems and leachate treatment, it is desirable to formulate standards.
④ Data management	Present situation: MCHMPW collects and analyzes the SWM data from each governorate. The Central Statistics Office (CSO) arranges and publishes the results. Issue: In order to improve the efficiency of data collection, it is desirable to create a database using cloud services. Issue: As much as possible data should be collected in terms of waste amounts (ton) for waste operations and area (m^2) for waste facilities, in order to make a more effective quantitative and comparative analysis. Issue: The current definition of transfer stations, as described in the CSO environmental reports needs to be reconsidered in accordance with Instruction No. 3 for the year 2011. Only stations having compaction facilities to press the collected waste into large trailers are considered as formal stations. However, for smaller TS, there may be no need for compaction facilities. The definition of formal TS should be broader and include the TS that maintain environmental conditions, e.g. the waste is not stored at the TS for more than 24 hours, the station is access controlled, the waste loading and unloading areas are closed, the station operation does not have any negative effect on surrounding traffic, etc.
3. SWM Operation	
① Street sweeping and waste collection	Present situation: As of 2019, the waste collection rate (in terms of population coverage) was about 90% in urban areas and 60% in rural areas. The amount of waste collected nationwide (as of 2019) excluding Kurdistan Region was 29,023 ton per day. In terms of generated waste amount rate, the nationwide waste collection rate was about 60%, with 40% of the waste uncollected and illegally dumped in open areas or self-treated. Issue: The strengthening of the waste collection capacity is an urgent requirement, and the low waste collection rate especially in rural areas is a problem.
② Transfer stations	Present situation: As of 2019, there are 77 transfer stations nationwide, excluding Kurdistan Region. Of these facilities, only 20 (26%) are defined as formal transfer stations, having compaction and other facilities in the station. Issue: It is necessary to develop and maintain the required transfer stations for ensuring that waste collection capacity is strengthened. It is desirable that any new transfer facilities be developed as formal transfer stations at least in urban areas.
③ Intermediate treatment and recycling	Present situation: Presently only two states, Outskirts of Baghdad and Dhi Qar, have recycling facilities, and Salah al-Din state only, has incineration facilities. Intermediate treatment facilities are not widespread. Issue:

Sector	Issues
	In order to realize a recycling-based society, it is essential to develop intermediate treatment facilities. Technical standards and systems for waste treatment and disposal, etc., described above are essential to promote development of these facilities and attract private investments.
④ Sanitary landfill	Present situation: There are 271 final disposal facilities nationwide, of which 67 (25%) have environmental permits, 157 (58%) do not have environmental permits, and 47 are open dumping sites (17%). Issue: Regarding construction of new disposal facilities, it is necessary to develop only facilities that are eligible to receive environmental permits and thereby increase the share of final disposal having environmental permits. Issue: Regarding open dumping sites, it is necessary to establish the technical standards for safe closure of such sites, terminate dumping there, and implement safety closure. Issue: A dump site inventory should be developed listing all the locations and characteristics of the open dumping sites, in order to set the priorities for safe closure and develop the phased closure plans.

Source: JST

Chapter 4 Solid Waste Management in Baghdad Mayoralty

4.1 General Conditions

4.1.1 Population

The population census is originally planned to be conducted every 10 years in Iraq, however the last census was conducted back in 1987 and since then the population has been updated based on population projections.

The current population of Baghdad Mayoralty was estimated by CSO to be 6,150,828 for the year 2019.

Table 4-1 Population of Baghdad Mayoralty (2019)

City	Total			Rural			Urban		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
Baghdad	6,150,828	3,036,512	3,114,316	0	0	0	6,150,828	3,036,512	3,114,316

Source: Population estimation, (2019), CSO

4.1.2 Natural Conditions

Located at an elevation of 37.16 meters above sea level, Baghdad has a Subtropical desert climate. The temperature and rainfall annual data (2018) of Bagdad is shown in Table 4-2. The average annual temperature is 24.7°C. The average annual rainfall is 35.5mm.

Table 4-2 Temperature and Rainfall Annual Data of Bagdad (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
Average Temperatures (°C)	11.9	15.1	21.3	23.2	29	34.3	36.2	35.5	32.8	26.9	17	13	24.7
Monthly Rainfall (mm)	0.9	88.4	2.8	80.5	9	0	0	0	0	15.1	60.4	27.1	35.5
Humidity (%)	53	64	41	48	38	23	21	25	27	41	78	82	45.1

Source: CSO 2018 Iraq

4.1.3 Economic Conditions

Baghdad Mayoralty is the capital of Iraq, and home to the Iraqi federal government. A large part of Iraq's manufacturing including the oil and gas industry, as well as the production of tobacco, leather and cement is located in Baghdad, except for heavy industry. The government is the city's principal employer. The governorate of Baghdad is the center of the Iraqi economic, commercial, banking and financial sectors. The main investment performance is in six areas: oil, gas, chemical plants, housing and infrastructure in Baghdad Mayoralty. Baghdad International Airport is the main airport in Iraq and the capital is well connected by roads and rail to the rest of the country. Baghdad Mayoralty is home to four universities and a number of educational and research institutions.

According to the WFP, Baghdad governorate had the lowest unemployment rates ranging from 6 to 10% (2016 data), while unemployment among persons aged 15 – 24 was 5-7% (2017 data).

The WFP Socio-economic Atlas of Iraq provided the following wealth index quintile for Baghdad: poorest (17%), lower-middle (24%), middle (19%), upper-middle (21%), and richest (19%). Regarding household assets, the Atlas indicated the following breakdown for Baghdad: owned (67%), rented (19%), free with owner agreement (11%), and random house (3%). According to Oxford Poverty and Human Development Initiative 2019 dataset, 1.14% of the population of Baghdad governorate were in severe poverty, and 4% were vulnerable to poverty in 2018.

Internally displaced people and returnees in Baghdad governorate reported that access to employment

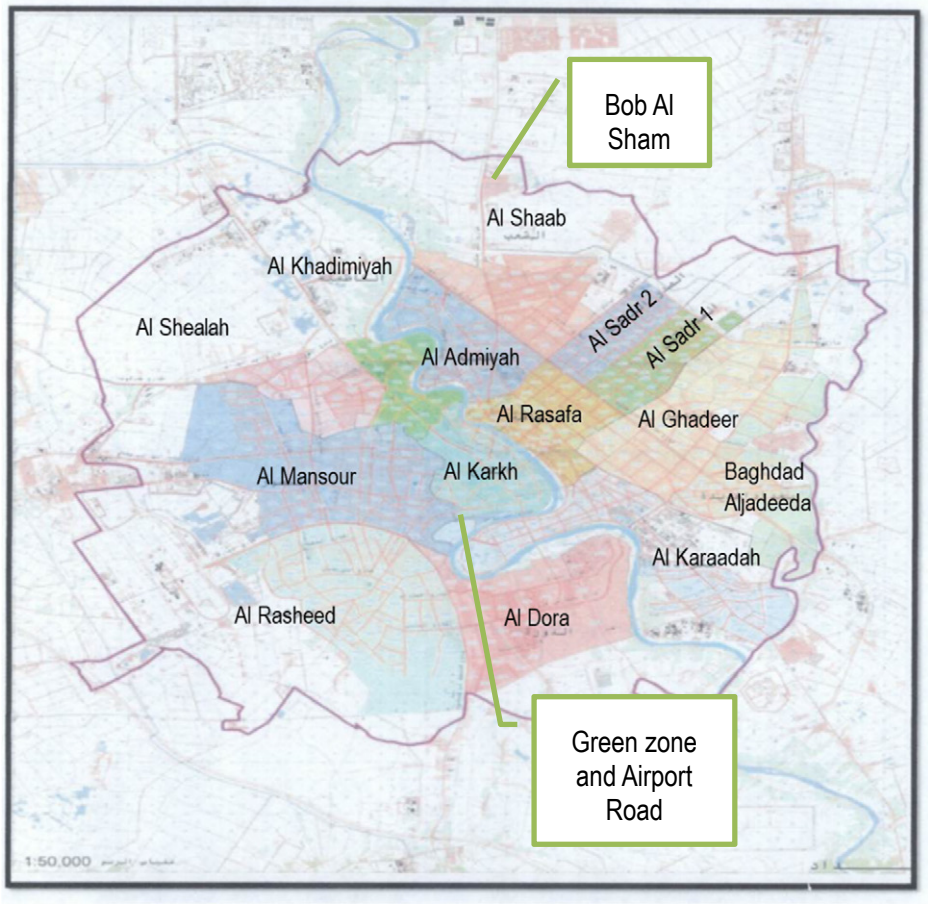
was a top concern for those living in Baghdad. International organization for Migration (IOM) stated that it was estimated that 88% of internally displaced persons (IDPs) relied on earnings from informal labor, less than 20% depended on pensions, 17% were dependent on support from family and friends, and 26% relied on cash aid. A joint IOM/Georgetown University study noted that, compared to other governorates, in Baghdad, the highest percentage of IDPs (73.7%) reported to be able to have an adequate standard of living.

4.2 Institutional and Legal Framework

4.2.1 Administrative Divisions

Baghdad Mayoralty is divided into the following 17 administrative divisions composed by 14 municipal departments and 3 units as shown in Fig. 4-1.

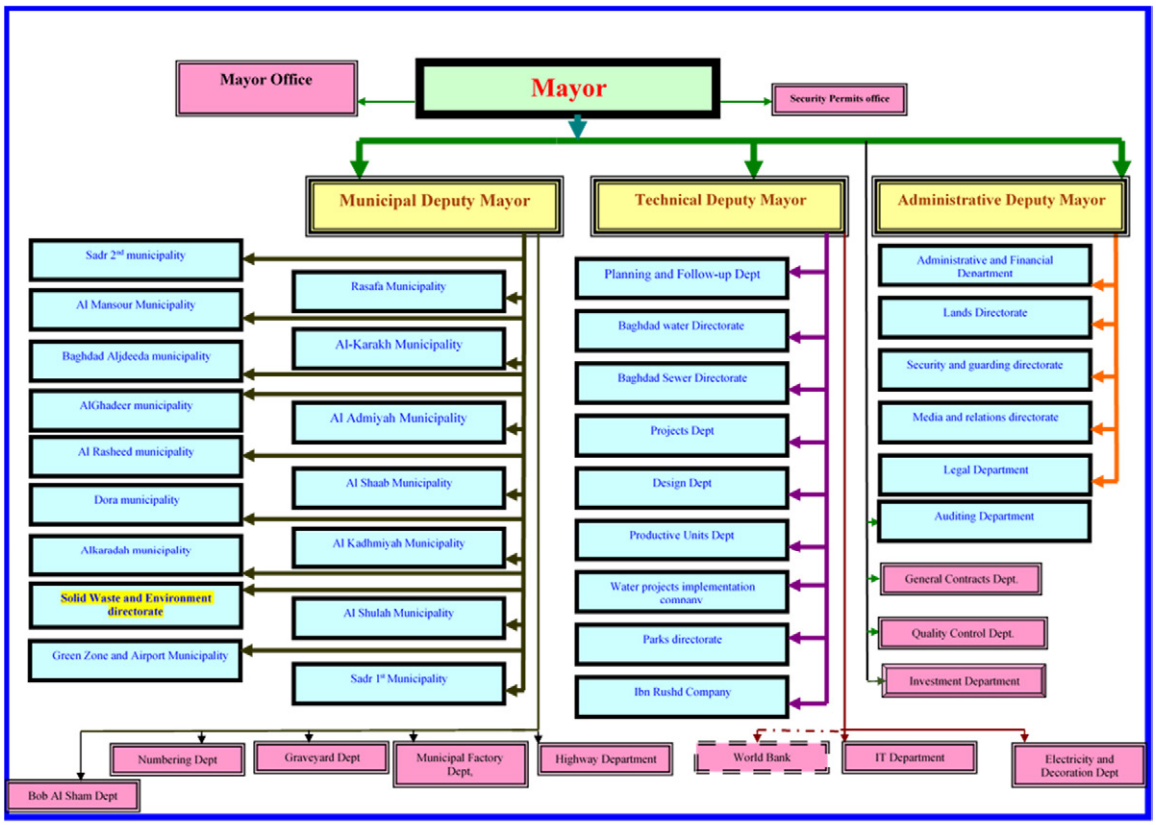
- Al Khadimiyah municipality Dep.
- Al Dora municipality Dep.
- Al Rasheed municipality Dep.
- Al Shealah municipality Dep.
- Al Mansour municipality Dep.
- Al Karkh municipality Dep.
- Al Admiyah municipality Dep.
- Al Shaab municipality Dep.
- Al Sadr 1 municipality Dep.
- Al Sadr 2 municipality Dep.
- Al Ghadeer municipality Dep.
- Al Karaadah municipality Dep.
- Baghdad Aljadeeda municipality Dep.
- Al Rasafa municipality Dep.
- Green Zone and Airport road (unit)
- Al Maamel Al Balady (unit)
- Bob Alsham (unit)



Source: SWED, Mayoralty

Fig. 4-1 Administrative Divisions of Baghdad Mayoralty

Baghdad Mayoralty is the entity providing municipal services to the Mayoralty where the Mayoralty is considered a municipality of special type. The Mayoralty is linked directly to the secretariat of council of ministers and the Mayor of Baghdad has a rank equivalent to Minister. The organization structure of Baghdad mayoralty is shown in Fig. 4-2.



Source: Baghdad City

Fig. 4-2 Organization Structure of Baghdad Mayoralty

4.2.2 Organization on SWM

Organizations related to SWM are Solid Waste and Environment Directorate and each municipal department (Hereinafter referred to as "SWED"), and their SWM responsibilities are shown in Table 4-3.

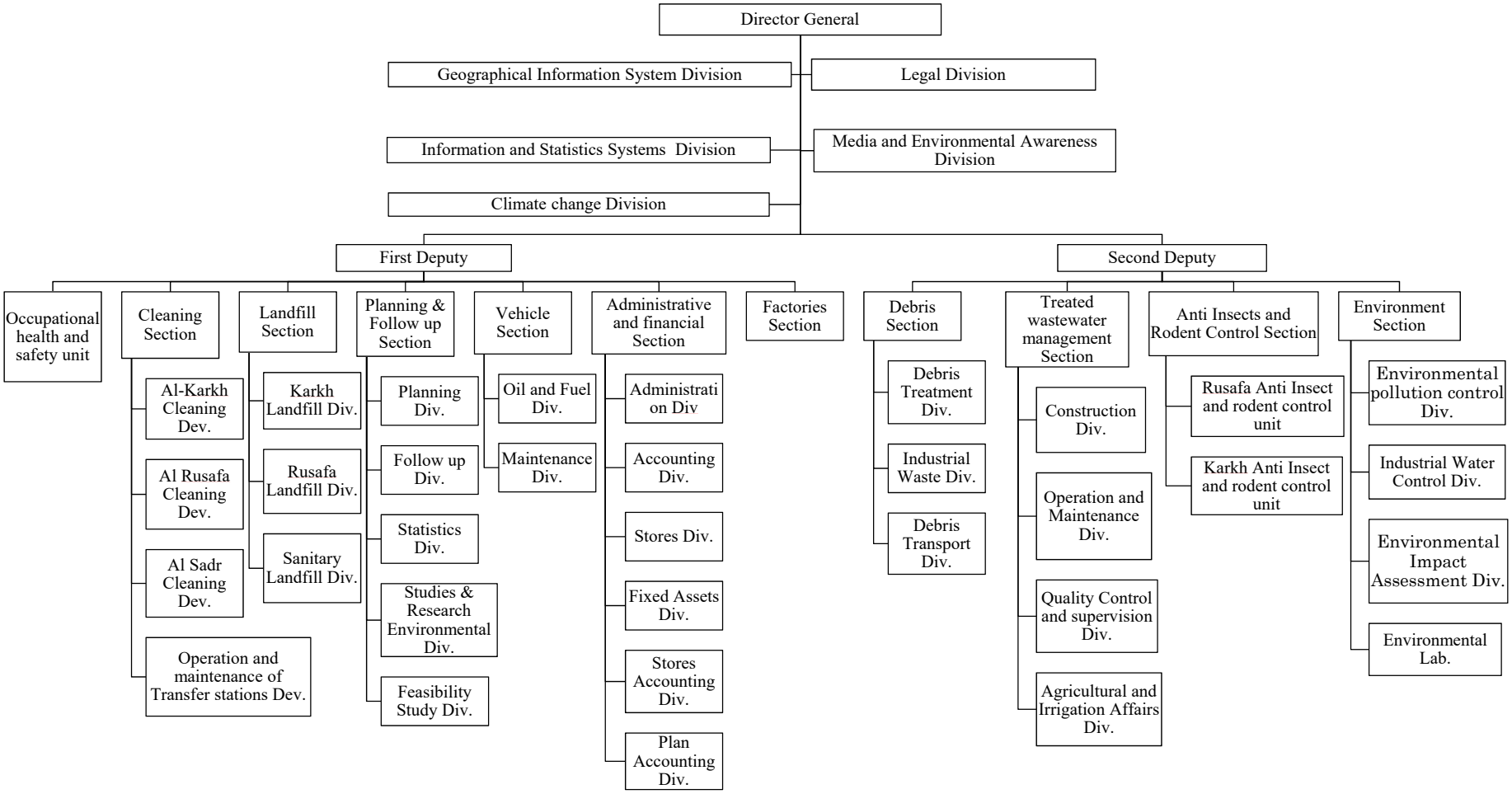
Table 4-3 SWM Organization of Baghdad Mayoralty

Stakeholder	Organization	Responsibility for SWM
Baghdad Mayoralty	Solid Waste and Environment Directorate	▪ Formulations of plans, laws, regulations, standards, etc. ▪ Financing and implementation ▪ Database ▪ Operation of the disposal facilities. ▪ Transporting rubble and industrial waste
	Each Municipal Department	▪ Cleaning activity ▪ Waste collection and transportation ▪ Operation of the transfer stations

Source: Answers of the JST questionnaire

(1) Solid Waste and Environment Directorate (SWED)

SWED has more than 100 employees, and the organization structure is shown in Fig. 4-3.



Source: Answers of the JST questionnaire

Fig. 4-3 Organization Structure of SWED

Tasks and roles of some departments related to SWM of SWED are:

Table 4-4 Task and Role of Some Departments under SWED

Department	Task
Sanitary Landfill Department	The department is organizing the work of the two disposal facilities, renting mechanisms and workers, and following up on waste positions. It consists of several divisions (Al-Karkh Landfill Division, Rusafa Landfill Division, Model Landfill Division)
Environment department	The department is responsible for preserving the environment of the city of Baghdad in accordance with the Iraqi international environmental standards, limitations, and specifications. The department is responsible for monitoring water and air pollution and submitting studies on the environmental effects resulting from sewage stations, hospitals, laboratories, and various factories.
Debris Handling Department	It is responsible for transporting rubble and industrial waste to the designated sites, sorting, and recycling as possible, and dealing with industrial, toxic and hazardous waste according to the established environmental specifications.
Plants Division	It manages and operates the waste sorting plants under construction and follows up on the completion of the remaining works of the waste sorting plants project and the field follow-up of the two plants
Climate Change Division	Preparing studies and research on climate changes, attending workshops and conferences, preparing adaptation plans and strategies for climate, and gas reduction accounts, preparing books and readings, and holding monthly meetings with municipalities.
Planning and Follow-up Section	The department undertakes the task of preparing, following up and coordinating the department's strategic plans, in addition to developing studies and field and development research to combat environmental pollution and maintain the cleanliness of Baghdad. It consists of the following divisions (planning, follow-up, studies and research, economic feasibility study)
Vehicles section	It is responsible for following up the affairs of all the department's vehicles and sanitary disposal facilities in a manner that ensures the required machinery and equipment and maintaining their periodic maintenance. It consists of two divisions (Maintenance Division, Fuel and Oil Division)
Insect and rodent control department	The department does not have a division-level formation, and the department includes a formation consisting of two units, one on the Karkh side and the other on the Rusafa side, whose tasks are to supervise and follow up on rodent control work in the city of Baghdad
Geographical Information Systems Division GIS	Collecting, checking, and entering data, as well as coordinating and collecting the necessary data from municipal departments, producing and printing maps according to the required information, as well as preparing reports, graphs and statistical tables.
Media and Environmental Awareness Division	Documenting and photographing the projects, works and activities of the department, conducting awareness campaigns for schools in partnership with the rest of the municipal departments, and participating in the campaigns of the Department of Rodent and Insect Control within the geographical areas of the municipal departments
Cleaning department	It undertakes the task of planning and coordinating with regard to cleaning work in the departments of the Municipality of Baghdad and consists of the following divisions (Al-Karkh Cleaning Division, Al-Sadr Cleaning Division, Al-Rusafa Cleaning Division, Operation and Maintenance of Transfer Stations Division)

Source: SWED

(2) Municipalities

Municipalities are responsible for all municipal activities including solid waste management. Cleaning divisions in each municipality implement the collection, the transportation of the municipal solid waste and the operation of the transfer stations as well.

The workers have already been trained on the compressors of the formal transfer stations in the manufacturing countries, and there were courses held by JICA in 2020 in the waste management sector, and there are some courses held by Planning and Follow-up Section.

In each municipality of the Mayoralty, there is a Municipal Awareness Division and an Environmental Division whose work is to spread environmental awareness and instruct on how to deal with waste and provide educational materials, especially for the students at all stages, and seek the cooperation of mosques, *Husseiniyas* (Meetinghouse for Muslims), and different segments of the society.

4.2.3 Bylaw and Guidelines Related to SWM

There is no specific bylaw for the SWM in Baghdad Mayoralty. The federal government has several laws and regulations as mentioned in 3.2.2. Baghdad Mayoralty executes solid waste management in accordance with the laws and regulation of the federal government.

4.3 Financial Information

Budget of Baghdad Mayoralty in 2019 was 370 billion IQD composed of own revenue, such as local tax, public service fees and so on. The budget was five times larger than that of Basrah city (77 billion IQD) mentioned in Chapter 5. Baghdad Mayoralty did not provide any replies to the Study's questions on the finances of SWM.

4.4 Policy and Plan Related to SWM

4.4.1 Master Plan for Municipal Solid Waste Management for the City of Baghdad (Draft)

Ministry of health and Environment and Baghdad Mayoralty formulated the "Master Plan for Municipal Solid Waste Management for the City of Baghdad" in 2010.

(1) Objectives

Objectives of the plan were as follows.

- To minimize current and future public health risks
- To minimize environmental impacts/damage from solid waste mismanagement by **timely collection**, **safe disposal/adequate closure/remediation of existing dump site**
- To increase cost-efficiency and establish a well-functioning organization of the Municipal Solid Waste Management system with **adequately trained** staff and clear division of responsibilities
- Reduced littering and improved visual impact – A clean city

(2) Strategy

Strategies of the plan were as shown below.

- **Sustainable development.**
- The prevention principle: Waste generation should be avoided and minimized as far as possible in order to secure conservation of nature and resources.

- **The precautionary principle**: The precautionary principle implies an obligation to take necessary measures to prevent or mitigate impact from waste on human health and environment. Especially hazardous substances in the waste should be avoided.
- **The polluter pays principle (and producers' " responsibility)**: Waste generators, especially producers putting products and packaging on the market, should pay the full costs for collection, transport, waste treatment and disposal.
- **The principle of proximity and self-sufficiency**: Secure an adequate infrastructure by establishing an integrated and appropriate network of disposal facilities. Waste should not be transported from the area unless there are no other options.
- **The waste hierarchy**: The waste hierarchy is shown on the right.

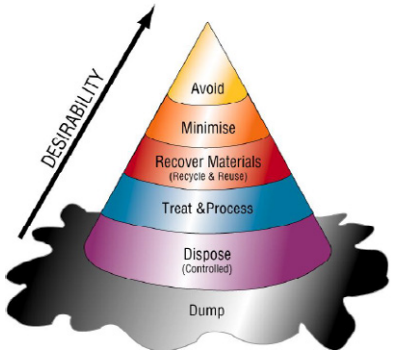


Fig. 4-4 The Waste Hierarchy

(3) Sub-goals

1) Efficient and Environmentally Safe Waste Collection/sanitary Disposal System

To establish a functioning, efficient and environmentally safe waste collection and sanitary disposal system operating under safe working conditions;

- All generated waste in the Baghdad Mayoralty should be collected efficiently regularly and managed properly.
- All municipal solid waste shall be discharged in appropriate containers and collected with specialized compacting vehicles with pay loads of 6-7 tons.
- All areas must have collection at least once a week.

2) Safety Collection and Transportation

Collection and transportation of the waste shall be carried out under good working and environmental conditions.

3) Internationally Accepted Waste Management System

To develop a waste management system based on internationally accepted principles of good waste management practices, the treatment solutions (landfilling, incineration, etc.) should be designed to handle large capacity, each landfill area should be at least 130 ha, the capacity of any incineration facility should be at least 500 000 metric ton per year.

4) Public Awareness

To raise the public awareness of public health and environmental risks and the need for responsible waste management in order to gain public engagement in and national support for improvements in waste management.

5) Remedying for Past Waste Management

To identify, priorities and address significant remedial requirements related to past waste management practices.

6) Operate and Monitor the Waste Management System

To establish the training and development required to build, operate and monitor the waste management system;

- Establish annual waste management/environmental reports by to present current data for waste collection, transportation, treatment and costs, including key indicators for follow-up of system efficiency.

- **Improved collection of waste data.**

7) Efficient Supervision and Enforcement of Waste Management

Efficient supervision and enforcement of waste management from the source to final disposal;

- The disciplining system should be simple to use.
- The level of fines should be a powerful incentive to behave correctly.

8) Private Investment

To introduce **Private Finance Initiative (PFI)/Public Private Partnership (PPP)** principles to waste management procurement by stimulating and encouraging private investment, increased participation of private companies in the waste management operations by introduction of procurement system.

(4) Planning Period

The total planning period is 20 years (until 2030), divided into phases, as follows.

Short-term phase < 5 years; Medium-term phase 5 – 10 years; Long-term phase 10 – 20 years.

(5) Main Goals

- **Recycling rate: 25% (achieved by 2020)**
- **Sanitary Disposal facility: 6 EC (European commission)- standard landfills**
- **Intermediate treatment: High performance EC**- standard waste incinerators with power generation for 1.4 million tons MSW/year (for treatment of MSW and infectious waste from healthcare establishments)

(6) Main Actions and Progress

The main actions of the master plan and their progress is shown in Table 4-5. Baghdad Mayoralty has implemented most of the activities stipulated in the master plan except for source separation.

Table 4-5 Main Actions and their Progress

Master Plan	Progress
Collection/ Transportation (Generation/Discharge) [Short-term] Training for waste collection and transportation workers (private/public) [Medium/Long term] Promotion of waste segregation/collection/waste reduction (Discharge control)	 Short term: There is continuous training to workers and staff. Medium/Long term: pilot projects were conducted in a Slahiyah and Zayona areas, however this initiative didn't continue due to weak management of municipal institutions and since the collected waste is mixed again when collected
Intermediate treatment/Recycling [Short-term] Implementation of the waste segregation/collection pilot project, and a survey to introduce a waste incineration facility and awareness activities [Medium-term] Introducing waste segregation system, application for introduction of incineration facility, and introduction of waste quality improvement system [Long-term] Improvement of incineration plants and	 Request for proposals were issued and several investors submitted offers for WtE projects of which 3 were selected so far and the mayoralty is still evaluating other offers being received. As for segregation, it is still under consideration.

Master Plan	Progress
recycling facilities	
Final disposal [Short-term] Identification of new construction sites for 6 landfill sites and EIA permit application procedure [Medium-term] Procurement of incineration plants (selection of contractor) and construction [Long-term] Appropriate closure of existing disposal facility, and adjustment for planning/construction of new disposal facility	Only two sites were identified which are Al Nabai and Nahrwan landfills. The Mayoralty has got the approval from ministry of health to use Al Nabai landfill until 2022. Other landfills were closed like Abu Ghreib and al Rasheed camp landfills.
Other [Short-term] Introduction of Weighbridge (Transfer Station), environmental awareness/education [Medium/Long term] Environmental awareness/education	Weighbridges are available in all formal transfer stations.

Source: Answers of the JST questionnaire

4.5 Municipal SWM Operation

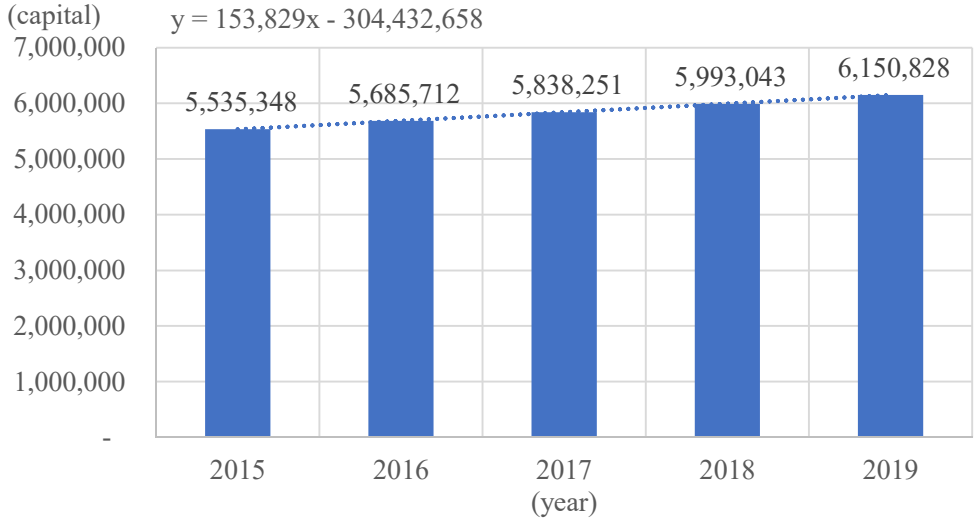
4.5.1 Waste Generation and Composition

(1) Municipal Solid Waste Amount Forecasts

There are two scenarios that the JST considered to forecast the population of Baghdad Mayoralty. The first scenario adopted the annual population estimates published by CSO for the period of 2015 to 2019 and using the growth trend projected the population to the year 2030.

The coefficients of the regression line were calculated by using the least squares method. The equation of the regression line is below, and the regression line is graphically shown in Fig. 4-5.

・The equation of the regression line: y=153,829x -304,432,658



Source: JST estimate using Population Estimation of Iraq 2015 – 2019, (2019), CSO

Fig. 4-5 Regression Line for Population Forecast in Baghdad Mayoralty under Scenario 1

Under the first scenario, the CSO population estimated for 2018 was 5,993,043 (the CSO report

estimates), and the population forecast for 2030 was 7,840,415.

The replies provided by Baghdad Mayoralty to the JST questionnaire indicated that the population of Baghdad City in 2018 was 8,120,000. The source of this figure was a letter provided by the Ministry of Planning to Baghdad Mayoralty. This figure is more than that forecast for year 2030 under the first scenario.

Considering that an official population census has not been implemented for over 20 years, movement of people inside Iraq has become freer, and the data provided by other sources such as CIA data book putting the population of Baghdad City at 7.3 million in 2021, and Wikipedia estimating 7.67 million in 2014 the JST developed the second scenario based on the population (8,120,000) provided by Baghdad Mayoralty. The population forecast in the second scenario was 11,049,035 in 2030 which is estimated using an annual growth rate of 2.6 % which is the same value applied in the first scenario.

The generated waste amount for 2020 was estimated to be 10,427 ton/day based on the information provided directly by Baghdad Mayoralty. Dividing this waste generation amount by the population figures for 2020 under both scenarios, the unit generation rate (Unit generation rate kg/capita/day) was calculated to be 1.65 kg/capita/day under Scenario 1 and 1.22 kg/capita/day under Scenario 2. Using an annual growth rate of 1% to the Unit generation rate in both scenarios, the waste generation amounts in each were estimated. As shown in Fig. 3-7, in the CSO's environmental report, the Unit generation rate in the whole of Iraq is 1.36 kg/capita/day, and Unit generation rate in Baghdad Mayoralty is 1.09 kg/capita/day. As a result of discussions with Baghdad Mayoralty, it was decided that the Unit generation rate of 1.65 kg/capita/day in Scenario 1 was excessive compared to the CSO report, and Scenario 2 was selected.

Unit generation rate of Baghdad Mayoralty in Scenario1: 10,427 ton/day÷6,302,124 people＝1.65 kg/capita/day

Unit generation rate of Baghdad Mayoralty in Scenario2:10,427 ton/day÷8,547,729 people＝1.22 kg/capita/day

Table 4-6 shows the population and waste generation of Baghdad Mayoralty. Using the annual growth rate of 1% as the Unit generation rate of both scenarios, the amount of waste generated in each was estimated.

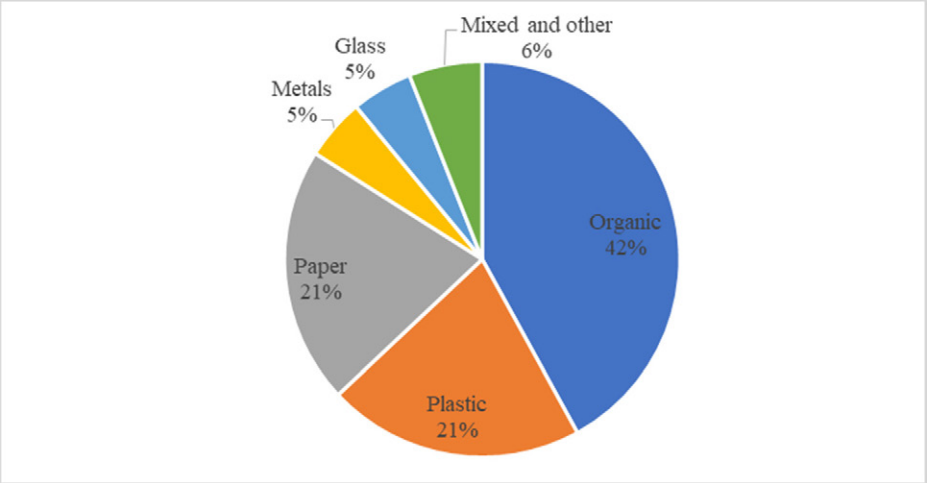
Table 4-6 Population and MSW Generation in Baghdad City

Year	Scenario 1 CSO base			Scenario 2 BM base		
	Population	MSW (ton/day)	UGR (kg/cap/day)	Population	MSW (ton/day)	UGR (kg/cap/day)
2015	5,535,348					
2016	5,685,712					
2017	5,838,251					
2018	5,993,043			8,120,000		
2019	6,150,828			8,331,120		
2020	6,302,124	10,427	1.65	8,547,729	10,427	1.22
2021				8,769,970	10,805	1.23
2022				8,997,989	11,197	1.24
2023				9,231,937	11,603	1.26
2024				9,471,967	12,024	1.27
2025				9,718,239	12,460	1.28
2026				9,970,913	12,912	1.29
2027				10,230,156	13,380	1.31
2028				10,496,141	13,865	1.32
2029				10,769,040	14,368	1.33
2030				11,049,035	14,889	1.35

Source: JST estimate using Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

(2) Municipal Solid Waste Composition

Baghdad Mayoralty has a record of wastes arriving to the disposal facilities for the year 2021 (from January to August) per each municipal department. The implemented survey of waste composition as shown in Fig. 4-6.



Source: Interview to SWED, Baghdad Mayoralty

Fig. 4-6 Waste Composition in Baghdad Mayoralty

4.5.2 Waste Collection and Transportation

(1) Waste Collection and Transportation

Each Municipal Department is responsible for collection of the waste within its borders, primarily municipal waste, scrap and agricultural wastes. And therefore, each municipal department has its own work plans with mostly four shifts of dawn, morning, evening, and night shifts. The municipal departments collected 9,385 ton/day on average of waste by themselves without using private waste collection companies.

Table 4-7 Waste Collection in Baghdad Mayoralty

1) Collection coverage population	85-90% in 2020
2) Execution body	Each municipal department
3) Waste amount collected	9,385 ton/day in 2020

Source: Answer of the questionnaire and online meeting

The unified database that Baghdad Mayoralty relies on is the Baghdad Mayoralty operated vehicle tracking system (GPS). There is a central division in the Planning and Follow-up section under SWED that submits monthly and bi-monthly reports to the municipal departments and accounting division for negligent vehicles that did not go out to work and deducts the wages of the accompanying workers, as well as fuel expenditures for the vehicles in addition to punishing the drivers who carry out open dumping, if any. Even though SWED basically covers all area and residents of the Mayoralty, the department estimates that 10%-15% of municipal solid waste is not collected and transported to the disposal facilities.

The data on the number of trips for each waste collection vehicle (compactors, Six-wheel, Kia (small truck), crane, tanker, etc.), working shifts and days is collected from each municipal department. The data is analyzed, and the municipal departments are required to explain the reasons behind any operational issues that have been identified by the analysis such as vehicles that were not operated or operated for less than the normal operating hours, increased open dumping and not transporting the collected waste to the transfer station or disposal facilities, and frequent vehicle breakdowns, etc.

In 2020 there were 2,378 units of the equipment for solid waste management and other purposes that were directly operated by the Mayoralty. These included the waste collection trucks, waste transfer trucks, mechanical sweepers etc. In addition to the mayoralty's collection trucks allocated to the municipal departments, each municipal department directly leased trucks from the private sector to meet its needs. The total leased trucks were more than 1,000 units in 2020. The typical types of collection trucks operated are compactor trucks (capacities 2 to 7 tons), container carriers (20 tons), dump trucks (10 tons), pick-ups (1 ton).

With regard to the periodic maintenance of the vehicles of Baghdad Mayoralty, there is a specialized workshop under the directorate that repairs and maintains the vehicles in coordination with the relevant municipality. Alternatively, the repair work is carried out by the municipal departments of machineries distributed in the municipalities. As for the leased vehicles, Baghdad Mayoralty is not responsible for any repair or financial costs, except for the cost of transporting waste.

Municipal departments collect waste by themselves and therefore there are no private companies contracted at the present time. Five years ago, Baghdad Mayoralty outsourced waste collection to private cleaning companies in Al Rasafa, Al Karadah and Al Karkh municipal departments. However, the cleaning companies stopped the waste collection service because of the financial difficulties of Baghdad Mayoralty. At that time, budget disbursement from Ministry of Finance to the mayoralty was tentatively stopped and Baghdad Mayoralty was required to pay the contract amount to the companies by the mayoralty's income only such as local taxes, public utility charges and so on. And therefore, Baghdad mayoralty had to suspend the payment amounts to the companies and implement waste collection directly. In general, waste collection cost by the private company is lower than the costs incurred by local governments. As mentioned earlier that 10%-15% of generated solid waste is not collected nor transported, the service level, frequency and collection point etc., may have deteriorated compared to the collection service that was provided by the private companies.

Source: JST

Fig. 4-7 Waste Collection Work

(1) Transfer Stations

There are nine formal transfer stations and 16 informal transfer stations in Baghdad Mayoralty as far as confirmed, as shown in Table 4-8. All solid waste collected in Baghdad Mayoralty is transferred to disposal facilities through the transfer stations regardless of formal or informal ones. Each municipal department operates the transfer stations in their jurisdiction.

Table 4-8 List of Transfer Station (TS)

Municipal Department	Formal TS	Informal TS	Total
Al Khadimiyah municipality Dep.		1	1
Al Dora municipality Dep.	1	1	2
Al Rasheed municipality Dep.	1	1	2
Al Shealah municipality Dep.	1	1	2
Al Mansour municipality Dep.	1	1	2
Al Karkh municipality Dep.		1	1
Al Admiyah municipality Dep.		1	1
Al Shaab municipality Dep.	1	1	2
Al Sadr 1 municipality Dep.	1	1	2
Al Sadr 2 municipality Dep.		1	1
Al Ghadeer municipality Dep.	1	1	2
Al Karaadah municipality Dep.	1	1	2
Baghdad Aljadeeda municipality Dep.		1	1
Al Rasafa municipality Dep.	1	1	2
Green Zone and Airport road (unit)		1	1
Al Maamel Al Balady (unit)			0
Bob Alsham (unit)		1	1
Total	9	16	25

Source: Answer of the JST questionnaire (Baghdad Mayoralty)

Detailed information of each formal transfer station is described in Table 4-9. The formal transfer stations received on average 100 – 270 ton/day of collected waste, much less than the station design capacity of 500 ton/day. The formal transfer stations receive solid waste collected by collection vehicles owned by the Mayoralty.

Mechanical compaction systems are installed at the formal transfer stations to enhance the efficiency of transporting the solid waste to the disposal facilities. Incoming wastes at these stations are weighed, compacted, and then transported to the disposal facilities by specialized vehicles either owned by the Mayoralty or leased vehicles. The stations have fence & gate, administration building, weighbridge and mechanical compactors.

Weighbridge

Unloading platform


Unloading platform


Unloading pit

Compaction machine under the pit

Compaction machine under the pit


Specialized container


Specialized vehicle and container

Source: JST

Fig. 4-8 Al Dora and Al Rasheed Transfer Stations

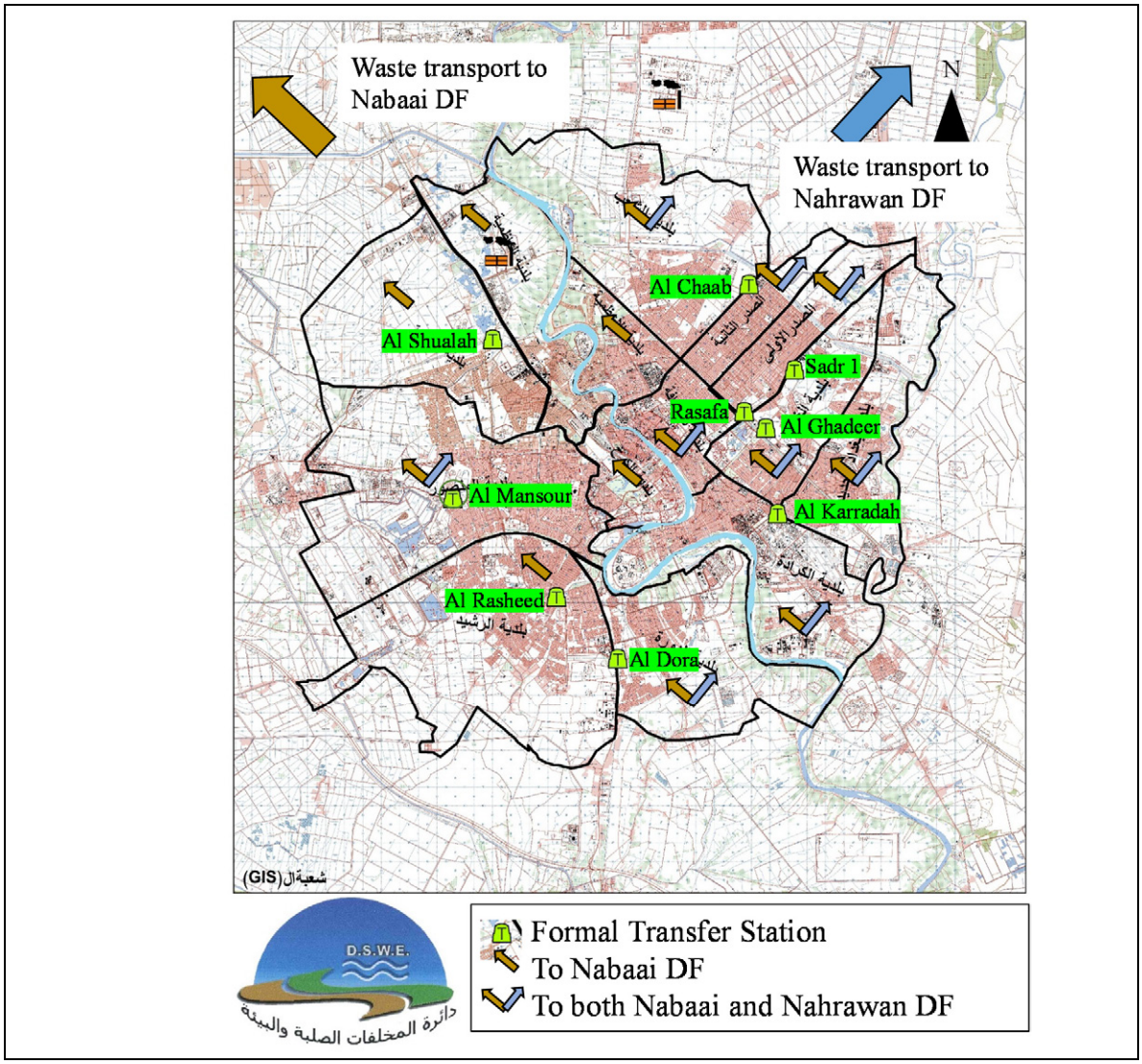
Table 4-9 List of Formal Transfer Station

		Formal Transfer Station								
		Al Sadr 1	**Al Karaadah**	**Al Ghadeer**	**Al Shaab**	**Al Dora**	**Al Rasheed**	**Al Mansour**	**Al Shealah**	**Al Rasafa**
A	**General**									
A-1	What is the entity directly operating transfer stations:									
		Municipality								
A-2	Waste amount entering the transfer station									
	ton/day	100	270	240	200	240	250	260	160	220
A-4	Number of waste pickers at the transfer station									
	person	0	0	0	0	0	0	0	0	0
A-5	Waste types incoming at transfer station by approximate percentages									
		Mixed Waste								
A-6	Is there an operation manual or guidelines for the transfer station operation?									
		There are records of Vehicles and Waste Amount Entering site								
B	**Environmental impacts**									
B-1	Is there a bad odor emitted from the transfer station?									
		No	No	No	No	No	No	No	No	No
B-2	Is there waste scattering or litter from the transfer station to the surrounding areas?									
		No	No	No	No	No	No	No	No	No
B-3	Are there stray dogs or other animals at the transfer station?									
		No	No	No	No	No	No	No	No	No
B-4	Are there complaints by the surrounding public about transfer station operation?									
		No	No	No	No	No	No	No	No	No
B-5	Are there any problems or safety concerns with waste pickers at the transfer station?									
		No	No	No	No	No	No	No	No	No
C	**Additional Information obtained through Questionnaire and Site Visit**									
C-1	Operation starting year									
	Year	2010	2011	2011	2010	2010	2011	2011	2009	2010
C-2	Design Capacity									
	ton/day	500	500	500	500	500	500	500	500	500
C-3	Operating days per week									
	day/week	7	7	7	7	7	7	7	7	7
C-4	Operating hours per day									
	Hr/Day	8 hr/shift	8 hr/shift	8 hr/shift	8 hr/shift	8 hr/shift	8 hr/shift	8 hr/shift	8 hr/shift	8 hr/shift

		Formal Transfer Station								
		Al Sadr 1	**Al Karaadah**	**Al Ghadeer**	**Al Shaab**	**Al Dora**	**Al Rasheed**	**Al Mansour**	**Al Shealah**	**Al Rasafa**
C-5	Available Facility									
	fence and gate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	weighbridge	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Admin building	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-6	Available Plant/Heavy Equipment									
	Waste Compactor	2 (1 + 1)	2 (1 + 1)	2 (1 + 1)	2 (1 + 1)	2 (1 + 1)	2 (1 + 1)	2 (1 + 1)	2 (1 + 1)	2 (1 + 1)
	Waste Container					15	23	21		
	Operational Waste Container					13	21	18		
	Waste Container Lifting Truck	7	7	7	7	7	7	7	7	7
	Operational Waste Container Lifting Truck					6	5	4		
	Container Rail Wagon	7	7	7	7	7	7	7	7	7
	Operational Container Rail Wagon					1	7	5		
	Wheel Loader	No	No	No	No	No	No	No	No	No
	Trucks	No	No	No	No	No	No	No	No	No
C-7	who has access to									
		Municipal Owned Vehicles								

Source: Answer of the JST questionnaire (Baghdad Mayoralty)

Fig. 4-9 shows the locations of the nine formal transfer stations and the directions of the waste collected in each municipality, either to Nabaai DF or to Nahrawan DF, or to both disposal facilities.



Source: Answer of the JST questionnaire (SWED)

Fig. 4-9 Location Map of Formal Transfer Stations

A contract was concluded by Baghdad Mayoralty with the Ministry of Industry and Minerals to establish five formal transfer stations in Baghdad at a total cost 22.5 billion IQD. However, the work is suspended on the project. The Federal Board of Supreme Audit recommended approaching the relevant authorities in order to re-start the project and complete it in accordance with the environmental requirements, as it is one of the important projects and has a clear impact on the health of the citizens by closing the informal transfer stations that spread pollution and diseases. The following table shows the details[10].

[10] Source: Detailed report on the state's policy of municipal solid waste management, 2019, Federal Board of Supreme Audit

Table 4-10 Suspended Project for Construction of Formal Transfer Stations

Station Name	Geographical Location	Municipalities served	Cost (IQD)	Amount Paid (IQD)	Contract Duration	Date of Commencement
Baghdad Al Jadeeda	Alobaidy	Baghdad Al Jadeeda	225,000,000	450,000,000	730 Days	30/1/2014
Al Karkh	Next to Dora Station	Al Karkh				11/2/2014
Al Sadr 2	Kesra & Atash	Al Sadr 2				14/4/2014
Al Adhamiya	Kesra & Atash	Al Adhamiya				14/8/2014
Al Kadhmiya	Abu Jdaiel	Al Kadhmiya				Land receiving delayed due to problems with Ministry of Water Resources

Source: Detailed report on the state's policy of municipal solid waste management, Federal Board of Supreme Audit

In addition to the nine formal transfer stations, there are reportedly 16 informal transfer stations whose locations are not exactly identified. Table 4-11 shows the operation status of the informal transfer stations. Informal transfer stations are operated by the municipal departments. Informal transfer stations do not have mechanical compacters and therefore solid waste is unloaded on the ground in open space by the collection trucks and then re-loaded to larger trucks by wheel loaders. The unloading and re-loading work at the informal transfer stations exposes the neighborhood residents to offensive odors and insects etc.

Table 4-11 Operation Status of Informal Transfer Stations

Operator	Municipal department
Equipment	Wheel Loader(s) and Truck(s)
Facility	No available information
Operation day	7 days

Source: Answer of the JST questionnaire

Source: JST

Fig. 4-10 Informal Transfer Station

SWED does not have accurate records of the waste amounts incoming to the informal transfer stations due to the lack of weighbridges there. According to SWED, UNICEF is donating weighbridges to 14 informal transfer stations.

(2) Street Sweeping

The municipalities sweep the streets using mechanical sweepers, as well as workers. The workers are engaged in primary collection activities as well.

There are 57 mechanical sweepers as shown in Table 4-12 including 4 rented units. The operational capacity of the sweeper is more functional and provides greater economic feasibility than the human effort in terms of production, in addition to eliminating the risks of accidents to the sweeping workers who work on the main streets and highways.

Table 4-12 Number of the Mechanical Sweepers by Municipality

No	Municipality	Number of Sweepers
1	Al Khadimiyah	2
2	Al Dora	3
3	Al Rasheed	5
4	Al Shealah	2
5	Al Mansour	4
6	Al Karkh	5
7	Al Admiyah	2
8	Al Shaab	2
9	Al Sadr 1	3
10	Al Sadr 2	2
11	Al Ghadeer	9
12	Al Karaadah	3
13	Baghdad Aljadeeda	2
14	Al Rasafa	4
15	Al Mentaka and Airport road	5
16	Al Maamel Al Balady	2
17	Bob Alsham	2
Total		**57**

Source: Answer of JST Questionnaire (SWED)

4.5.3 Intermediate Treatment

Baghdad Mayoralty has recently reviewed three investment offers and submitted them to the Ministry of Electricity in order to determine the tariff for sale of electricity generated from the waste using anaerobic digesters. The project will be constructed and operated by the investors.

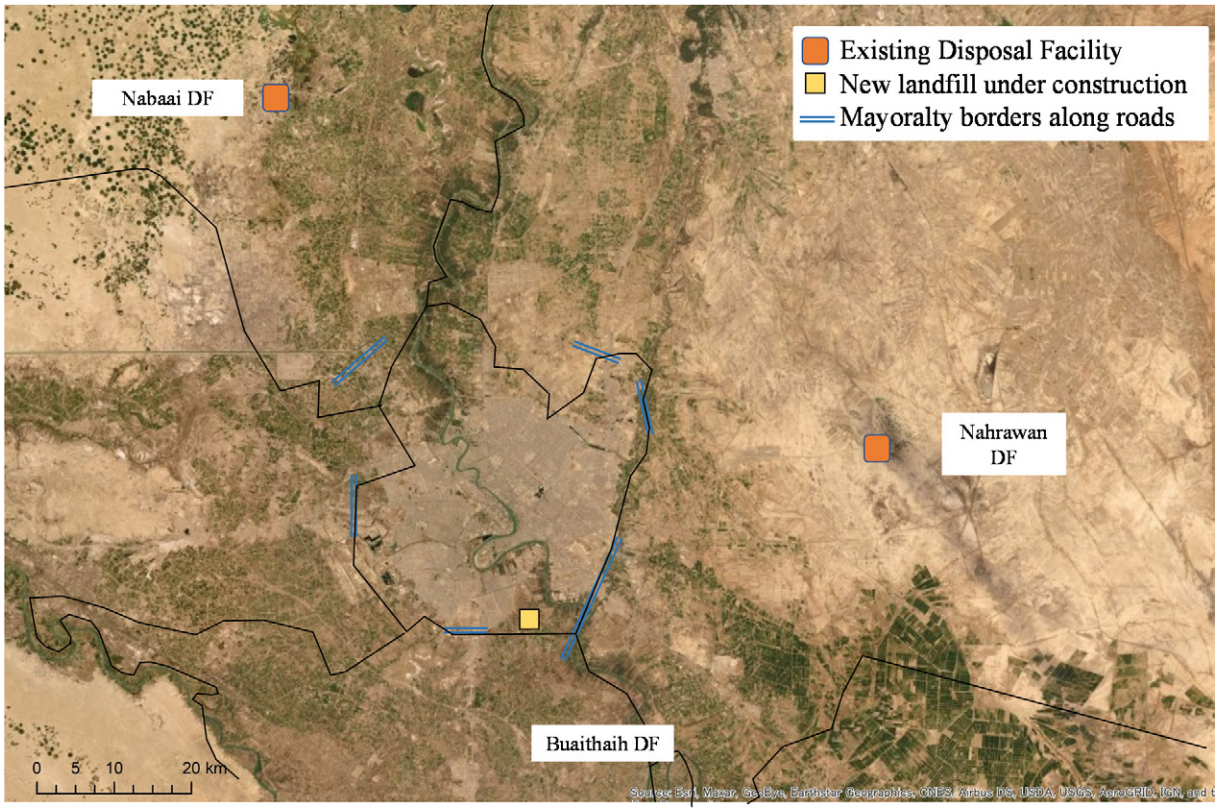
Two intermediate treatment facilities of capacities 1,000 ton/day each are 75% complete but construction has stopped due to problems on the contractor's side. Baghdad Mayoralty is currently seeking to withdraw the works from that contractor and assign a new contractor to complete the construction. In principle the facilities will be run by the mayoralty. The waste will be transported to both facilities in mixed state and separated there. Organic waste will be shred and cut and compost will be created.

Baghdad Mayoralty implements periodic waste composition studies to understand the waste composition and prospects for recycling.

4.5.4 Final Disposal

4.5.4.1 Disposal Facilities for Municipal Solid Waste (MSW) in Baghdad Mayoralty

Baghdad Mayoralty operates three disposal facilities (DF). At present Nahrawan and Nabaai disposal facilities are in operation and Buathaih facility is under construction as shown in Fig. 4-11.



Source: JST

Fig. 4-11 Location of MSW Disposal Facilities Used by Baghdad Mayoralty

Both operating disposal facilities are in neighboring governorates: Nabaai DF is located in Salah El Din governorate and Nahrawan DF in Diyalah governorate. The new disposal facilities, presently under construction, Buaithaih disposal facility is within the boundaries of Baghdad Mayoralty. The amounts of disposed municipal solid waste, based on the data provided by the Baghdad Mayoralty for May 2021, were 1,416 ton/day in Nahrawan DF and 7,969 ton/day in Nabaai DF respectively.

(1) Site Features

Nabaai DF is located 56 kilometers northwest of the city center, and Nahrawan DF is 55 kilometers east of the city center. All waste is arriving at both disposal facilities via transfer stations.

The new Buathaih disposal facility is located at the border of the city, 17 kilometers southeast of the city center[11].

The two operating disposal facilities of Nabaai and Nahrawan lie 40 meters and 35 meters above sea level respectively. The new disposal facility of Buaithaih is slightly lower at 33 meters above sea level[12].

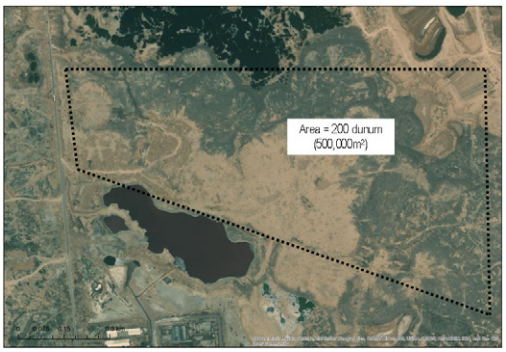
The three disposal facilities lie in the Mesopotamia plain, according to a paper published in 2018[13]. The sediments of the Mesopotamia plain consist mainly of silt and clay: however, locally some depressions occur. They may have some organic soil with silt and clay.

[11] All distances approximate and measured off satellite maps, assuming the truck routes taken
[12] https://en-gb.topographic-map.com/maps/lppy/Baghdad/
[13] Geology of the Euphrates River with Emphasize on the Iraqi Part, Journal of Earth Sciences and Geotechnical Engineering, 2018, Varoujan K. Sissakian, et al. https://www.diva-portal.org/smash/get/diva2:1199711/FULLTEXT01.pdf

(2) Disposal Facility Layout

The three disposal facilities layout plans are shown in Fig. 4-12.

Nabaai DF



Nahrawan DF

Buaithaih LF

The boundaries drawn above for the two disposal facilities of Nabaai and Nahrawan are shown to understand the size of the sites, and do not indicate the exact boundaries of both disposal facilities.

The boundaries for Buaithaih LF are correct.

The three maps are not of the same scale.

Source: JST

Fig. 4-12 Baghdad Mayoralty Three Disposal Facilities

4.5.4.2 Current Situation of the Disposal Facilities

(1) Facilities and Equipment

The facilities available at the two operating disposal facilities are identified in Table 4-13. Both disposal facilities basically have no facilities to mitigate environmental impacts emitted from the disposal operations and ensure the well-being of the site staffs and disposal facility users.

Table 4-13 Facility and Equipment for Nabaai and Nahrawan Disposal Facilities

Facility	Nabaai DF	Nahrawan DF		Facility	Nabaai DF	Nahrawan DF
1. Gate and fence	No	No		13. Weighbridge(1)	No	No
2. Embankment	No	No		14. Gate house/ office(2)	No	No
3. Storm water drainage	No reply	No reply		15. Control building/ office	No	No
4. Waste cell (above GL)	No	No		16. Paved access road	Yes	Yes
5. Waste cell (sub-GL)	Waste is disposed in depressions, and used mines			17. Internal levelled road	Yes	Yes
6. Gas venting	No	No		18. Disposal platform	No reply	
7. Natural liner (clay)	No reply	No reply		19. Tire wash facility	No	No
8. Leachate collection pipes	No	No		20. Site lights	Limited	Limited
9. Leachate pond (tank)	No	No		21. Groundwater monitor wells	No	No
10. Leachate recirculation	No	No		22. Site laboratory	No	No

Facility	Nabaai DF	Nahrawan DF		Facility	Nabaai DF	Nahrawan DF
11. Leachate treatment	No	No		23. Gas collection system	No	No
12. Geomembrane liner	No	No				
Notes: (1) Weighbridges are available and will be installed once disposal facility is safe and secure (2) There is a department recording incoming wastes						

Source: Answer of JST Questionnaire

(2) Operations Indicators

The disposal operations indicators were provided by the counterparts as shown in Table 4-14. Baghdad Mayoralty estimates the remaining capacities of Nabaai DF and Nahrawan DF as 2 years or more, and 3 years or more, respectively.

Table 4-14 Disposal Operations Indicators(1)

Item	Operation indicator	Nabaai DF	Nahrawan DF
A	General		
A-1	What is the entity directly operating the site: Municipality (which Department) or Private sector	Department of Solid Waste and Environment, BM	Department of Solid Waste and Environment, BM
A-2	Waste amount entering the site (ton/day)	7,200 ton/day	2,100 ton/day
A-3	Operating days a week (days/week)	7 days	7 days
A-4	Operating hours per day (hours/day)	16 hours, two shifts	16 hours, two shifts
A-5	Number of collection trucks entering the DF	635 trucks	150 trucks
A-6	Number of waste pickers at the site (person)	Difficult to estimate	Difficult to estimate
A-7	Waste height (meters)	Ground level	Ground level
A-8	Approx. years remaining to dispose waste at the site (years)	More than 3 years	More than 2 years
A-9	Waste types disposed at the site by approximate percentages [Municipal (domestic, commercial, institutional), Hazardous, C&D, Agricultural, Market, Slaughterhouse, Expired goods, etc.]	No reply	No reply
A-10	Utilities available at the site (Power, Water, Communication)	Available, but with limited capacities	Available, but with limited capacities
A-11	Is there an operation manual or guidelines for the site operation?	Records of data are maintained	Records of data are maintained
B	Heavy Equipment(2)		
B-1	Large bulldozer	8 hours/shift, good condition	
B-2	Medium size bulldozer	8 hours/shift, good condition	
B-3	Dump truck	8 hours/shift, good condition	
B-4	Loader	8 hours/shift, good condition	
B-5	Excavator	8 hours/shift, good condition	
B-6	Water tankers	8 hours/shift, good condition	
C	Disposal facility staff by position and number of persons per position		
C-1	Manager	Head of the Disposal Facilities Unit	
C-2	Mechanical engineer	None	None
C-3	Supervisor	1	1
C-4	Foreman	None	None
C-5	Technician	None	None
C-6	Workers	15	7
C-7	Equipment operators	Heavy equipment are rented with the operators	
C-8	Waste recorder	Yes	Yes
C-9	Security	None	None
D	Operational norms at each site		
D-1	Is there a waste disposal platform where trucks discharge the waste?	There are designated areas for waste emptying	There are designated areas for waste emptying

Item	Operation indicator	Nabaai DF	Nahrawan DF
D-2	Are trucks guided to positions in the site for unloading the waste?	Yes	Yes
D-3	How often is cover soil applied over the disposed waste?	Daily	Daily
D-4	Is soil cover material available nearby?	Yes	Yes
D-5	How often does open burning occur?	Sometimes and extinguished	Sometimes and extinguished
D-6	Are there daily records of waste arrivals?	Yes	Yes
D-7	In case of re-circulation how many hours are pumps operated per day?	None	None
D-8	In case of aeration, how many hours is the aerator operated per day?	None	None
D-9	In case of using electric power generator, how many hours is it operated per day?	Depending on working hours	Depending on working hours
D-10	Conditions of internal site roads (width, levelling, slope, etc.)	Fair	Fair
D-11	General conditions of waste slopes	Level and covered with soil	Level and covered with soil
D-12	Are the vertical gas vents continuously extended as the waste disposal progresses?	No vents installed	No vents installed
D-13	Is the storm water drainage system regularly cleared?	Not available	No
D-14	Is the leachate collection system still properly functioning?	Not available	Not available
E	Environmental effects		
E-1	Is there a bad odor emitted from the site?	Yes	Yes
E-2	Is there waste scattering or litter from the site to the surrounding areas?	Partial	Partial
E-3	Are there stray dogs or other animals at the site?	Yes	Yes
E-4	Are there complaints by the surrounding public about disposal operations?	No, DF is far from residential areas	No, DF is far from residential areas
E-5	Impacts of site on surrounding water bodies (rivers, lakes, groundwater)	None	None
E-6	Are there frequent collapses of waste slopes at the site? If Yes, how often?	No	No
E-7	Are there any problems or safety concerns with waste pickers working inside the site?	Yes	Yes
E-8	Are there any environmental tests done related to site operations (water sampling, soil analysis, air samples, mosquito counts, etc.)? If Yes, please describe what tests.	Yes	Yes
E-9	Are there any concerns about the relationship with the residents surrounding the disposal facilities?	Some concerns	Some concerns

F	Operational costs annually	2018	2019	2020
F-1	Salaries	No reply	No reply	No reply
F-2	Fuel & lubricants	No reply	No reply	No reply
F-3	Equipment maintenance	No reply	No reply	No reply
F-4	Consumables' procurement	No reply	No reply	No reply
F-5	Utilities	No reply	No reply	No reply

Source: Answer of JST Questionnaire

The local engineers of JST visited the Nahrawan disposal facility in August 2021. Fig. 4-13 shows some photographs taken during the visit. The local engineers have so far been unable to visit Nabaai disposal facility, due to security conditions there.

	
Continuous burning, waste dumping at edges, no waste cells, waste disposed at different locations in site evident from smoke in different locations, leachate ponds at foot of waste (August 2021)	Lack of cover materials, insufficient waste compaction (May 2021)

Source: JST

Fig. 4-13 Nahrawan Disposal Facility Visit

Some operational issues, identified from the visit and photographs may be summarized as follows:

- Disposing waste from waste edges and pushing the waste into depressions over a wide area instead of constructing a waste cell and confining disposal within the cell, together with compaction and cover application
- Spontaneous burning of the waste which is very difficult to extinguish under the present waste operation especially when disposing waste in different locations of the disposal facility and not concentrating the activity at one location
- Leachate collecting at the waste disposal foot and immediately above the old quarry bed, contaminating the groundwater
- Insufficient and irregular cover soil application over the completed waste disposal layers
- Lack of access control at the disposal site and control house to inspect and weigh the waste entering the site, a situation arising from the concerns of security at the site

(3) Nahrawan DF Rehabilitation Proposal

In September 2020, a USAID team visited the site to make a preliminary analysis and improvement recommendations. Based on the preliminary report[14] that was issued, a rehabilitation plan was presented that would increase the life of the site beyond 2040 if the present some 1,000 ton/day disposed waste amount will increase by about 5% annually and considering soil cover volume and proper compaction. The waste height will be raised to 50 meters. The cover of the report illustrates the concept behind the proposed rehabilitation plan as shown in Fig. 4-14.

[14] Al Nehrawan Landfill Life Extension and Rehabilitation – Preliminary Report, September 2020

Source: Al Nehrawan Landfill Life Extension and Rehabilitation – Preliminary Report, September 2020, Front cover

Fig. 4-14 Concept of Proposed Nahrawan DF Rehabilitation Plan

The rehabilitation plan will transform the disposal facility into a Controlled Disposal facility from its present status of open dumping into depressions and excavated pits and levelling to ground level to developing waste disposal cells and disposing above ground. The improvements will realize the following operation conditions:

- Planned cell development
- Laying of impermeable soil layer
- Improved leachate and surface water management
- Regular soil cover
- Waste compaction
- Gas management
- Groundwater monitoring
- Access control and basic record keeping
- Increased lifetime of the disposal facility

(4) Sanitary Landfill Category

The National Solid Waste Master Plan (NSWMP) for Iraq, 2007 proposed categories of landfill, as shown in Table 4-15. The category of disposal facility is determined by how the facilities available at the site and their operation mitigate the negative impacts on the environment.

Table 4-15 NSWMP Proposed Landfill Categories

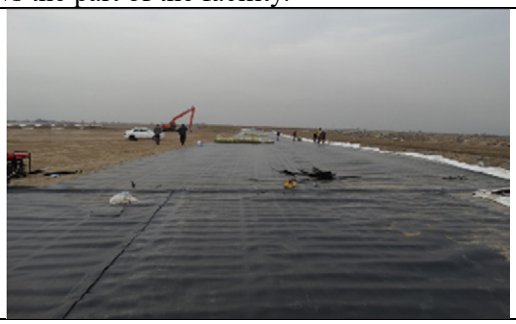
Category	Description
S(1)	Sanitary landfill with full containment, monitoring and landfill gas collection and treatment and leachate management and chemical treatment
A	Controlled, sanitary landfills with full containment and evidence of some form or landfill gas and leachate management
B	Sites with environmental and health protection, these may be retro-fitted to create controlled, sanitary landfill sites
C	Sites with some limited form of environmental and health protection, may continue to be used in the interim period prior to the completed development of controlled landfill sites
D	High risk sites with no form of environmental and health protection and are in need of urgent mitigation measures
E	Wild dumping sites with no management or form of control, sites requiring urgent mitigation measures
Note (1): The JST proposes that a higher-level "Superior" Category be added to promote the development of full sanitary landfills in Iraq.	

Source: JST

We evaluate both disposal facilities of Nabaai and Nahrawan are Category D. While heavy equipment is used at the facilities to spread and compact the disposed waste and soil cover is reportedly applied daily there, there are no other facilities to mitigate the potentially negative impacts of operating a disposal facility on the surrounding environment. The facilities need urgent mitigation measures. The route taken by transfer trucks to reach the Nahrawan DF was changed to avoid residential areas as much as possible.

4.5.4.3 Buaithaih New Sanitary Disposal Facility

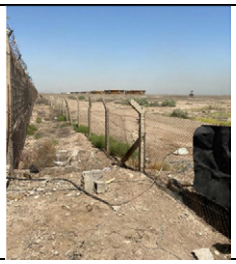
The Buaithaih landfill under construction is the first environmentally approved landfill in Baghdad City and has facilities to meet the requirements of a sanitary landfill site. Buaithaih landfill site is designed as a 5 years life span with daily 1,000 ton/day of incoming waste. In December 2020, Baghdad City / SWED resumed work on the construction of Buaithaih landfill by the Al-Faris Company, a public company affiliated to the Ministry of Industry and Minerals. It consists of one cell with an area of 60 thousand square meters. The site has been compacted and furnished with a geotextile layer, a geomembrane sheet, sand layer 20cm thick, and gravel layer 30cm thick. The cell includes a network of pipes for collecting and draining the leachate produced from the waste outside the cell to sedimentation basins. There are several service buildings on the site in addition to the weighbridge for weighing the trucks before and after emptying into the cell. The goal of this project is the safe and sanitary disposal of solid waste according to global environmental standards to conserve soil and ground water[15]. Fig. 4-15 shows the part of the facility.



Installing liner on the waste cell bed

Installing liner in the leachate pond

[15] Newspaper coverage of interviews with officials in Baghdad Mayoralty

	
Weighbridge and control room	Surrounding fence

Source: JST

Fig. 4-15 Photographs of Facilities under Construction in Buaithaih Disposal Facility (2021)

4.5.5 Baghdad Mayoralty Municipal Solid Waste Material Flow

The information collected to prepare the MSW waste flow for Baghdad Mayoralty (BM), together with the information gathering method is shown in Table 4-16.

Table 4-16 Baghdad Mayoralty MSW Flow Data and Information Gathering Method, Year 2020

Data	Value	Information gathering method
1) Population	8,547,729 persons	2018 population (8,120,000) provided to BM by Ministry of Planning, and an annual growth of 2.6% identified from CSO trends is applied
2) Collected waste amount	9,385 ton/day	Estimated by BM by multiplying collection trucks trip numbers by their haul capacities
3) Waste collection coverage	90%	Estimated by BM

Source: JST

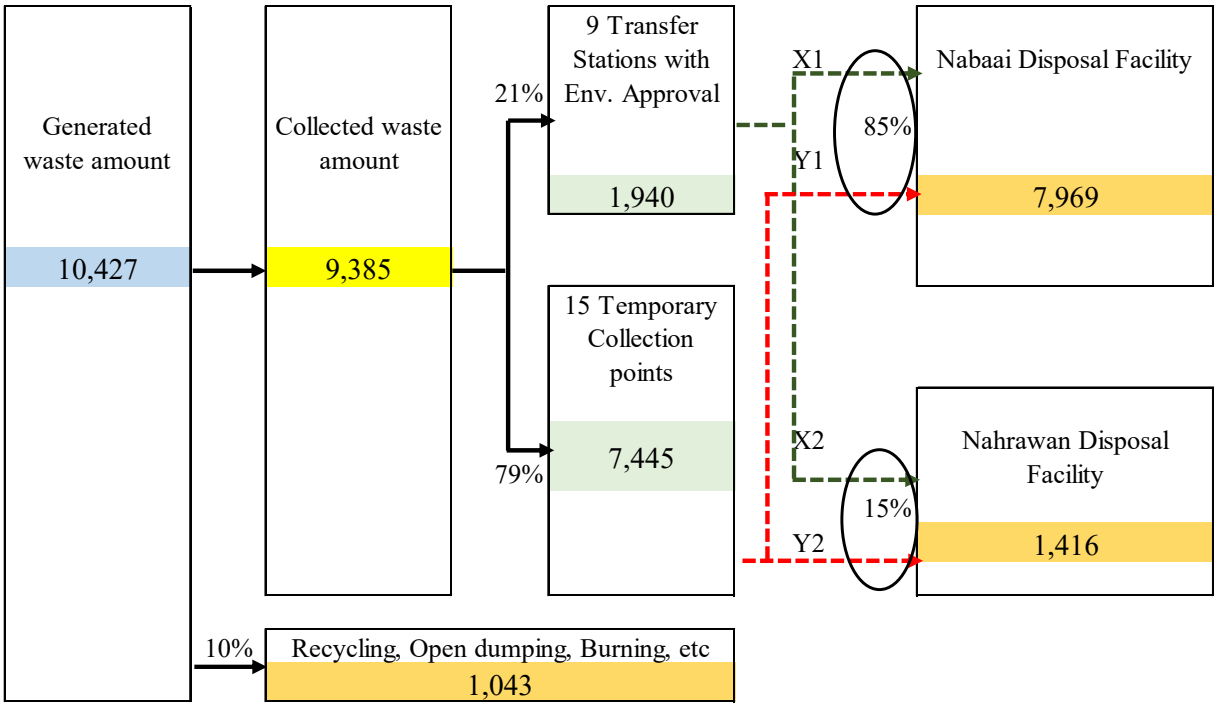
The generated waste amount is calculated to be 10,427 ton/day based on data 2) and 3) shown in Table 4-16.

At present all the waste collected in Baghdad Mayoralty is transported to transfer stations for reloading on to larger semitrailers and trucks for transport to either Nabaai DF or Nahrawan DF.

Transfer stations are both formal and informal and are in all the municipalities.

Weighbridges are available at the formal transfer stations and records are maintained. But there are no weighbridges and no data available data. Therefore, there are some limitations to the waste flow study; it was not possible to study the waste flow by individual municipality and transfer station facility.

The estimated municipal waste flow for Baghdad Mayoralty for 2020 is shown in Fig. 4-16.



Notes:
(1) Collection coverage is 90% of the generated municipal solid waste
(2) 79% of collected waste is unloaded at 15 temporary collection points, while 29% is unloaded at formal TS
(3) 85% of the waste collected is disposed at Nabaai DF and the remaining 15% at Nahrawan DF
(4) Amounts of recyclables salvaged by waste pickers at temporary collection points are unknown
(5) It is not possible to estimate the values X1, X2, Y1 and Y2 because of lack of data

Source: JST

Fig. 4-16 MSW Flow for Baghdad Mayoralty in 2020

The MSW flow of Baghdad Mayoralty indicates the following:

- There is an urgent need to depend on obtaining accurate data from weighbridges at the disposal facilities and transfer stations. BM is aware of this need and working together with UNICEF has procured weighbridges for the two operating DFs and several the informal TSs. Once these weighbridges are installed it will be possible to develop more accurate MSW flows.
- The nine formal transfer stations have a combined capacity of 4,500 ton/day (design capacity 500 ton/day per station) but are being operated at around 43% of that capacity. The formal transfer stations should be utilized to their full capacities to refrain from using of informal and temporary transfer stations.
- There is evidence of some informal recycling ongoing, as a percentage of the uncollected waste is being recycled. There is a need for BM to understand the recycling situation and introduce measures to expand recycling.

4.6 Private Companies Involved in Waste Management

In Baghdad City, several private companies are engaged in waste management as shown in Table 4-17. All MSW collection in Baghdad City is directly managed by the city. Although details have not been confirmed, it is considered that the three companies engaged in collection of wastes generated from

business establishments that are not collected by the city and wastes other than MSW. Of the three companies, Global Company and Bahjat Aladaa Company were engaged in waste collection under contract with the city until 2017. Global Company has 120 waste collection vehicles and 1,200 employees. Bahjat Aladaa Company has 80 waste collection vehicles and 800 employees.

In addition, there is a private company in the city that disposes of hazardous wastes such as petroleum and chemicals (Jawharat Al-Salem Company for disposal and treatment of chemical wastes and general trade ltd.). This company has 32 employees and has been under contract with the Ministry of Higher Education and Technology since 2012 to incinerate petroleum waste, treat and dispose of chemicals and other hazardous waste, and dispose of medical waste.

Table 4-17 Private Companies Involved in Waste Management

Field of Work	Company Name
Waste collection and transportation	Global Company, Bahjat Aladaa Company, Akdeniz Cleaning Services
Treatment of hazardous wastes	Jawharat Al-Salem company for disposal and treatment of chemical wastes and general trade ltd., Medisol

Source: JST

4.7 Impact on Medical Waste Associated with COVID-19

The management of medical waste is under the jurisdiction of the Ministry of Health and Environment. The Ministry of Health and the Environment has not been able to ascertain the actual situation of medical solid waste generation and treatment, and has set up a committee to investigate the situation. According to the preliminary figures of the committee's survey, Baghdad Governorate as a whole generates 67.6 ton of medical solid wastes per day. According to the UNDP report[16], the spread of COVID-19 has led to an increase in the use of disposable medical protective equipment such as masks and gowns, which is estimated to increase the amount of medical solid waste by 1-3 kg per hospitalized patient compared to normal conditions.

4.8 Issues on SWM for Baghdad Mayoralty

JST summarize solid waste management issues in Table 4-18 from three viewpoints, 1) Policy and Plan, 2) Institutional system and 3) Operation.

Table 4-18 Present Situation and Issues on SWM for Baghdad Mayoralty

Sector	Issues
1. Policy and Plan	
① Master Plan	Present situation: The master plan for municipal solid waste management was formulated in 2010. The target area is Baghdad Mayoralty, and the activities are presented over a short, medium, and long term for 20 years. Issue: It has been 10 years since the formulation of the plan, and an interim evaluation of the plan should be conducted in line with changes in the implementation status of the plan and social needs. Issue: The latest population census was carried out in 1987. There is only population projection from 1988.
2. Institutional system	
① Data	Present situation:

[16] The Impact of COVID-19 on Environmental Sustainability in Iraq (February 2021)

Sector	Issues
management	Weighbridges are installed at formal transfer stations, but they are not installed at final disposal facilities or informal transfer stations. For this reason, the amounts of waste collected and disposed are not measured and are estimated from the number of trips. As for estimates of the amount of waste generated, there is room for improvement in the accuracy of the data because surveys for both the unit generation rate (in terms of kilogram per person per day) and the population census have not been carried out in recent years. UNICEF is donating weighbridges to the 14 informal transfer stations. Issue: It is necessary to install weighbridges at the final disposal facilities, or along the routes towards the facilities, if the security conditions do not allow for installing the weighbridges within the facilities that are located outside Baghdad Mayoralty borders. Issue: It is necessary to survey the waste generation amount of waste at the source and grasp the waste unit generation rate. Issue: Data related to SWM, such as collection amount, budget, SWM facilities and so on is stored among some divisions and directorates and is not integrated.
② Collection of waste management fees	Present situation: Waste management fees are collected from businesses but are not collected from residents living in residential areas. Issue: Resolution No. 133 for the year 1996 allows residents living in residential areas to receive waste management services free of charge and fees cannot be collected. It is recommended that the Federal government consider revising this policy and the relevant laws and regulations.
③ Management of the private sector	Present situation: All the solid waste management services are directly implemented by Baghdad Mayoralty. Baghdad Mayoralty is renting waste collection truck, heavy equipment for disposal facility etc. from private companies. Issue: No
④ Training system	Present situation: There is no own training system on solid waste management expect for the training provided by the donors. Issue: In Baghdad Mayoralty, the development of intermediate treatment and final disposal facilities is progressing. In order to operate these facilities properly, it is essential to acquire specialized skills such as creating operation plans and securing sufficient operating expenses. In addition, specialized knowledge and know-how are required to consider prolonging the life of disposal sites, and it is necessary to develop these skills.
3. SWM Operation	
① Street sweeping and waste collection and transport	Present situation: Baghdad Mayoralty directly operates waste collection throughout the city. The service is extended to all the city's population where 9,400 tons of waste are theoretically collected daily. however around 10%- 15% of waste is not collected or is illegally dumped during transportation because of negligence by drivers and workers Issue: It is necessary to improve waste collection rate by educational activities for drivers/site workers and appropriate management.
② Transfer station	Present situation: There are nine formal transfer stations and at least 16 informal temporary transfer stations. Municipal departments operate the transfer station in their jurisdictions. Issue: With regard to informal transfer stations, each municipality operates its informal transfer stations independently. Since informal transfer stations are unsanitary, without environmental approval, and have many problems such as waste scattering and emitting bad odors in the surrounding area, it is necessary to rehabilitate and convert these stations into formal transfer stations.

Sector	Issues
③ Intermediate treatment and recycling	Present situation: In Baghdad Mayoralty, there are no intermediate treatment facilities currently in operation. On the other hand, the city and Federal Government are studying an investment proposal to develop a WtE facility using waste heat, based on proposals from three companies. The purchase prices for the electric power to be generated from the project are under evaluation by the Ministry of Electricity. In addition, two recycling-related are being developed, but construction has stopped due to problems with construction companies. Issue: It is necessary to proceed without delays in implementing the construction of WtE facilities and the two recycling-related facilities currently being promoted. Issue: The central government is investigating the situation of WtE facilities in developed countries and neighboring countries, establish a feed-in tariff system, and create the suitable environment to encourage private companies' investments. Baghdad Mayoralty shall also promote to develop incentives and technical standards for private companies in cooperation with the Federal government.
④ Final disposal facility	Present situation: Baghdad Mayoralty is operating two disposal facilities: Nabaai DF and Nahrawan DF. Both disposal facilities are not environmentally approved, and the amounts of disposed waste in each are 8,000 ton/day and 1,400 ton/day respectively. In addition, the Buathaih sanitary landfill is currently under construction as a disposal facility with environmental approval and is scheduled to start operation in 2022. The planned waste disposal amount at this disposal site is 1,000 ton/day. Issue: The Buaithaih landfill is estimated to have a lifespan of 5 years once it commences operation, with a daily waste disposal amount of 1,000 ton/day. It is therefore necessary to continue using both Nabaai DF and Nahrawan DF in the future. On the other hand, the remaining years of both disposal sites are estimated by SWED to be 2-3 years. The only way to secure waste disposal capacity is to increase the disposed waste height at both disposal facilities and to mine the disposed waste to add to the disposal capacity. Issue: Both Nabaai DF and Nahrawan DF are operating without environmental permissions, and in JST evaluation they are rated as Category D – High risk sites with no form of environmental and health protection. Since it is necessary to continue to use these facilities in the future, operational and facilities improvements must be made with an aim for a higher category. Issue: Both Nabaai DF and Nahrawan DF are located in other municipalities outside of Baghdad Mayoralty. Small municipalities lack the ability to build and operate disposal sites. It is necessary to consider operating these facilities as regional ones and accept the waste of the municipalities where the disposal facilities are located as well as neighboring municipalities.
⑤ Environmental education and public awareness	Present situation: There are very little environmental education and public awareness activities related to SWM and recycling which is being conducted by the media directorates in SWED and municipal institution in collaboration with Mosques, Husseiniya, and schools. Baghdad Mayoralty does not feel any current necessity of the environmental education and public awareness-raising activities because of lack of proper and complete source separation system so far. Issue: A plan related to environmental education and public awareness-raising activities will be prepared and implemented at that time of commencement of the source separation.

Source: JST

Among the issues mentioned in above table, more detailed explanation of some of them are provided hereafter.

4.8.1 Capacity Development of Related Staff and Training System

(1) Raising of the Capabilities on Recycling and Intermediate Treatment

Both recycling and selection of appropriate intermediate treatment systems depend to a great degree on the composition and amount of the generated wastes. It is therefore very important for Baghdad Mayoralty SWM staff to collect the relevant data and continue to conduct the appropriate surveys as they have been doing that will ensure that they understand their waste. Also, in addition to the waste composition surveys Baghdad Mayoralty is presently doing, they also need to implement tests designed to estimate calorific values of the materials that are found in waste and the waste moisture content.

Securing the general public's support is another important element in the success of recycling and implementing intermediate treatment facilities. The public will need to embrace supporting activities such as separation of the waste at source, storing the separated waste in generation places until collection, accepting the construction and operation of facilities in their neighborhoods, and purchase of goods and services made from waste materials. The MSW staff will need to upgrade their capabilities to interact with the public and convince them to become more involved in SWM efforts.

The private sector may be more adequate to construct and operate the related facilities. Contracts will need to be negotiated with related industries both local and foreign, standards set, technical and financial options evaluated, and monitoring of operations and quality control. The SWM staff should be able to implement these tasks.

(2) Development of Disposal Facility Staff Capacities

It is important to have professional engineers and technicians to manage the disposal facility planning and operations. The need for planning of the operation to ensure maximum utilization of the site has already been discussed. Site operation in an environmentally acceptable manner is also essential.

With the proposal to increase the disposal facility lifetime through raising the height of the disposed waste, placing and compaction of waste slopes must be done carefully to avoid slope collapses. Highly trained heavy equipment operators as well as mechanics are needed at the disposal facilities to operate and maintain the heavy equipment, as well as other equipment needed for treatment facilities. Internal burning in the waste layers is a phenomenon often observed at disposal facilities and once more high-quality site staff is required to minimize such occurrences and deal with those that do happen.

Finally, Baghdad Mayoralty will soon be challenged with operating three disposal facilities at higher sanitary standards at the same time, and planning and implementing upgrading works in two of them. The department within Baghdad Mayoralty entrusted with disposal facilities operations will need to be expanded with staff of high degree of technical background and resources for data collection, analysis, and planning.

4.8.2 Waste Collection and Transportation

(1) Improvement of the Formal Transfer Stations and Rehabilitation/reconstruction of the Informal Transfer Stations

There are 9 formal transfer stations and 16 informal transfer stations identified in the mayoralty. The formal transfer stations and the informal transfer stations received 1,940 ton/day and 7,445 ton/day of municipal solid waste as shown in Table 4-19. In comparison with the design capacity 4,500 ton/day (500 ton/day x 9 stations), the incoming waste amount to the formal transfer station is less than half of the capacity. Besides, the incoming waste amounts to the informal transfer stations are around double of the amounts to the formal transfer stations.

Table 4-19 Incoming Waste Amount of Formal and Informal Transfer Station

	No. of TSs	Design capacity (ton/day)	Incoming waste amount (ton/day)	Incoming waste amount per station (ton/day)
Formal transfer stations	9	4,500	1,940	216
Informal transfer stations	16	-	7,445	465
Total	25	-	9,385	-

Source: JST

It is recommended that Baghdad Mayoralty utilize the formal transfer station at the maximum through improving the operation and procuring trailers with specialized containers. It is obvious that the informal transfer stations are contributing more to transporting municipal solid waste to disposal facilities than the formal transfer stations. It is further suggested that Baghdad Mayoralty shall not immediately close the informal transfer stations and shall as much as possible rehabilitate or reconstruct informal transfer stations that meet operational and environmental requirements in terms of their locations and where there is a possibility to introduce some improvements aiming to converting them to formal transfer stations.

4.8.3 Intermediate Treatment

(1) Establishment of a Recycling Unit within SWED

It is recommended that Baghdad Mayoralty setup a dedicated recycling unit within the Solid Waste and Environment Directorate to collect information on the waste pickers active in the city in terms of the waste materials they are salvaging from the waste stream, the quantities of the materials, their buyers and other information. The unit should prepare plans to encourage this activity, improve the working conditions of the waste pickers and introduce processing equipment at the formal transfer stations to mainstream this activity.

(2) Study on Intermediate Treatment

The Baghdad Mayoralty has plans to soon introduce composting and waste-to-energy (WtE) facilities for intermediate treatment. The former is suited to the mainly organic municipal waste generated in Iraq and is affordable but requires large areas and the quality of produced compost needs to be carefully monitored in order to be sought after by farmers, etc. The produced compost may also be used in the green belt project under implementation by the Mayoralty.

On the other hand, WtE facilities such as incinerators and digesters require large capital to construct and highly technical skills to operate. The operation costs are also expensive and therefore it is difficult to recover the costs of construction and operation by the sales of the produced energy. Baghdad Mayoralty needs to work with the Federal Government to introduce incentives to investors interested in working in this sector.

However, it is important to implement feasibility studies both by the government as well as interested private sector enterprises. It is also necessary for the government to develop the technical standards that are essential to safely design, construct and operate these facilities.

4.8.4 Final Disposal

(1) Development of the Buaithaih New Sanitary Landfill

1) Operation Plan

The Buaithaih sanitary landfill is expected to enter service sometime in 2022. An operation plan for the

site should be prepared. This plan will identify the possible number of years to operate the landfill and the required waste disposal depth below ground level and height above the ground. An estimation of the necessary height of waste (23m) to operate the landfill for at least five years has been prepared as shown in Table 4-20.

Table 4-20 Disposal Volume and Waste Height Required for 5-Year Operation

Items	unit	Value
A - Waste disposal at Buaithaih LF		
(1) Total landfill area	m^2	140,000
(2) Area used for actual waste disposal	%	75%
(3) Waste disposal depth + height(1)	m	23
(4) Volume available for disposal	m^3	2,261,506
B - Lifetime of the landfill		
(1) Waste disposed at landfill(2)	ton/year	365,000
(2) Compacted waste density	ton/m^3	0.9
(3) Waste disposal volume	m^3/year	405,556
(4) Cover soil volume (10% of waste volume)	m^3	40,556
(5) Total disposal volume annually	m^3/year	446,111
(6) Number of operating years	year	5
(7) Totdal waste disposed at LF	m^3	2,230,556
Notes: (1) Waste disposal site is sum of depth excavated for disposal below ground plus waste height above ground (2) Waste disposal assumed to be 1,000 ton/day		

Source: JST

Based on this estimation, the operation plan components would be as follows:

- Waste disposed of at the site to be maintained at 1,000 ton/day and a weighbridge shall be provided at the site to record the incoming waste amounts and provide data for calculating the remaining waste disposal volume.
- Waste cells should be constructed to provide for waste disposal height of at least 20 meters.
- The plan shall consider whether to maintain the waste disposal height to around 20 meters height and operate the landfill for five years, or to increase the height more to operate the landfill for a longer period. In case of increasing the height over 20 meters careful consideration should be made to the difficulties both in operating the landfill at the raised height within the available limited area as well as the possible land use after safe closure.
- Sufficient heavy equipment, in terms of number and technical shall be provided to densely compact the waste disposed to achieve an average compaction density of 0.9 ton/m^3 and manage internal operations of the site to the design waste height.
- Operation costs to implement the plan shall be estimated at the commencement of operation, and annual budgets shall be prepared.
- Human resources needed for the landfill operations shall be identified in the plan and secured.

The site manager and staff should be familiar with the operation plan.

2) Environmental Management Plan (EMP)

The Buaithaih LF has been designed and is being constructed as a sanitary landfill, and it should also be operated as a sanitary landfill. An EMP will ensure that the landfill operation is regularly monitored and any negative impacts resulting from the operation are quickly mitigated.

Components covered in the EMP shall include amongst others, the following:

- Sampling and testing of leachate before and after treatment
- Sampling and testing of surface water and groundwater extracted from monitoring wells drilled and maintained for that purpose
- Periodic review of operational records to ensure that cover soil is applied daily over the compacted waste, any complaints are speedily dealt with, and the safety and health of the landfill staff are protected

(2) Improvement of Nabaai and Nahrawan Disposal Facilities

1) Life Span of the Two Disposal Facilities

Baghdad Mayoralty has estimated the remaining life span for the two disposal facilities of Nabaai and Nahrawan to be more than 3 years and 2 years respectively. Basically, the disposal operations in both facilities are implemented by filling in natural depressions, abandoned quarries and excavation works. Disposed waste is levelled to ground level. As reported earlier a USAID study indicated that Nahrawan DF can be used up to 2040 by increasing the disposal height to 50 meters above ground level. JST also studied the disposal heights of both disposal facilities as described hereafter.

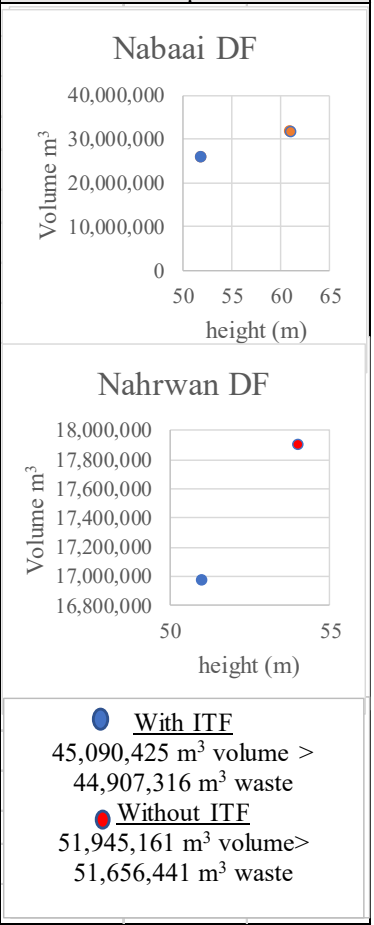
Baghdad Mayoralty has two options on utilizing the existing disposal facilities: one is to continue the present practice of disposal below ground level as much as possible and up to low heights above the ground or to continue to use the disposal facilities by increasing the waste disposal height as much as possible. The first option will entail the immediate search for a suitable site to develop new disposal facilities as well as to prepare and implement the safety closure of the present disposal facilities.

This study recommends that Baghdad Mayoralty shall take the second option to rehabilitate the present two disposal facilities and continue to use them as long as possible. Baghdad Mayoralty reported that they have permission from the Federal Government (Ministry of Health) to operate the Nabaai DF up to the end of 2021, but they are discussing extending this deadline until the intermediate treatment facilities are developed and commence operations.

An example where the waste disposal heights required up to 2030 at both disposal facilities have been roughly computed is shown in Table 4-21. The waste disposal heights required at Nabaai and Nahrawan disposal facilities in order to meet the waste disposal demand in 2030 are 52 meters and 51 meters respectively with the condition of operating intermediate treatment facilities. In this assumption for the first 5 years Buaithaih landfill will also receive the waste up to 2026.

Table 4-21 Waste Disposal Heights Required at Nabaai and Nahrawan DF Up to 2030

Items	unit	Value	Graphs
A - Accumulated waste disposal requirement by 2030			
(1) With Intermediate treatment facilities (ITF)	m^3	44,907,316	
(2) Without intermediate treatment facilities (ITF)	m^3	51,656,441	
B - Nabaai Disposal Facility			
(1) Total landfill area	m^2	1,000,000	
(2) Area used for actual waste disposal	%	75%	
(3) Waste volume already disposed at the DF	m^3	10,928,144	
(4) Waste disposal depth + height[(1)] with ITF[(2)]	m	52	
(5) Waste disposal volume available (w/ ITF)	m^3	25,862,186	
(6) Waste disposal depth + height[(1)] without ITF[(3)]	m	61	
(7) Waste disposal volume available (w/o ITF)	m^3	31,774,439	
C - Nahrawan Disposal Facility			
(1) Total landfill area	m^2	500,000	
(2) Area used for actual waste disposal	%	75%	
(3) Waste volume already disposed at the DF	m^3	647,291	
(4) Waste disposal depth + height[(1)] with ITF[(2)]	m	51	
(5) Waste disposal volume available (w/ ITF)	m^3	16,966,732	
(6) Waste disposal depth + height[(1)] without ITF[(3)]	m	54	
(7) Waste disposal volume available (w/o ITF)	m^3	17,909,215	
D - Buaithaih Sanitary Landfill[(4)]			
(1) Waste disposable volume available	m^3	2,261,506	
E - Coverage of waste disposal requirement			
(1) Waste disposal volume available (w/ ITF)	m^3	45,090,425	
(2) Waste disposal volume available (w/o ITF)	m^3	51,945,161	



Notes: (1) Depth below ground plus height above ground
(2) Around 30% of waste will be deviated from disposal facilities with ITF
(3) Only 10% of the waste will deviated without ITF, through recycling
(4) Waste amount to be disposed at Buaithiah LF fixed so it is not affected by ITF availablity (refer to Table 4-20)

Source: JST

2) Upgrading of the Two Disposal Facilities

The target for upgrading both disposal facilities should be to achieve Category A level (refer to Table 4-15). Studies need to be implemented to understand geological and topography features of the two facilities, identify locations of the disposed waste and disposal heights, surrounding environmental features, etc.

A liner system will be necessary to isolate old waste and new waste cells to be constructed. Based on cost feasibility, the potential to mine old waste and use as cover material shall be investigated. Considering the large areas of the facilities, especially Nahrawan DF it is advisable to develop a phased upgrading plan.

(3) Regional Utilization of Nabaai and Nahrawan Disposal Facilities

Baghdad Mayoralty will continue to depend on sites in the adjacent governorates to develop and operate SWM facilities. It is therefore important to consider the concept of regional SWM facilities where more than one municipality can transport their wastes.

Baghdad Mayoralty has confirmed it is interested in operating regional disposal facilities and has already

suggested this to Baghdad Governorate (which comprises Baghdad Mayoralty and Baghdad Outskirts).

There are many forms for operating regional facilities. One municipality may have the total responsibility for operation and collect tipping fees from other municipalities using the site. Another method would be to form an operating organization of all the municipalities using the facility to operate it. The initial reaction would be the former method as it puts the responsibility solely with one municipality. But in this case, the facilities are located within the boundaries of the governorate or municipality that is benefitting less from the facilities' operation but will be much more affected by the long-term environmental impacts after the site is closed. Any operating arrangement reached by the parties using the facility should not only consider the operation but also the maintenance of the disposal facilities after closure. The maintenance period can last anywhere between 10 and 20 years and require many resources.

It is recommended that the issue of regional management of the disposal facilities be discussed at the time of preparing the upgrading plans. The Federal Government also has a role to play in this regard.

Chapter 5 Solid Waste Management in Basrah City

5.1 General Conditions

5.1.1 Population

The population census is originally planned to be conducted every 10 years in Iraq, however the last census was conducted back in 1987 and since then the population is calculated based on projections of the population.

The current population of Basrah City was estimated to be 1,474,072 for the year 2019.

Table 5-1 Population of Basrah City

City	Total			Rural			Urban		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
Basrah	1,474,072	732,826	741,246	97,939	49,059	48,880	1,376,133	683,767	692,366

Source: Population Estimation of Iraq 2015 – 2019, (2019), CSO

5.1.2 Natural Conditions

Located at an elevation of 2.56 meters above sea level, Basrah has a Subtropical desert climate. The temperature and rainfall annual data (2018) of Basrah are shown in Table 5-2. The average annual temperature is respectively; Basrah (south) 28.2℃, and the average annual rainfall is 21.6mm.

Table 5-2 Temperature and Rainfall Annual Data (2018) of Basrah City

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
Average Temperatures (℃)	14.5	18.3	24.3	26.4	33.3	38.8	40.1	39.3	37.5	29.9	19.8	16.2	28.2
Monthly Rainfall (mm)	0	42.8	4.1	10.9	7.1	0	0	0	0	24	50.4	12	21.6
Humidity (%)	54	53	40	45	30	18	16	18	25	45	73	72	40.8

Source: CSO 2018 Iraq

5.1.3 Economic Condition[17]

According to reference source, Basrah's oil exports constituted around 98% of Iraq's federal revenues in 2019, 'with a monthly average of around USD 6.5bn'. Despite this massive oil export amount, the source observed that poverty and lack of basic services were prevalent in the governorate and were the drivers behind the protests that took place in 2018 and 2019. The population growth rate, the rural-to-urban migration driven by environmental change, the drop in global oil prices and the COVID-19 crisis may have had an impact on the economy of Basrah.

The six main investment performances of Basrah City are oil, gas, chemical plants, housing, and infrastructure.

5.1.4 Security Situation

The security situation in Basrah remains a key issue to be considered by both residents and visitors. The tribal armed conflicts and presence of armed militias beyond the control of the governmental security

[17] European Asylum Support Office (EASO) - Iraq Key socio-economic indicators For Baghdad, Basra and Erbil - September 2020

forces has hindered the stability of the security situation in Basrah.

Large protests occur regularly in Basrah. While many of these demonstrations are peaceful, there have been frequent violent clashes between Iraqi security forces and protesters, resulting in significant casualties including loss of life.

5.2 Institutional and Legal Framework

5.2.1 Organization for SWM

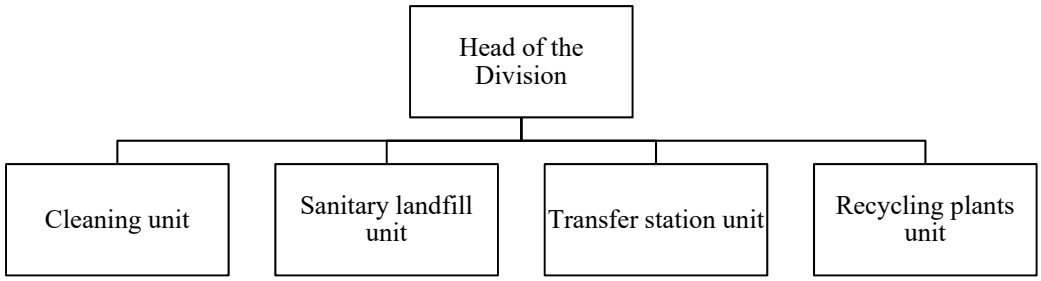
SWM in Basrah City is managed by the Solid Waste and Environment Directorate (hereinafter referred to as "SWED") in Basrah City. The city according to the latest reorganization by the federal government currently falls under the Basrah Governorate administratively. While on a technical level it is linked to General Directorate of Municipalities of MCHMPW.

Table 5-3 SWM Organization of Basrah City

Stakeholder	Organization	Responsibility
MCHMPW	General Directorate of Municipalities	• General Policies and Plans • Laws, Regulations, Standards, Fees, Fines and operation indicators • Treatment and types of projects and their specifications • Strategic projects such as Sanitary Landfills and Intermediate Treatment facilities
Basrah Governorate		• Financing and implementation
Basrah City	Solid Waste and Environment Division	▪ Database ▪ Collection of wastes ▪ Operation of facilities

Source: Answer of JST Questionnaire

Organization structure of Solid Waste and Environment Division is described in Fig. 5-1. The directorate has four units, namely cleaning unit, sanitary landfill unit, transfer station unit and recycling plants unit. The Directorate currently has 370 employees distributed as shown on the organization chart.



Source: Answer of JST Questionnaire

Fig. 5-1 Organization Structure of Solid Waste and Environment Division

5.2.2 Bylaw and Guidelines Related to SWM

There is no specific bylaw for SWM in Basrah City. Basrah City implements solid waste management in accordance with the laws and regulation of the federal government.

5.3 Financial Information

The budget for SWM in Basrah City is supplied from the ordinary budget of Basrah Governorate, according to the budget estimation by the city. Basrah City collects a SWM fee of 2,000 IQD/household per month along with the water bill, as directed by MCHMPW. The annual budget for SWM in 2021 is 42 billion IQD, as shown in Table 5 4, which is about half of the city budget of 82.4 billion IQD.

Table 5-4 Basrah City's Total Budget and SWM Budget

Unit: billion IQD

Item	2019	2020	2021
Total Budget	77.2	80.1	82.4
SWM Budget	50.0	50.0 (actual budget: 46.0)	42.0

Source: Answer of the JST questionnaire (Basrah City)

The unit cost of SWM was calculated as 67.9 USD/ton as shown in Table 5-5, based on the waste collection amount of 1,272 ton/day and the actual expenditure in 2020. According to What a Waste 2.0 (World Bank 2018), Iraq falls into the category of high-middle income countries. The unit cost of SWM for collection, transportation and final disposal in high-middle income countries is in the range of 75 - 165USD/ton. Basrah City's unit cost of SWM is slightly below this range. The average waste collection rate in high-middle income countries is 82%, while Basrah is slightly lower at 76%. This suggests that the unit cost of SWM may also be lower.

Table 5-5 SWM Cost and Cost per Waste Amount Collected

Item	Annual Cost (Billion IQD)	Waste amount (ton/year)	Unit SWM cost	
			(IQD/ton)	(USD/ton)
SWM cost	46	464,280	99,078	67.9

*1: Answer of the JST questionnaire (Basrah City)
*2: Estimation by JST, 365 days x 1,272ton/day (Refer to 5.5.2)
*3: USD 1 = IQD 1,460

What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050, (World Bank, 2018)

Table 5.2 Typical Waste Management Costs by Disposal Type
US$/tonne

	Low-income countries	Lower-middle-income countries	Upper-middle-income countries	High-income countries
Collection and transfer	20–50	30–75	50–100	90–200
Controlled landfill to sanitary landfill	10–20	15–40	20–65	40–100
Open dumping	2–8	3–10	—	—
Recycling	0–25	5–30	5–50	30–80
Composting	5–30	10–40	20–75	35–90

Source: World Bank Solid Waste Community of Practice and Climate and Clean Air Coalition.
Note: — = not available.

5.4 Policy and Plan Related to SWM

5.4.1 Integrated Solid Waste Management Master Plan for Basrah Governorate

United Nations Children's Fund (UNICEF) formulated the "Integrated solid waste management master plan for Basrah governorate" in 2009.

(1) Objectives

- To ensure regular collection of solid waste
- To maximize waste recycling and reuse
- To ensure sanitary disposal of unusable waste
- To promote sustainable livelihoods and income from waste management

(2) Strategy

1) Facilities and Equipment

The plan recognizes that the waste management industry is capital-intensive and that facilities are ultimately paid through government budgets or user charges. Consequently, the Governorate supports the following policies:

- Investment plans will prioritize providing levels of service which meet **basic needs for public and environmental health protection**.
- Higher levels of service---oriented to the convenience of households and other waste generators---will be provided on the assumption that **the beneficiaries will pay** all or most of any additional costs.
- The Governorate will strive to continuously **improve the availability of information relevant to SWM planning decisions**, including data on demographics, waste composition and volumes, and the existing facilities and operations.

2) Management and Operations

The plan aims to continuously **increase the volume and profitability of recycling**. Measures include:

- Promotion, intensification, and expansion of waste stream separation close to the source. These may include investment in segregated waste collection systems, regulatory and economic incentives, public education, and direct or indirect support for sorting industries.
- Technical, financial, and/or policy support for recycling industries.
- Technical, financial, and/or public support for waste markets to stimulate demand and link buyers and sellers.

3) Maintenance of Facilities and Equipment

The Plan's **20-year objective is to ensure sanitary landfilling of all unusable and unused MSW.** Interim measures include the control and eventual closure of existing dumpsites.

4) Financing for O&M and Capital Improvements

Reliable and adequate financing is a necessary condition for an effective solid waste management system. Public services like SWM can be publicly or privately financed. Public finance can come from user charges, municipal general revenues (local taxes), or central-local transfers (derived from taxes, grants, loans, etc.). **User charges** will be set locally rather than nationally so as to better reflect the actual costs and levels of SWM service in the local area.

5) Informed and Cooperative Beneficiaries

No SWM authority can hope to influence individual waste behavior without **an active public education and communications program**. To this end, the plan proposes the following policies:

- The SWM authority will maintain a properly staffed and budgeted **public education and communications program**.
- Systematic communication strategies will be designed to identify appropriate communication media, materials, audiences, and forums for the various messages.

6) Legal and Regulatory Framework

Legal and regulatory measures can influence waste behavior. While legal measures for some SWM matters---**particularly hazardous waste and waste reduction**---must be set at the national level, municipal ordinances and regulations can also contribute to effective and efficient SWM system performance. To this end, the Governorate proposes the following policies:

- The Governorate will set, publicize, and enforce penalties against vandalism or theft of public SWM property, including curbside containers, bins, collection equipment, etc.
- The Governorate may choose to set regulations and ordinances to support waste separation by local residents, businesses, or institutions.

7) Waste Markets

The Governorate recognizes that efficient recycling systems can be adequately organized and operated through market forces and that government can contribute mainly through regulation of environmental and Operational health and safety aspects of recycling and perhaps through market stimulation. The plan proposes the following policies:

- The Governorate will provide technical support to stimulate **waste markets** (includes feasibility studies, design and implementation of waste market information systems, or support for research and development of small-scale recycling technologies).
- The Governorate may provide financial support or economic incentives for feasible and **publicly beneficial** sorting or recycling projects.

(3) Planning Period

Short-term phase: 2009 – 2014

Medium-term phase: 2014 – 2019

Long-term phase: 2019 – 2029

(4) Main Goals

- **Collection rate: 90% (2014)**
- **Sanitary Landfill site: 1 (2014)** * There was no sanitary landfill at the time of planning, and the plan was to close the open-dump site (No. 651 Al Zubayr) and build a new sanitary landfill site (No. 36/2 district 46).
- **Transfer Station: 2 (2014)** * Intermediate treatment had not been officially implemented, only recyclable resources were being collected by the informal sector.

(5) Main Actions and Progress

The main actions of the master plan and their progress is shown in Table 5-6.

Table 5-6 Main Actions and their Progress

Master Plan	Progress
Generation / Discharge [Short-term] Separation of dry and hydrous waste	There is no separation.
Collection/ Transportation [Short-term] Strengthening container collection by increasing the number of workers and introducing equipment [Medium-term] Training for road cleaning worker and introduction of equipment [Long-term] Formulation and implementation of the plan for introduction of necessary equipment	The goal of waste collection rate in 2014 is 90%, however the current waste collection rate is short of the target, at 76%.
Intermediate treatment/ Recycling [Medium-term] Feasibility study by implementing a pilot project for intermediate treatment and recycling facilities [Long-term] Formulation and implementation of the plan for introduction of necessary equipment	There is no F/S on the intermediate treatment and recycling facility. Basrah City has a Recycling Plants Unit under SWED for promoting and developing Intermediate treatment / Recycling facility.
Final disposal [Short-term] Construction of sanitary landfill sites: 1 site [Medium-term] Construction of sanitary landfill sites neighboring intermediate treatment facilities: 1site [Long-term] Formulation and implementation of the plan for introduction of necessary equipment	Rafaaiya landfill site has been operated as a sanitary landfill with environmental approval. Basrah City has a recycling plants unit under the department responsible for solid waste management.
Other [Short-term] Establishment of waste department, personnel and budget allocation planning, accounting system construction, and data management ability training	Basrah City has a Solid Waste and Environment Division which is composed of four units, namely cleaning unit, sanitary landfill unit, transfer station unit and recycling plants unit

Source: Answer of JST Questionnaire

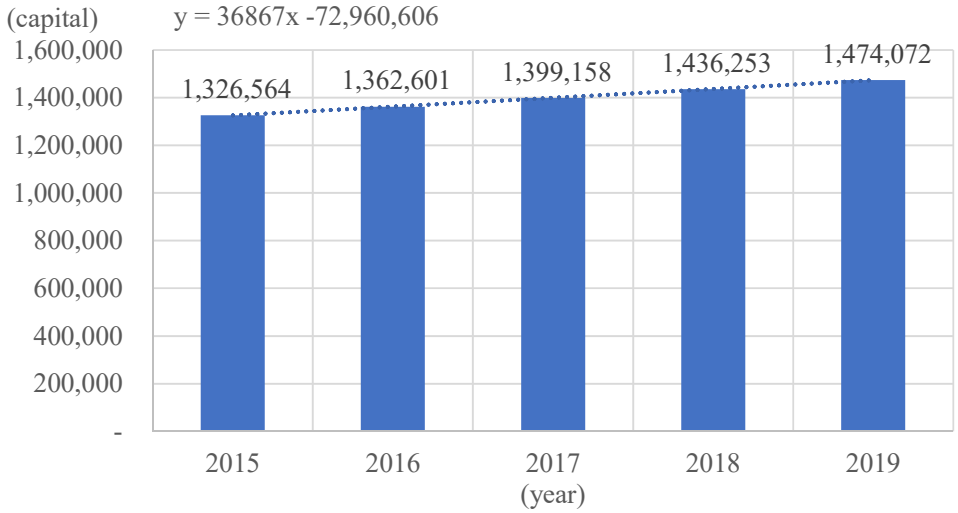
5.5 Municipal SWM Operation

5.5.1 Waste Generation and Composition

(1) Municipal Waste Amount Forecasts

Based on the existing statistics and the master plan, JST projected municipal solid waste (MSW) amount generated after 2020. For the population forecast (2020 - 2030), the estimates for Basrah City (Qadha of Al-Basrah) in Population Estimation of Iraq (2015 - 2019) (CSO) were utilized to determine the regression line as below. The coefficients of the regression line are calculated by using the least squares method. The equation of the regression line is below, and the regression line is shown in Fig. 5-2.

・The equation of the regression line: y=36,867x -72,960,606



Source: JST estimate using Population Estimation of Iraq 2015 – 2019, (2019)

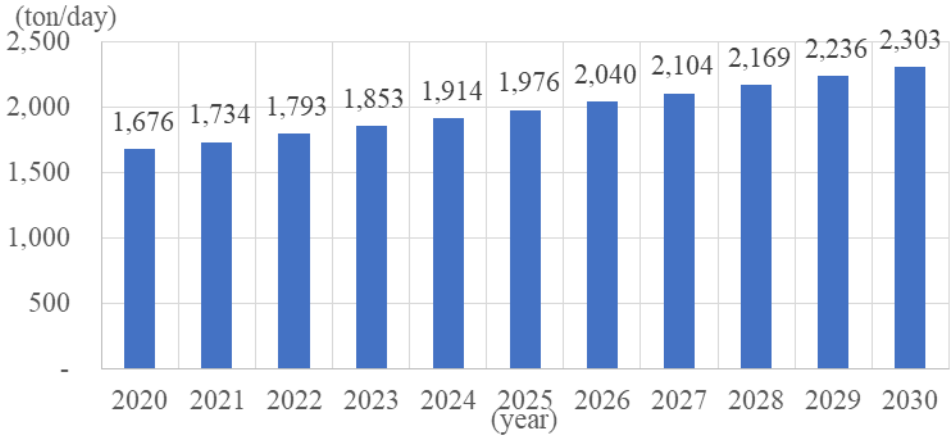
Fig. 5-2 Regression Line for Population Forecast in Basrah City

The total generated municipal waste amount provided by Basrah City was 1,676 ton/day in 2020. By dividing the generation amount over the population, the Unit generation rate in 2020 was calculated to be 1.11 kg/capita/day. The Unit generation rate was assumed to increase by 1% annually. The estimation of the MSW generation amounts is shown in Table 5-7 and forecast of MSW generation in Basrah City is shown in Fig. 5-3.

Table 5-7 Population and Annual MSW Generated in Basrah City

Year	Population	UGR (kg/cap/day)	MSW (ton/day)
2015	1,326,564		
2016	1,362,601		
2017	1,399,158		
2018	1,436,253		
2019	1,474,072		
2020	1,510,330	1.11	1,676
2021	1,547,197	1.12	1,734
2022	1,584,064	1.13	1,793
2023	1,620,930	1.14	1,853
2024	1,657,797	1.15	1,914
2025	1,694,664	1.17	1,976
2026	1,731,531	1.18	2,040
2027	1,768,398	1.19	2,104
2028	1,805,264	1.20	2,169
2029	1,842,131	1.21	2,236
2030	1,878,998	1.23	2,303

Source: JST estimate using Population Estimation of Iraq 2015 – 2019, (2019), CSO and operation data provided by Basrah City.

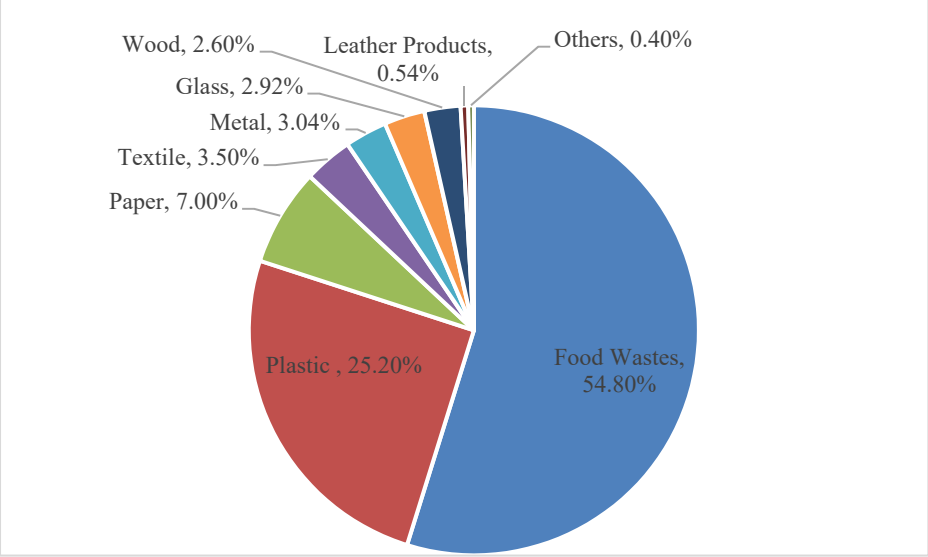


Source: JST estimate using Population Estimation of Iraq 2015 – 2019, (2019), CSO

Fig. 5-3 Forecast of MSW Generation in Basrah City

(2) Municipal Solid Waste Composition

Fig. 5-4 shows the results of a waste composition survey conducted at Babylon University in 2012. According to this survey, the average general waste composition was 54.8% for food waste, 25.2% for plastics, and 7% for paper, with a total of 87% for the 3 types.



Source: Integrated Solid Waste Management for Urban Area in Basrah District Report

Fig. 5-4 Waste Composition in Basrah City

5.5.2 Waste Collection and Transportation

(1) Waste Collection and Transportation Work

Waste amount collected is 1,272 ton/day in 2020 as shown in Table 5-8. Basrah City is divided into seven zones (Rabat, Maqal, Arabian Gulf, Qibla, Al Ashar, Alkhoura, and Al Ghadeer) for the waste collection. Basrah City is outsourcing to the private company of "Ihsan and Artouch" the implementation of daily waste removal from 2 of the 7 zones; Arabian Gulf and Al Ashar, while waste collection in the remaining five zones is the responsibility of Basrah City which uses its own collection trucks and rents additional trucks from the private sector to compensate for the shortage in its trucks. The city has a plan to extend waste collection by private company to three other zones (Rabat, Maqal and Al Ghadeer) bringing the total to 5 zones where waste will be collected by private company.

The residents discharge their waste mixed without source separation and all the waste collected is transported directly to the disposal facility.

Table 5-8 Waste Collection in Basrah City

1) Collection area	Door to door and station
2) Collection frequency	Two shifts (morning and evening)
3) Collection zone	Zones collected by the city: 5 zones Rabat, Maqal, Qibla, Alkhoura, and Al Ghadeer
	Zones collected by the private company: 2 zones Arabian Gulf and Al Ashar
4) Waste amount collected	1,272 ton/day in 2020

Source: Answer of the JST questionnaire (Basrah City)

The collection vehicles Basrah City uses to collect municipal waste from the 5 zones are described in Table 5-9. The city has 219 units of compactor trucks and rents 192 units. The city has a workshop for maintenance of their own equipment, while maintenance of all rented vehicles is the responsibility of the private company leasing them.

Table 5-9 Waste Collection Equipment List

Vehicle type	Number of units (Own vehicle)		Remarks
Waste compactor truck	411	(219)	
Tractors	31		
Mini dump truck	77	(27)	
Shovel Truck	35	(27)	
Large dump truck	102	(77)	
Bulldozers	13	(8)	Disposal facility
Tankers	24	(16)	Water and fuel tanks
Waste compactors	4	(4)	Disposal facility
Total	697	(378)	

Source: Answer of the JST questionnaire (Basrah City)

Source: JST

Fig. 5-5 Waste Collection Work

(2) Transfer Station

There are no operating transfer stations in the city while two formal transfer stations are under construction by the city and governorate budgets. Outline of the two transfer stations is shown in Table 5-10. Basrah City will operate the two transfer stations by themselves. The new transfer stations will be composed of ramp, unloading platforms with compaction machine, sorting line and administration buildings for drivers and workers. According to SWED, Basrah City plans to segregate the recyclables by the sorting line and will sell the recyclables. Construction is reported to be 50% complete in both stations, however the surrounding residents are objecting to the operation of transfer stations in their neighborhood. SWED intends to make more efforts to convince the residents that the transfer stations will be operated in an environmentally sound manner. Once both transfer stations are completed, the efficiency of waste collection is expected to increase, and almost 100% of the generated waste will be brought to the stations for transfer and/or recycling.

Table 5-10 Outline of the New Transfer Stations in Basrah City

Station Name	Capacity	Area	Location	Status (Formal or Informal)
Hamdan Station	850 ton/day	8,000 m^2	Near Hamdan Industrial Area	Formal
Al Qaem Station	850 ton/day	8,000 m^2	Al Qaem Street, Jihad Neighborhood	Formal

Source: Answer of the JST questionnaire (Basrah City)

Source: Answer of the JST questionnaire (Basrah City)

Fig. 5-6 Transfer Stations under Construction

5.5.3 Intermediate Treatment

At present there are no activities for intermediate treatment implemented by Basrah City or the private sector.

There is a Recycling Plants Unit in the city's SWM organization. The presence of this unit is promising: the city has not completely put aside recycling.

Takamol project of USAID is reportedly active in promotion of public awareness on waste reduction and recycling, but the city recognizes that more efforts are required.

Waste pickers are active in the city, which sometimes creates a problem for the waste collection and street sweeping operations. They salvage plastics, cardboard, glass bottles, electrical appliances, etc. from the waste and sell them to informal processing plants. The processed materials are then sold to businesses locally and in Kurdistan. The municipality does not have numerical information on these activities. However, the waste pickers presence indicates that there is demand for recycling of salvaged materials from the waste stream.

5.5.4 Final Disposal

5.5.4.1 Disposal Facility for Basrah City Municipal Solid Waste

There is one disposal facility used for MSW management by Basrah City. This disposal facility can be called a sanitary landfill and has environmental approval. It is the second sanitary landfill in operation in Iraq after the Kirkuk sanitary landfill.

Source: Answer of the JST questionnaire

Fig. 5-7 Location of MSW Disposal Facility used by Basrah City

The Basrah City disposal facility is in the neighboring municipality (*Qadha*) of Zubair, 45 to 50 kilometers from the city center and is referred to as Rafaaiya landfill. It is owned by Basrah City.

According to a study implemented in 2016[18], this area known as the Al-Barjesia region is about 5-10

[18] A selection study for sanitary landfill site at Basra City, south of Iraq, Wathiq A. Al-Ramdhan, et al, Journal of Life Sciences 10 (2016) 198-202, April 2016

meters above sea level, while the depth of the groundwater ranged from 15-25 meters, which is a relatively good depth from the landfill bed to the groundwater. The soil was sandy with a permeability of 0.75-0.84 mm^3/min indicating the need for liner construction.

The disposal facility is located on a total area of about 24 hectares, as shown in Fig. 5-8. Basrah City reported that the disposal facility waste disposal design capacity was 1,575,000 m^3, however a more detailed estimation has been made by the JST, as discussed in section 5.8.3 hereafter.

As a new disposal facility in the future, a state-owned land 20 km west of the existing disposal facility is listed as a candidate construction site. Basrah City is waiting for the allocation of the state-owned land by the Ministry of Petroleum, which manages the land.

Note: lengths are approximate and have been measured off satellite maps
Source: Answer of the JST questionnaire

Fig. 5-8 Layout of Rafaaiya landfill site

5.5.4.2 Landfill Facilities

The facilities available at the landfill are identified in Table 5-11.

Table 5-11 Facilities and Equipment at Rafaaiya Landfill Facilities

Facility	Y/N		Facility	Y/N
1. Gate and fence	Yes		13. Weighbridge	Yes
2. Embankment	Yes		14. Gate house/ office	Yes
3. Storm water drainage	Yes		15. Control building/ office	Yes
4. Waste cell (above GL)	No		16. Paved access road	Yes
5. Waste cell (sub-GL)	Yes		17. Internal levelled road	Yes
6. Gas venting	No		18. Disposal platform	Yes
7. Natural liner (clay)	Yes		19. Tire wash facility	Yes
8. Leachate collection pipes	Yes		20. Site lights	No
9. Leachate pond (tank)	Yes		21. Groundwater monitor wells	No
10. Leachate recirculation	No		22. Site laboratory	No

Facility	Y/N		Facility	Y/N
11. Leachate treatment	No		23. Gas collection system	No
12. Geomembrane liner	Yes			

Source: Answer of the JST questionnaire

5.5.4.3 Landfill Operation

The disposal operations indicators were provided by the counterparts as shown in Table 5-12.

Table 5-12 Disposal Operations Indicators

Item	Operation indicator	Description
A	General	
A-1	What is the entity directly operating the site: Municipality (which Department) or Private sector	Basrah City
A-2	Waste amount entering the site (ton/day)	1,200 ton/day(1) 1,300-1,600 ton/day(2)
A-3	Operating days a week (days/week)	7 days
A-4	Operating hours per day (hours/day)	6AM to 1PM – waste disposal 1PM to 6PM – mainly compaction and soil cover application
A-5	Number of collection trucks entering the disposal site	442 trucks
A-6	Number of waste pickers at the site (person)	None
A-7	Waste height (meters)	About 8 meters below ground and 5.5 meters above(2)
A-8	Approx. years remaining to dispose waste at the site (years)	Approx. 5(1) – 10 years(2)
A-9	Waste types disposed at the site by approximate percentages [Municipal (domestic, commercial, institutional), Hazardous, C&D, Agricultural, Market, Slaughterhouse, Expired goods, etc.]	Municipal wastes mainly Special cells for expired goods(2)
A-10	Utilities available at the site (Power, Water, Communication)	All three available
A-11	Is there an operation manual or guidelines for the site operation?	No reply
B	Heavy Equipment(2)(3)	
B-1	Backhoe	2 units
B-2	Steel roller compactor	1 unit
B-3	Kawasaki Wheel loader	2 units
B-4	Chain loader	1 unit
B-5	Bulldozer	6 units
B-6	Fire fighting vehicles	2 units
B-7	Tanker vehicles	3 units
B-8	Isuzu dump truck	4 units
B-9	Isuzu container truck	2 units
B-10	Trucks	4 units
B-11	Pick-up vehicles	2 units
C	Disposal facility staff by position and number of persons per position	

Item	Operation indicator	Description
C-1	Manager	1
C-2	Mechanical engineer	None
C-3	Supervisor	3
C-4	Foreman	1
C-5	Technician	None
C-6	Workers	15
C-7	Equipment operators	17
C-8	Waste recorder	5
C-9	Security	4
D	Operational norms at each site	
D-1	Is there a waste disposal platform where trucks discharge the waste?	Yes
D-2	Are trucks guided to positions in the site for unloading the waste?	Yes
D-3	How often is cover soil applied over the disposed waste?	Once weekly
D-4	Is soil cover material available nearby?	Yes
D-5	How often does open burning occur?	Rarely
D-6	Are there daily records of waste arrivals?	Yes
D-7	In case of re-circulation how many hours are pumps operated per day?	No recirculation
D-8	In case of aeration, how many hours is the aerator operated per day?	No aeration
D-9	In case of using electric power generator, how many hours is it operated per day?	17 hours
D-10	Conditions of internal site roads (width, levelling, slope, etc.)	Poor
D-11	General conditions of waste slopes	1 H 2 V
D-12	Are the vertical gas vents continuously extended as the waste disposal progresses?	No vents installed
D-13	Is the storm water drainage system regularly cleared?	No
D-14	Is the leachate collection system still properly functioning?	No reply
E	Environmental effects	
E-1	Is there a bad odor emitted from the site?	Yes
E-2	Is there waste scattering or litter from the site to the surrounding areas?	No
E-3	Are there stray dogs or other animals at the site?	Yes
E-4	Are there complaints by the surrounding public about disposal operations?	Rare
E-5	Impacts of site on surrounding water bodies (rivers, lakes, groundwater)	None
E-6	Are there frequent collapses of waste slopes at the site? If Yes, how often?	No
E-7	Are there any problems or safety concerns with waste pickers working inside the site?	Yes
E-8	Are there any environmental tests done related to site operations (water sampling, soil analysis, air samples,	No

Item	Operation indicator	Description		
	mosquito counts, etc.)? If Yes, please describe what tests.			
E-9	Are there any concerns about the relationship with the residents surrounding the disposal facilities?	Yes		
F	Operational costs annually	2018	2019	2020
F-1	Salaries	No reply	No reply	No reply
F-2	Fuel & lubricants	No reply	No reply	No reply
F-3	Equipment maintenance	No reply	No reply	No reply
F-4	Consumables' procurement	No reply	No reply	No reply
F-5	Utilities	No reply	No reply	No reply
Note: Replies to Survey questionnaire provided by (1) Basrah City Directorate (refers to 2020), (2) Sanitary Landfill Unit, Basrah City (refers to 2021) (3) All heavy equipment units are rented.				

Source: Answer of the JST questionnaire

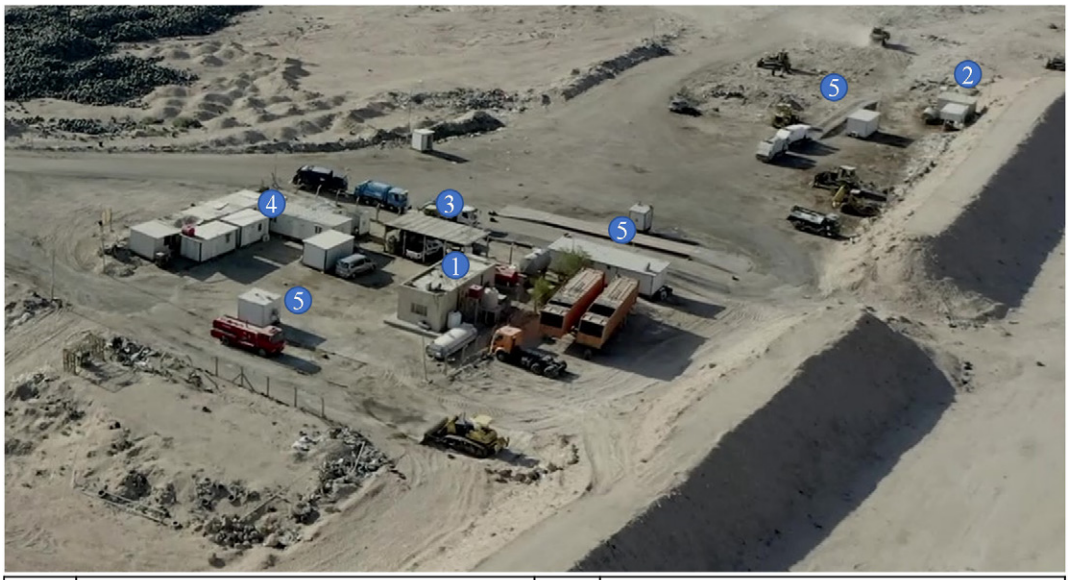
Waste picking is prohibited at the site, to ensure the safety of the disposal facility staff and landfill operations do not face delays. All heavy equipment units at the disposal facility are rented with the operators. The Municipality staff at the disposal facility supervise the heavy equipment work. The rent includes the operators and their salaries, fuel for the equipment and their maintenance and repairs.

5.5.4.4 Disposal Facility Management and Waste Inspection Area

The waste disposed at Rafaaiya landfill is generated within Basrah City. The disposal facility does not receive any waste from the municipality it is located in or from other municipalities of Basrah Governorate. The arriving waste is inspected and weighed at the administrative area. Hazardous wastes are not accepted for landfill at the disposal facility.

However, some waste categories, other than MSW are accepted at the disposal facility such as wastes from seaports, hospitals (non-hazardous portion), and petroleum related industries wastes. These wastes are recorded separately from the municipal solid waste in the disposal facility records.

The disposal facility management and waste inspection area is shown in Fig. 5-9.



1	Administration bldg., 2 rooms, 1 bathroom	4	Multipurpose caravans
2	Heavy equipment garage	5	Four weighbridges
3	Generator shelter		

Source: Answer of the JST questionnaire

Fig. 5-9 Disposal Facility Management and Waste Inspection Area

There are four weighbridges at the site. The largest weighbridge can weigh up to 100 tons. There is one office inside the site where all the data from the weighbridges are managed. All arriving trucks are collection trucks; presently no transfer stations are in operation in Basrah City. The collection trucks are weighed twice, at arrival and departure to and from the landfill. The two large trailer trucks in the photograph (Fig. 5-9 above) behind the administrative building are parked at the site for future use when the transfer stations presently under construction commence operation.

The arriving waste trucks are directed to the designated areas where they unload the hauled waste. Wheel loaders are used to place and spread the waste in layers after which the waste layer is compacted. Soil cover is applied once a week on the disposed waste.

According to Basrah City officials, the city's financial difficulties have delayed payments to contractors, delaying the ongoing construction of the new waste cell. A new procurement list for heavy equipment has also been prepared, but so far no budget has been allocated. Until the procurement is possible, Basrah City will continue to rent heavy equipment from the private sector. There is a lack of training to improve the capacity of landfill staff, and landfill specialists are also required.

5.5.4.5 Waste Cells

Photographs of the new waste cell under construction are shown in Fig. 5-10.

	
Waste cell under construction	Leachate basin under construction

Source: JST

Fig. 5-10 Waste Cell Construction

(1) Cell Construction

The first cell (200m x 200m) was constructed by UNICEF and started operation in 2011. The second cell (200m x 400m) was constructed in 2014 and commenced operation in 2015. A third cell (55,000 m^2) is presently under construction.

A soil embankment is constructed around the cells' perimeters with a height of 5.5m, slope of 1 V (vertical) to 2 H (horizontal) and a top width of 4m. The cell beds are excavated to a depth of around 8 meters below ground level. Accordingly, the total disposal height initially prepared at cell construction is about 13.5 meters.

The volume provided for waste disposal and soil cover by the three waste cells is reported by Basrah City to be sufficient to operate the disposal facility for the coming five to ten years.

(2) Liner System

A liner system has been constructed at the bed of each waste cell in five (5) layers as follows (layer 1 bottom to layer 2 top):

Layer 1	Subbase (mixed gravel) type compacted to a thickness of 20 cm
Layers 2 and 3	Placing and compacting fine soil layer to a thickness of 20 cm. Then above that a second soil layer is placed and compacted to a thickness of 20 cm each (total 40 cm)
Layer 4	1 sheet of HDPE membrane of 2.5 mm. It is an impermeable liner to obstruct the flow of the leachate into the soil below the cell.
Layer 5	Graduated gravel layer to a thickness of 40 cm surrounding the leachate pipes network. It acts as a filter layer to direct the leachate to the leachate pipes network

(3) Leachate Collection and Treatment System

A network of perforated UPVC pipes collect the generated leachate and drain it to a covered leachate basin. Every few months the sludge at the bottom of the basin is cleaned out and transported to the sewage treatment plant for treatment there. The sludge is not disposed of at the disposal facility.

5.5.4.6 Sanitary Landfill Category

The Rafaaiya disposal facility falls short of satisfying all the requirements of Category A, because there

is no form of landfill gas management provided. Leachate is managed through installed natural and artificial liners made from Clay layer and HDPE membrane and pipe network for collection of generated leachate, storage at the leachate basins and periodic removal of the sludge that settles in the basins and transport it to a sewage treatment plant. Strict control of incoming wastes may prevent the disposal of hazardous wastes at the site and thereby reduce the fear of production of toxic leachate at the disposal facility which would require more complex chemical treatment of the leachate, than the aerobic treatment available.

Vertical gas vents were not installed in the site, however considering that the more difficult leachate mitigation measures have been provided, for the purpose of this study, the Rafaaiya disposal facility is designated as Category A, while highlighting the requirement to install vertical gas vents.

5.5.5 SWM Material Flow

The information collected to prepare the MSW waste flow for Basrah City, together with the information gathering method is shown in Table 5-13.

Table 5-13 Basrah City Waste Data for Year 2020

Data	Value	Information gathering method
1) Population	1,510,330 capita	Trend of CSO population estimates for 2015 to 2019 applied to estimate 2020 population
2) Unit Generation Rate (UGR)	1.25 kg/cap/day	Estimated by Basrah City (method unclear)
3) Generated waste amount	1,676 ton/day	Estimated by Basrah City (method unclear)
4) Collected waste amount (ton/day)	1,272 ton/day	Weighbridge at disposal facility

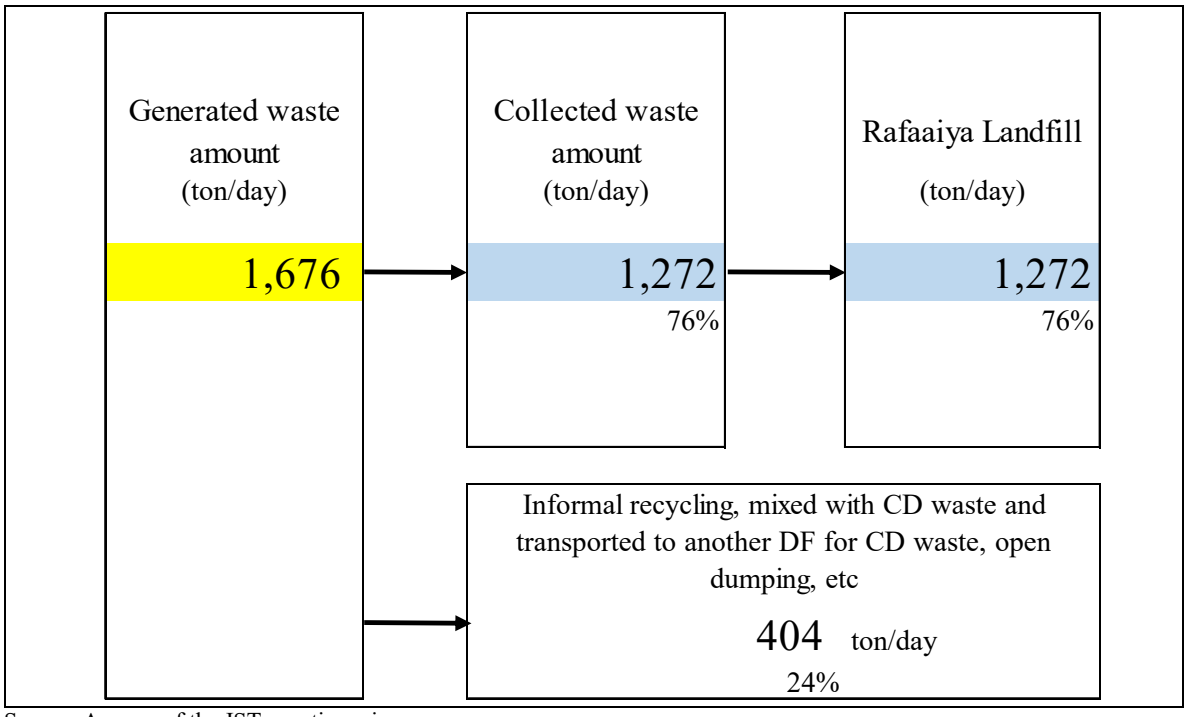
Source: Answer of the JST questionnaire

Of the four data shown in the table, the most reliable one is 4) the collected waste amount as it was measured using weighbridges at the disposal facility and covers only MSW collected from Basrah City. On the other hand, both 1) and 2) are related to waste generation amount. If the Unit generation rate shown in the Table, of 1.25 kg/capita/day is multiplied by the population of the city, the product should be the waste generation amount. However, this amount of 1,888 ton/day (1.25 x 1,510,330/1,000) is more than the amount of 1,676 ton/day, also provided by Basrah City (Data 3)).

The collection rate is 76% (=1,272/1,676) in case of using the waste generation amount (element 3) of 1,676 ton/day but falls to 67% in case of using the amount of 1,888 ton/day generated as explained above.

Basrah City has clarified that the collection coverage rate is not as low as 67% and that the value provided for the Unit generation rate may also contain non-municipal wastes. Accordingly, it was decided to use the data for 1) population, 3) generated waste amount, and 4) collected waste amount as shown in the table. Unit generation rate 1.11 kg/capita/day which is calculated dividing Generated amount 1,676 ton/day by population in Basrah City was adopted to the following figure.

Fig. 5-11 shows the solid waste material flow for Basrah City for the year 2020. Seventy-six (76%) percent of the generated waste is collected and transported directly to the disposal facility.



Source: Answer of the JST questionnaire

Fig. 5-11 Basrah City Solid Waste Material Flow in 2020

The MSW flow of Basrah City indicates the following:

- The lack of transfer stations and utilization of only one disposal facility distant from the city center have contributed to the lower collection coverage rate.
- There are no intermediate treatment facilities.
- It is difficult to determine the outcome of the uncollected MSW, however Basrah City has indicated that open dumping is limited to certain areas of the city such as empty construction plots in new housing areas and informal housing areas.
- There is a need to understand the recycling situation and make efforts to promote recycling in order to divert waste from the disposal facility.
- Basrah City should implement waste generation surveys at least once annually to determine the MSW unit generation rates. The survey should cover all MSW generators; residents, commercial activities, institutions, and open spaces.

5.6 Private Companies Involved in Waste Management

In Basrah City, several private companies are engaged in waste management as shown in Table 4 17. Two of the collection companies, Arabian Guld and Al Ashsr, are currently engaged in waste collection under contract with Basrah City. However, according to Al Ashsr, they are still in a difficult situation as they have only received three months of payment for last year. JST was able to identify three private companies engaged in recycling, but two of them are out of business. A company, State Company for Fertilizers, treats industrial wastewater to recover urea. It also collects and transports industrial wastes from factories.

Table 5-14 Private Companies Involved in Waste Management

Field of Work	Name of Company
Collection and Transportation	Arabian Guld, Al Ashsr, Atrouch
Recycling	State company for Fertilizers, State company for iron and steel (out of business), State company for petrochemicals (out of business)

Source: JST

5.7 Impact on Medical Waste Associated with COVID-19

The management of medical waste is under the jurisdiction of the Ministry of Health and Environment. The Ministry of Health and the Environment has not been able to ascertain the actual situation of medical solid waste generation and treatment, and has set up a committee to investigate the situation. According to the preliminary figures of the committee's survey, Basrah Governorate as a whole generates 17.6 ton of medical solid wastes per day. According to the UNDP report[19], the spread of COVID-19 has led to an increase in the use of disposable medical protective equipment such as masks and gowns, which is estimated to increase the amount of medical solid waste by 1-3 kg per hospitalized patient compared to normal conditions.

5.8 Issues on SWM for Basrah City

JST summarized solid waste management issues in Table 5-15 from three viewpoints, 1) Policy and Plan, 2) Institutional system and 3) Operation.

Table 5-15 Present Situation and Issues on SWM for Basrah City

Sector	Issues
1. Policy and Plan	
① Master Plan	Present situation: There is a draft master plan for municipal solid waste management which was formulated in 2008. The target area is the entire governorate of Basra, and the plan activities are presented in short-, medium- and long-term horizons over 20 years. Issue: More than 10 years have passed since the formulation of the plan, and an interim evaluation of the plan should be conducted in accordance with changes in the implementation status of the plan's proposed activities and social needs. Issue: The latest population census was carried out in 1987. There is only population projection from 1988.
2. Institutional system	
① Data management	Present situation: Since weighbridges are installed at the disposal facility, it is possible to grasp the amounts of waste collected and disposed. As the amount of waste generated has not been surveyed (in terms of unit generation rate) and the census has not been conducted in recent years, there is room for improvement in the accuracy of the data. Issue: It is necessary to survey the generation amount of waste at the source and grasp the unit generation rate (kilogram per person per day). Issue: Data related to SWM, such as collection amount, budget, SWM facilities and so on is stored among some divisions and directorates and is not integrated.
② Collection of	Present situation: Based on the instructions of MCHMPW, Basrah City collects a monthly waste disposal

[19] The Impact of COVID-19 on Environmental Sustainability in Iraq (February 2021)

Sector	Issues
waste management fees	fee of 2,000 IQD / household together with the water fee. Issue: No issues.
③ Management of private sector service providers	Present situation: Basrah City has entrusted waste collection in two of seven areas of the city to a private waste collection company (the contract with the private company ended in August 2021 and the city is presently considering to announce a new tender for the two areas in October). In the future, the city is also considering entrusting the collection services to private companies in three more areas. Issue: The new tender for the two areas is delayed because of the budget disbursement from the governorate,
④ Training system	Present situation: There is no own training system on solid waste management expect for the training provided by the donors. Issue: In Basrah City a transfer station is under construction, and the time is approaching to consider the remaining lifespan of the sole disposal facility and develop a new disposal facility. These activities require specialized knowledge and know-how, which need to be developed.
3. SWM Operation	
① Street sweeping and waste collection and transport	Present situation: The city is divided into seven divisions, operations in five of which are directly managed by Basrah City, and the remaining two divisions are outsourced to private contractors. The waste collection amount is estimated to be 1,272 ton/day, and the waste collection rate is 76% of the generated waste amount. Issue: The waste collection rate is only 76%, and the remaining 24% of uncollected waste is dumped in open areas or burnt. There is an urgent need to strengthen the waste collection capacity and to improve the collection coverage rate.
② Transfer stations	Present situation: The Rafaaiya landfill is located outside the city, about 40 km from Basrah City center, and there are no transfer stations currently in operation in Basrah City. Two transfer stations are under construction in Basrah City. Both are formal transfer stations with design capacity of 850 ton/day each. However, the residents near the new transfer stations are objecting on the operation of these facilities. Issue: In order to increase the collection and transportation capacity, it is necessary to get the consent of the surrounding residents and speed up the present slow construction progress, avoiding further delays.
③ Intermediate treatment and recycling	Present situation: There are no interim or recycling facilities currently in operation or planned. On the other hand, a Transfer Station &Recycling Plants Unit exists in SWED organization, which is in charge of SWM. Issue: For future facility development, it is important to regularly survey the waste amount and composition of Basrah City, collect information on intermediate treatment technologies, and eventually conduct a feasibility study on the intermediate treatment processes suitable for Basrah City's waste conditions.
④ Final disposal	Present situation: The waste of Basrah City is disposed of in Rafaaiya landfill. The landfill area is 24 hectares, and the remaining lifespan is estimated by SWED to be from 5 to 10 years. Already, the landfill has obtained environmental permission. Although the landfill does not have chemical treatment for the leachate generated at the site and relies only on biological treatment, JST has evaluated the landfill as Category A – Controlled, sanitary landfill sites, because it is equipped with a liner system and leachate collection pipe network. Issue:

Sector	Issues
	The remaining capacity of the Rafaaiya landfill is estimated by JST to be from 5 to 10 years, and it is time to consider the construction of a new disposal site. Even though Basrah City and Basrah Governorate failed to develop a regional disposal facility that receives not only Basrah City waste, but also the waste of the municipality where it is located, as well as neighboring municipalities, they may consider the regional disposal facility again. Basrah City found a potential site for developing new disposal facility. However, there is no guarantee that the resources to develop the new disposal facilities will be readily available, therefore the Rafaaiya landfill operation should be prolonged as much as possible. It is necessary to reconsider waste disposal height and mining of disposed waste in order to effectively utilize the site to the maximum.
⑤ Environmental education and public awareness	Present situation: USAID's Takamol project is engaged in activities to reduce the generation of waste and raise awareness on recycling. And Media unit of the city implements PR activities. Issue: In cooperation with the Takamol project, it is desirable for Basrah City to strengthen and develop its own awareness-raising activities. For that reason, it is necessary to formulate a plan for environmental education and public awareness.

Source: JST

Among the issues mentioned in above table, more detailed explanation and recommendations have been made for some of them as described hereafter.

5.8.1 Capacity Development of Related Staff and Training System

As mentioned in 4.8.1, Basrah City also needs to develop the skills of staff regarding "recycling and intermediate treatment" and "final disposal" and a training system for that purpose.

5.8.2 Intermediate Treatment

(1) Fact-finding Survey of the Waste Pickers by Recycling Unit

It is recommended that the recycling unit of Basrah City collect information on the waste pickers active in the city in terms of the waste materials they are salvaging from the waste stream, the quantities of the materials, their buyers and other information. The unit should prepare plans to encourage this activity, improve the working conditions of the waste pickers and introduce processing equipment at formal transfer stations to be constructed in the future to mainstream this activity.

5.8.3 Final Disposal

(1) Development of a New Sanitary Disposal Facility

The municipality has indicated that the Rafaaiya landfill has a lifetime of 5 to 10 years and is already searching for a site to develop a new sanitary landfill.

To develop a new sanitary landfill, it is necessary to follow a transparent process to obtain understandings from residents. That process will ensure the new sanitary landfill is technically appropriate both in terms of construction and operation, mitigate any negative effects that the new landfill will have on the surrounding natural and social environment, and gain the support of the public as much as possible. The process will differ from one country to another and if done properly may take anywhere from 3 to 5 years. The process may be summarized as follows:

1. Develop the criteria for selection of the site for the new landfill
2. Prepare the technical standards of the disposal facilities and operation
3. Implement natural and social surveys for the proposed sites and prioritize the most suitable sites

4. Implement an initial environmental examination (IEE) to prepare the short list of sites or the selected site
5. Prepare the site layout plan, basic design, and environmental management plan (EMP)
6. Implement an Environmental Impact Assessment (EIA) of the site based on the national standards as well as any specific additions related to landfills
7. Hold public meetings with stakeholders to explain the project and gain support and understanding for its implementation
8. Identify the technical specifications of the heavy equipment and other equipment required for landfill operations (such as generators, aerators, weighbridges, landfill gas and leachate treatment equipment, etc.)
9. Prepare the budget for construction and procurement of the equipment
10. Initiate the tendering process after preparing the tender documents, inclusive of either detailed designs or preliminary designs (based on tender type) and identifying the qualified contractors
11. Commence construction and equipment procurement tendering
12. During construction commence training of available staff and hiring of new staff for the site operation

(2) Extension of Disposal Facility Utilization Period

It is difficult to secure sites for disposal facilities and the cost of construction of sanitary landfills is high. Furthermore, it takes time to implement a new disposal facility project. Therefore, it is better to operate the existing disposal facility for the longest time possible.

Two concepts may be considered to extend the life of the disposal facility. The first concept would be to increase the disposed waste height. Another concept would be to mine the waste in the closed Cells 1 and 2 and use in Cell 3 as cover material, and utilize the mined area as the new cell. The first concept provides more disposal space than the second one and is more efficient. It is studied here in more detail.

Under some assumptions, as shown in Table 5-16, the cumulative waste disposal amount when operating the Rafaaiya disposal facility until 2030 was calculated. The cumulative waste disposal volume between 2021 and 2030, including both the waste and soil covering materials brought into the disposal site, is estimated to be 8 million m^3, and it is necessary to secure this capacity.

For this estimation value, the waste generation prediction described above in the same chapter is adopted. Improvements in SWM were assumed as follows; waste collection rate will improve to 100% by 2024 considering the expected commencement of operation of the two new transfer stations in 2022, recycling rate (amount of waste collected but diverted from disposal facility to recycling) will grow to 12% by 2029, and waste compaction at the disposal facility will achieve compacted waste density of 0.9 ton/m^3.

Table 5-16 Waste Disposal Volume Required Up to 2030

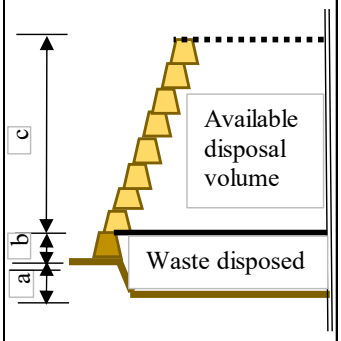
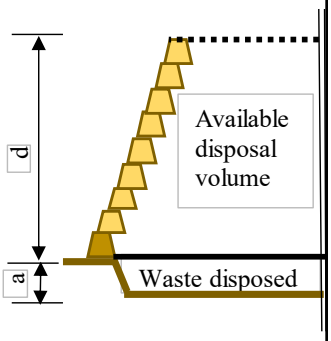
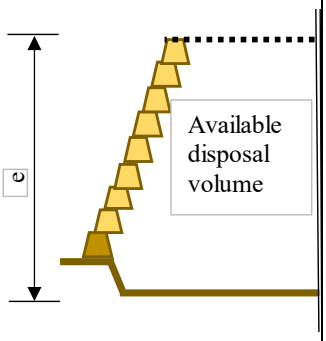
Items	unit	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1. Basrah city population	capita	1,547,197	1,594,688	1,636,679	1,680,059	1,724,504	1,770,079	1,816,862	1,864,926	1,914,238	1,964,848
2. Unit generation rate	kg/cap/day	1.12	1.13	1.14	1.15	1.17	1.18	1.19	1.20	1.21	1.23
3. MSW amount generated	ton/day	1,734	1,793	1,853	1,914	1,976	2,040	2,104	2,169	2,236	2,303
4. Waste collection rate	%	80%	90%	95%	100%	100%	100%	100%	100%	100%	100%
5. Recycling rate	%	1%	2%	3%	5%	6%	7%	8%	10%	12%	12%
6. Waste disposal amount - daily	ton/day	1,370	1,578	1,705	1,819	1,858	1,897	1,936	1,952	1,967	2,027
- annual	ton/year	500,022	575,961	622,316	663,797	678,131	692,367	706,501	712,606	718,109	739,806
7. Compacted waste density	ton/m^3	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
8. Waste disposal volume	m^3/year	555,580	639,957	691,463	737,553	753,478	769,297	785,001	791,784	797,899	822,006
9. Cummulative waste disposal volume	m^3	555,580	1,195,537	1,886,999	2,624,552	3,378,030	4,147,327	4,932,328	5,724,112	6,522,011	7,344,018
10. Cover soil volume (10% of waste volume)	m^3	55,558	119,554	188,700	262,455	337,803	414,733	493,233	572,411	652,201	734,402
11. Total Cummulative waste disposal volume	m^3	611,138	1,315,090	2,075,699	2,887,007	3,715,834	4,562,060	5,425,561	6,296,523	7,174,212	8,078,420

Source: JST

The approximate cross sections and dimensions of the three waste cells of Rafaaiya disposal facility are

shown in Table 5-17. The cells have been designed to provide a height of 13.5 meters. This height is composed of excavating below the ground level to a depth of 8 meters and constructing an embankment surrounding the cells to a height of 5.5 meters above ground level.

Table 5-17 Remaining Disposal Area in Rafaaiya Disposal Facility

Item	unit	Cell 1	Cell 2	Cell 3
1. Cell disposal conditions	not to scale			
2. Area	m^2	40,000	80,000	55,000
3. Height	m	a = 8m (disposal completed) b = 5.5m (disposal completed) c = 44.5m	a = 8m (disposal completed) d = 50m	e = 58m
4. Remaining disposal volume	m^3	1,413,324	3,338,617	2,477,548
		7,229,489		

Source: JST

Disposal to the design height has been completed in Cell 1 and for Cell 2 the waste disposal has been completed up to the ground level. Cell 3 is under construction and may be completed by the end of 2021. If the design depth + height of 13.5 meters is maintained, then the remaining disposal volume for the three cells will be 1,069,768 m^3. Referring to the forecast cumulative waste disposal volumes (8 million cubic meters) shown in Table 5-16, the disposal facility will be full by mid-2022, just short of two years from now. On the other hand, for the disposal facility to secure 7,229,489 m^3 of the remaining disposal capacity which equivalent to utilize the disposal facility up to 2029, the waste disposal height must be increased by 42.5 meters above the design height, i.e., 58 meters including 8 m underground.

The effect of adding additional height to the present embankment design height of 5.5m is shown in Table 5-18. Adding 9.5m, and thereby having a total disposed waste height of 15 meters above ground level would extend the life of the disposal facility to the 2nd quarter of year 2024. Given the time to complete the process of developing a new sanitary disposal facility, this is the minimum height that needs to be considered. On the other hand, delays in the process may require extending the disposal facility life further, reaching a disposed waste height of 26 meters by 2025 or 31 meters by 2026.

Table 5-18 Relationship between Disposed Waste Heights and Disposal Facility Age

1. Disposed waste height above GL	m	5.5	12.0	15.0	20.0	26.0	31.0
2. Additional waste height above GL+5.5	m	0	6.5	9.5	14.5	20.5	25.5
3. Disposal volume available	m^3	1,069,768	2,022,704	2,462,520	3,195,545	4,075,177	4,808,204
4. Closure of landfill	Year	2021(Q3)	2022(Q4)	2023(Q2)	2024(Q1)	2025(Q2)	2026(Q2)

Source: JST

Obviously, extending the disposed waste heights will require detailed planning and design.

Requirements for a second layer of natural permeability liner and leachate pipes network will need to be studied. And operations plans will be necessary to develop the perimeter site roads for the collection trucks to reach the elevated disposal areas. However, it is recommended that Basrah City develop the operation plans to increase the lifetime of the disposal facility in tandem with searching for new sites to construct a new disposal facility and setting a maximum date of commencement of operations in a new disposal facility by 2030.

(3) Regional Utilization of Disposal Facility

Rafaaiya disposal facility receives only municipal waste that is generated in Basrah City. The adjacent photograph shows waste that is generated in Zubair municipality and transported to a dumping site along the disposal facility perimeter and is burnt.

This open burning affects the wellbeing of the staff working in the adjacent Rafaaiya landfill as well as the reputation of the landfill. It is very easy for third parties to assume that the open burning is originating from the landfill itself.

Basrah City has indicated its willingness to receive waste from other neighboring municipalities provided the conditions for operation responsibility and sharing of the operation costs are developed and agreed upon. It is strongly recommended that both municipalities discuss on how to dispose of the Zubair waste inside the landfill in a sanitary manner rather than outside the site by open burning. Basrah City will continue to depend on surrounding municipalities for finding land to construct disposal facilities and should seek such lands through cooperation and development of regional facilities that serve both Basrah City as well as the host municipality.

Chapter 6 Solid Waste Management in Erbil City

6.1 General Conditions

6.1.1 Population

The population census is originally planned to be conducted every 10 years in Iraq, however the last census was conducted back in 1987 and since then the population is calculated based on projection of the population. This is due to several factors among which is insecurity and internal displacement. CSO issued reports with estimates of populations showing a population of 1,323,903 for Erbil City for the year 2019.

Table 6-1 Population in Erbil City for 2019

City	Total			Rural			Urban		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
Erbil	1,323,903	655,111	668,792	133,987	66,879	67,108	1,189,916	588,232	601,684

Source: Population Estimation of Iraq 2015 – 2019, (2019), CSO

6.1.2 Natural Conditions

Located at an elevation of 395 meters above sea level, Erbil has a Mediterranean, hot summer climate. The temperature and rainfall annual data (2018) of Erbil are shown in Table 6-2. The average annual temperature is 25.8℃ (north), and average annual rainfall is 81.5mm.

Table 6-2 Temperature and Rainfall Annual Data (2018) of Erbil

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
Average Temperatures (℃)	10.7	12.4	18.4	21.2	25.8	31.8	35.5	34.6	31.9	25.7	16	45.4	25.8
Monthly Rainfall (mm)	44	164.4	8	77.9	74.6	1.7	0	0	0	42.3	132.9	188	81.5
Humidity (%)	54	53	40	45	30	18	16	18	25	45	73	72	40.8

Source: KSCO Erbil

6.1.3 Economic Condition[20]

The Kurdistan Region economy is dominated by government employment, construction, wholesale and retail trade, and agriculture. It also has a growing oil industry. In a 2016 report, the World Bank described the Kurdistan Region economy as being dominated by government employment which amounted to more than 50 % in total employment, and by a high dependency on the oil sector. According to a Minority Rights Group International 2017 report '90% of all Kurdistan Regional government revenues come from the oil and gas sector'.

The Erbil governorate is the commercial and administrative center of Kurdistan Region. It is rich in natural resources, especially oil and gas, while the food supply is dependent on products imported from Iran and Turkey. According to IOM, 'the Erbil City is a trade center in Iraq and a transit point for most imported materials reaching Iraq from abroad, particularly from Turkey'. Its attractiveness to tourists makes Erbil the most visited region of Kurdistan Region, representing two thirds of tourist arrivals. According to a 2017 analysis by Mark A. DeWeaver, economist at the American University of Iraq Sulaymaniyah, the Kurdistan Region has entered into the third year of an economic recession that has started with the 2014 crash in world oil prices (which fell by over 50% in the second half of that year).

[20] European Asylum Support Office (EASO) - Iraq Key socio-economic indicators For Baghdad

Following tensions in 2014 over oil revenue sharing between the regional and federal governments, the relations between Erbil and Baghdad worsened after the KRG held an independence referendum in September 2017 that saw 93% of voters overwhelmingly endorsing secession from Iraq. The vote, which was opposed by Baghdad and Iraq's neighboring countries, Turkey, Iran and the Western powers, was met with military and economic retaliation from Baghdad, which included forced closure of Erbil International Airport and re-gaining control of disputed territories such as the oil-rich area of Kirkuk.

The World Bank noted in April 2018 that as a result of Iraq's punitive measures 'KRG has lost half of its oil revenue' and the 'federal budget proposes to reduce transfers to KRG from 12 trillion IQD [about 8.86 billion EUR] in 2017 to 6.7 trillion IQD in 2018 and requires KRG to transfer the entirety of its remaining oil export receipts to the federal government'. The World Bank pointed out that lower level of transfers could be insufficient to pay salaries to KRG's civil servants and the military and 'could further increase vulnerability in KRG'. In a May 2018 report, the United States Institute of Peace estimated that 'KRG's debt is at least 17 billion USD, an unsustainable level that is probably in excess of 100% of the region's GDP'.

The recent plummeting of oil prices has exacerbated the economic crisis in the Kurdistan Region according to the New Arab. The source quoted the KRG Prime Minister, who declared that 'the Kurdish economy was slashed by more than 90 percent since the recent oil price crash'. The crisis affected all economic sectors including the services sector and private businesses.

In the KRG, investment from 2006 to 2019 reached 52 billion USD including the foreign direct investment equivalent to 12%[21]. Kurdistan Board of Investment granted licenses to 166 projects from the period of January 2019 to March 2021, with a total potential value of 5.11 billion USD. The five main investment performances of Erbil City are industry, tourism, commerce, agriculture and infrastructure[22].

6.1.4 Security Situation

Erbil differs completely when compared to what is currently taking place in other regions of Iraq, mostly due to strict security measures that were implemented to keep Erbil safe from car bombs and infiltrators. Measures include building a Security Trench to segregate the border between Erbil and the turbulent Mosul and Kirkuk provinces, as well as setting up surveillance barricades along this Trench. There are numerous layers of security measures with walls, road tunnels and check points to avoid any outside penetrations.

6.2 Institutional and Legal Framework

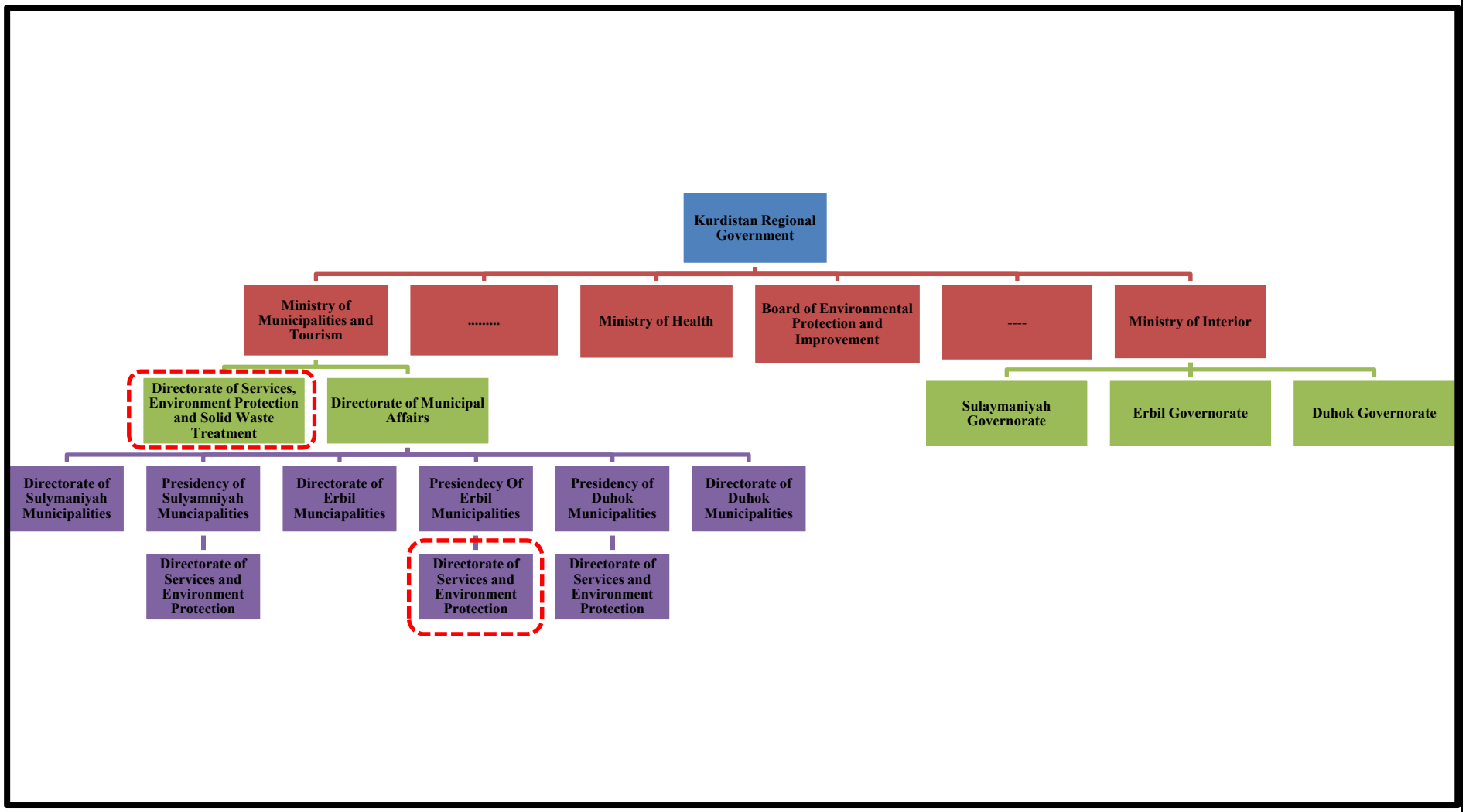
6.2.1 Organization for SWM

The General Organization chart of KRG and the relative entities is shown in Fig. 6-1. The Ministry of Municipalities and Tourism (MOMT) implements Municipal Solid Waste Management in all Kurdistan region including Erbil governorate, Duhok governorate and Sulaymaniyah Governorate.

Directorate of Services, Environment Protection and Solid Waste Treatment under MOMT is main body for SWM in Kurdistan region. In addition, Directorate of Services and Environment Protection of Presidency of Erbil Municipalities under Directorates of Municipal Affairs is the execution body for waste collection and final disposal in Erbil City. Besides Directorate of Erbil Municipalities is execution body for cleaning and waste collection in outskirts of Erbil governorate.

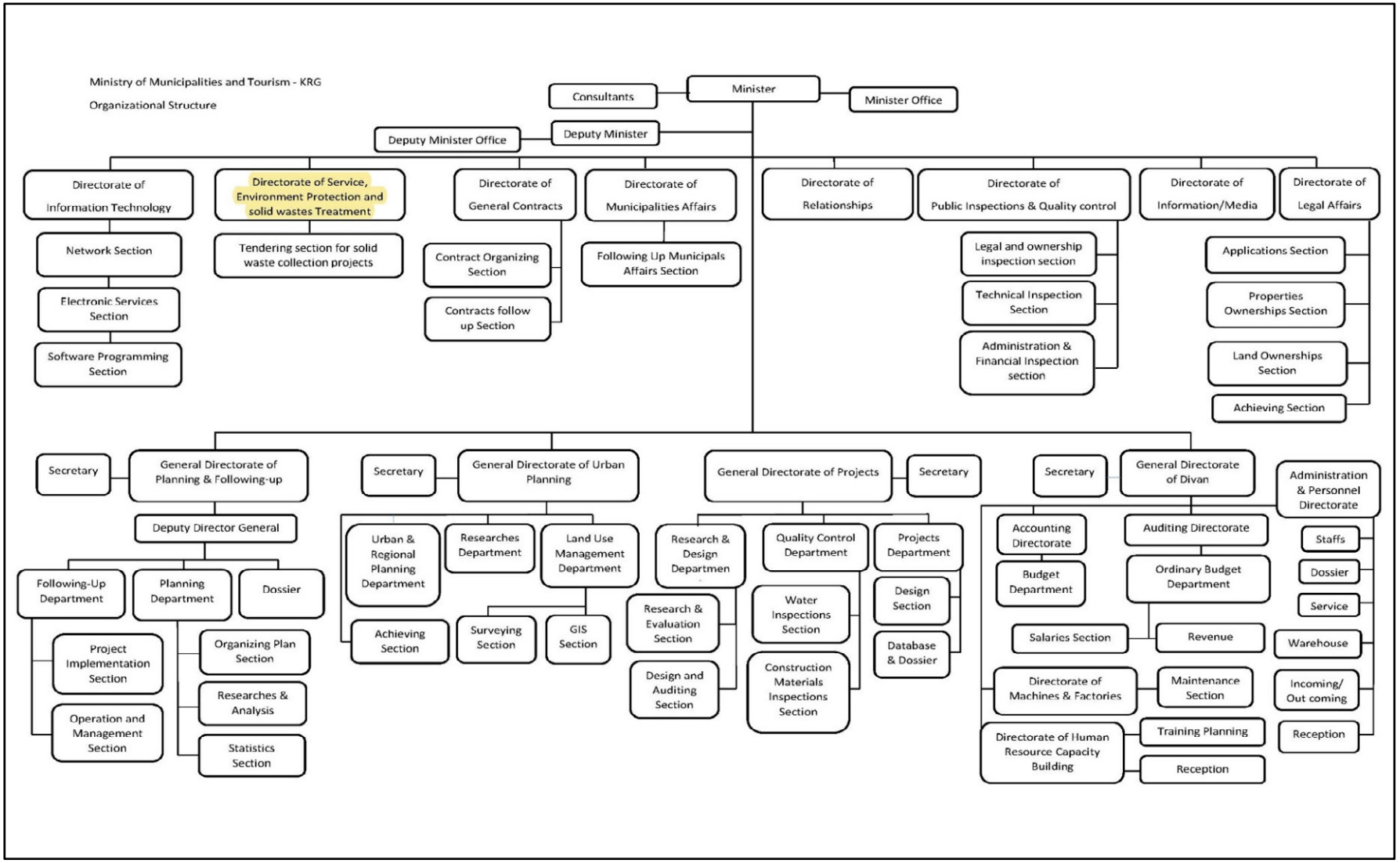
[21] Investment Plan from 2020 Board of Investment, KRG

[22] https://gov.krd/boi-en/publications/, Investment Plan, Licensed Projects



Source: MOMT

Fig. 6-1 KRG Organization Structure related to SWM



Source: MOMT

Fig. 6-2 MOMT Organization Structure

The solid waste management (excluding Healthcare wastes) is the responsibility of the Regional Ministry of Municipalities and Tourism (MOMT). Under MOMT there are directorates responsible for the management of solid wastes as well as directorates responsible for the operation of daily activities in SWM.

Table 6-3 SWM Organization of Erbil City

Stakeholder	Organization	Responsibility
MOMT	Directorate of Services, Environment Protection and Solid Waste Treatment (DSEPSWT)	• General Policies and Plans • Laws, Regulations, Standards, Fees, Fines and indicators • Treatment and type of projects and their specifications • Strategic projects such as Sanitary Landfills and Intermediate Treatment facilities
MOMT	Directorate of Services and Environment Protection (DSEP), Presidency of Erbil Municipalities	▪ Financing and implementation ▪ Database ▪ Collection of wastes ▪ Operation of facilities

Source: Answer of the JST questionnaire

(1) Directorate of Services, Environment Protection and Solid Waste Treatment (DSEPSWT)

DSEPSWT is reporting directly to the Minister of MOMT office. The directorate is responsible to manage the SWM in Kurdistan region.

The directorate currently employs only 5 staff members and is suffering from shortage of staff to be able to conduct the tasks allocated to it.

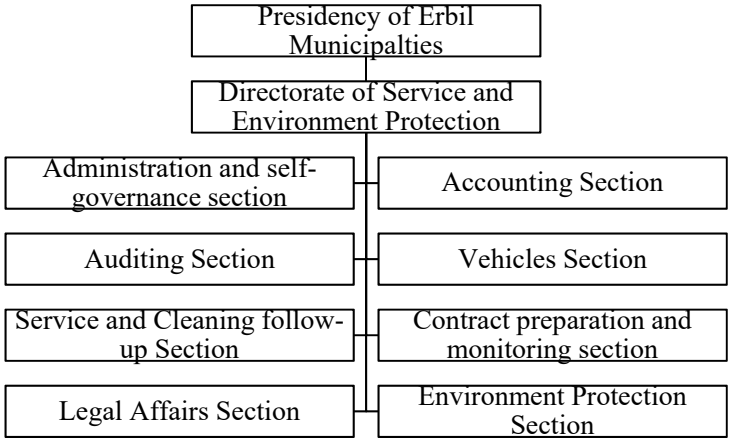
(2) Directorate of Services and Environment Protection (DSEP)

The directorate was established under the Ministerial order No. 7423 dated 5/4/2012 with the organization structure as shown in Fig. 6-3.

The directorate is responsible for supervision and follows up on cleaning works, collecting and transporting waste from roads, neighborhoods and households, and educating people on preserving the environment and cleaning up the city. This is in addition to the following tasks.

- Operation and Management of Disposal facility (Kani Qirzhala).
- Daily Monitoring and arrangement of cemeteries.
- Maintenance and fuel supply of directorate heavy equipment and vehicles.
- Organizing the salaries and allowances for staff.

The Directorate currently has 178 employees. The Directorate provides service to areas within Presidency of Erbil Municipalities boundaries consisting of six municipalities affiliated to Presidency of Erbil Municipalities, and it also includes the Cemetery of Kasnazan, which is within the boundaries of Kasnazan Municipality, and the West Cemetery located on the Guyer Road 15 km away.



Source: Answer of the JST questionnaire (Erbil City)

Fig. 6-3 DSEP Organization Structure

6.2.2 Bylaw and Guidelines Related to SWM

There is no specific bylaw for SWM in Kurdistan Region. Kurdistan Region has "Law No. (8) of 2008 - Law of Protection and Improvement of the Environment in the Kurdistan Region" and "Law No. 2 (2007) – Establishment of KRG Ministry of Municipality and Tourism" as mentioned in Chapter 2. MOMT execute solid waste management in accordance with the laws and regulations of the federal government and KRG.

6.3 Financial Information

As mentioned in Section 2.5 Financial Situation in Chapter 2, the budget allocation from the Federal Government to KRG is currently limited to a portion of civil servants' salaries and pensions. Costs of waste management and others are paid from the KRG's own resources such as local taxes, but not enough budget is allocated. Besides, despite two directives on collection of fees for waste management, namely, Instruction No. 80 (2016) "Collection of fees for Solid Waste Collection from Residential Houses" and Ministerial Order 4528 "Collection of fees from commercial entities", collection of fees from residents has not been implemented and collection from commercial entities has not been adequate.

According to the MOMT, the budget for SWM itself has not been prepared. Under such circumstances, MOMT has divided Erbil City into nine zones and has outsourced waste collection services to six waste collection companies. The list of waste collection companies and their respective monthly contract amounts are shown in Table 6-4. The total monthly contract amount for the six companies is 2.08 billion IQD. However, these six companies started their operations six months ago and have not received any payment so far, which puts them in a difficult financial situation.

Table 6-4 List of Waste Collection Companies and Contract Amount

Area	Contractor Name	Contract Duration	Contract Amount (IQD/month)
Zone 1	Hot Clean	1/1/2021 – 31/12/2023	IQD 183,542,000
Zone 2	Kahdar		IQD 224,425,000
Zone 3	Baghy Bergul		IQD 233,438,000
Zone 4	Dazzling Future		IQD 366,746,252
Zone 5	zok		IQD 287,202,500
Zone 6	Nrkh		IQD 337,588,525
Ainkawa	Kahdar		IQD 61,833,000
Banislawa, Daratow	Class Shtutgart		IQD 219,999,500

Area	Contractor Name	Contract Duration	Contract Amount (IQD/month)
Baherka, Chaweis, Kani Qirzhala	Nrkh		IQD 171,765,000
Total			IQD 2,086,539,777

Source: Answer of the JST questionnaire (MOMT)

As of 2021, the total cost of SWM is 2.37 billion IQD per month, as shown in Table 6-5. This monthly cost may not include staff salaries and other administrative costs. As there is no direct collection in Erbil City, but only private contractors, it can be assumed that the collection and transportation cost is equal to the contracted amount of 2.08 billion IQD. In other words, of the total monthly cost of 2.37 billion IQD in Erbil, 88% or 2.08 billion IQD is spent on collection and transportation.

The unit cost of waste collection and the entire SWM were calculated as 28 USD/ton and 31 USD/ton respectively based on the waste collection amount of 52,800 ton/month. According to What a Waste 2.0 (World Bank 2018), Iraq falls into the category of high-middle income countries. The unit cost of waste collection and transportation in high-middle income countries is in the range of 50 – 100 USD/ton. Erbil City, however, has a significantly lower collection service at 28 USD/ton; in fact, Erbil's collection rate is almost 100%, which is higher than the average of 82% for high-middle income countries. This may be due to a combination of factors, including (1) the high efficiency of collection services in Erbil City, (2) the relatively low cost of collection and transportation because collection of separated wastes has not been introduced in Erbil City, and (3) the fact that the cost of collection and transportation in Erbil City does not include the cost of MOMT staff who manage private contractors.

Table 6-5 SWM Cost and Cost per Waste Amount Collected

Item	Monthly Cost *1 (Million IQD)	Waste amount*2 (ton/month)	Unit SWM cost	
			(IQD/ton)	(USD/ton)*3
Waste collection	2,087	52,800	39,527	28.0
Final disposal	114		2,159	2.0
Others	106		2,008	1.0
Total	2,307		43,694	31.0

*1: Answer of the JST questionnaire
*2: Estimation by JST, 30 days x 1,760 ton/day (Refer to 6.5.2)
*3: USD 1 = IQD 1,460

What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050, (World Bank, 2018)

Table 5.2 Typical Waste Management Costs by Disposal Type

US$/tonne

	Low-income countries	Lower-middle-income countries	Upper-middle-income countries	High-income countries
Collection and transfer	20–50	30–75	50–100	90–200
Controlled landfill to sanitary landfill	10–20	15–40	20–65	40–100
Open dumping	2–8	3–10	—	—
Recycling	0–25	5–30	5–50	30–80
Composting	5–30	10–40	20–75	35–90

Source: World Bank Solid Waste Community of Practice and Climate and Clean Air Coalition.
Note: — = not available.

Erbil Municipality and MOMT will need to raise the finances required to implement the short-term action plan discussed in the preceding section. In case of applying to donors for technical and financial support, then donors need to be assured that there is clarity in reporting and managing of the disposal facilities financing.

The total disposal facility expenses for 2018, 2019, and 2020 (refer to the previous Table 6-12) showed a decrease. In 2020 an annual amount of 1,362 million IQD was expended, at a unit cost of 2,259 IQD/ton of waste disposed. When this value is converted into USD at the 2021 conversion rates, the unit cost is equivalent to 1.55 USD/ton. This is low, even for developing countries. There needs to be a cost breakdown of each SWM activity to decide how to wisely expend the available financial resources amongst the activities. Furthermore, accurate information on operation costs at disposal facilities helps the municipality determine tipping fees which may be levied on other municipalities or private sector companies bringing their waste to the disposal facility.

6.4 Policy and Plan Related to SWM

There are a few plans on solid waste management in Erbil governorate as mentioned below.

6.4.1 Solid Waste Masterplan for Erbil Governorate (2012)

The preparation of this plan was one of the components of the large solid waste management project for Iraq under Sponsorship of UNICEF. However, the master plan was never authorized and therefore not implemented. Summary of the master plan is described below to understand the situation and need at the time of preparation in 2012.

(1) Objectives

The purpose of the master plan for solid management waste is to present a vision and action plan expressing the needs of SWM in the Erbil Governorate, to guide the SWM efforts of the SWM related persons (decision makers, managers and providers of SWM services, private waste generators, community representatives and development partners and the general public).

The UNICEF directives for the preparation of the integrated master plan for solid waste management for Erbil governorate specified the objective of this plan as: Inculcating the principles of environmentally sound management of solid waste in the solid waste management departments in Erbil governorate while enhancing their capacity to effectively manage solid waste. In this context, the solid waste management master plan aims to review the current practices of waste management in a critical manner, propose recommendations for improvement and lay the foundations for investments in the short, medium and long term, and provide a template for the development of similar master plans for other governorates.

(2) Planning Period

The proposed time horizon for the master plan for solid waste management is prescribed by the short term, which ends by 2016; the medium-term ending by 2023 and the long-term ending by 2031.

(3) Main Goals and Actions

The solid waste management master plan defines the technical and operational elements of the solid waste management system in the short, medium and long terms, and this plan divides the technical and operational elements into the following items:

- Collection and transportation of waste
- Waste treatment
- Disposal of waste residues

Table 6-6 below shows action plans including the main goals and actions required to introduce management systems for each time period. According to the information from the Counterpart from MOMT, this Masterplan was not adopted and thus there is no progress or achievements recorded.

Table 6-6 Action Plan of the Master Plan

Time period	Goals	Actions
Short-term	Ensure that solid waste collection is carried out in a regular and efficient manner from Erbil City and its streets are cleaned	- Provision of Municipal solid waste collection equipment / trucks to Erbil City - Improve waste collection by identifying efficient pathways - Separation of harmful and medical waste from the collected municipal solid waste. - Continuing reliance on waste collectors who are dealt with informally to collect waste from some residential areas and stores while raising their efficiency through a new program for separating dry / wet waste at the source.
	Achieve an adequate level of cleanliness in the city	- Preparing immediate action plans to remove the accumulated waste in the streets.
	Provide effective regular services for the collection and transportation of waste in Erbil municipalities in the central area (outside Erbil City)	- Assessment of waste collection and transportation requirements. - Preparing a phased plan to purchase waste equipment and trucks for Erbil municipalities. - Establish effective services for the collection and transportation of waste for the central area of Erbil, Khabat, Daratoo and Bnaslawa using the experiences gained from the demonstration program for waste collection and transportation.
	Sanitary disposal of municipal solid waste for Erbil City	- Construction of sanitary landfills. - Closing Erbil City landfill (Kani Qirzhala)
	Supporting long-term improvement objectives for municipal solid waste disposal	- Carry out an assessment of the current landfills. - Preparing a list of priorities for landfills that must be rehabilitated or closed. - Conducting a survey of sites likely to be used as sanitary landfills and preparing technical specifications for the initial designs of the equipment to be purchased in the next phase.
	start of the waste treatment activities	Preparing a demonstration project for the solid waste treatment facility in Erbil City
Medium-term	- Improving waste collection and street cleaning services in Erbil Municipalities in the central area of Erbil, Khabat, Bnaslawa and Daratoo	- Review the performance of waste collection and transportation systems and the demonstration project for waste collection. - Set up separate waste collection systems for both municipal and construction waste. - Set up effective waste collection and transportation services for the central area of Erbil, using the experiences gained from the demonstration program for waste collection and transportation. - Separate waste collection and street sweeping operations.
	Establishing regular and efficient waste collection and transportation services in Erbil Municipalities in the northern and southern regions	- Assess the requirements for waste collection and transportation services. - Preparing a phased plan to purchase waste equipment and trucks for Erbil Municipalities.
	Establishing municipal solid waste treatment facilities	- Implementation of integrated waste treatment facilities and sanitary landfills for them in Erbil City and Soran region, with

Time period	Goals	Actions
	and sanitary landfills for disposal in the central and northern municipalities of Erbil	the use of the experiences gained from the demonstration project
Long-term	Increasing the efficiency rates of waste collection and transportation	- Continuous monitoring and evaluations of waste collection and transportation services - Preparing maps to define waste collection areas in Erbil Municipalities with the classification of these areas into areas that are not served - partly serviced - served to a small degree - are well served. - Expanding the scope of waste collection and transportation to cover all underserved areas in Erbil Municipalities.
	Establishing waste treatment facilities and sanitary landfills for solid waste in all Erbil Municipalities.	Implementation of integrated regional services for waste treatment and landfills in Erbil Governorate

Source: JST

6.4.2 Draft KRG Solid Waste Management Policy (2017)

The Draft KRG Solid Waste Management Policy was prepared in August 2017 and aimed at creating a roadmap for the improvement of Solid Management in Kurdistan Region for the following 10 years. The policy focused on improving the performance of solid waste collection and building adequate waste management and disposal capacities to provide the Kurdistan Regional Government with comprehensive and effective solid waste management solutions. The general situation of the SWM sector would be improved by developing new visions of the institutional framework that addresses the issue of overlapping responsibilities, and clarifying responsibilities.

This policy also comes in response to the challenges associated with the increasing influx of internally displaced persons, changing geopolitical scenarios and other emerging needs that have led to an increase in solid waste quantities. All of these wastes are dumped in open dumping sites, causing damage to the soil and pollution. Therefore, this policy aims to contain environmental damage and reverse its impact.

The waste sector requires a large capital. This requires spending large amounts of money that may not necessarily be available to the government today. Based on this reality, MOMT seeks to involve the private sector through design, build, operate and transfer contracts and thereby, easing the financial burden on the government.

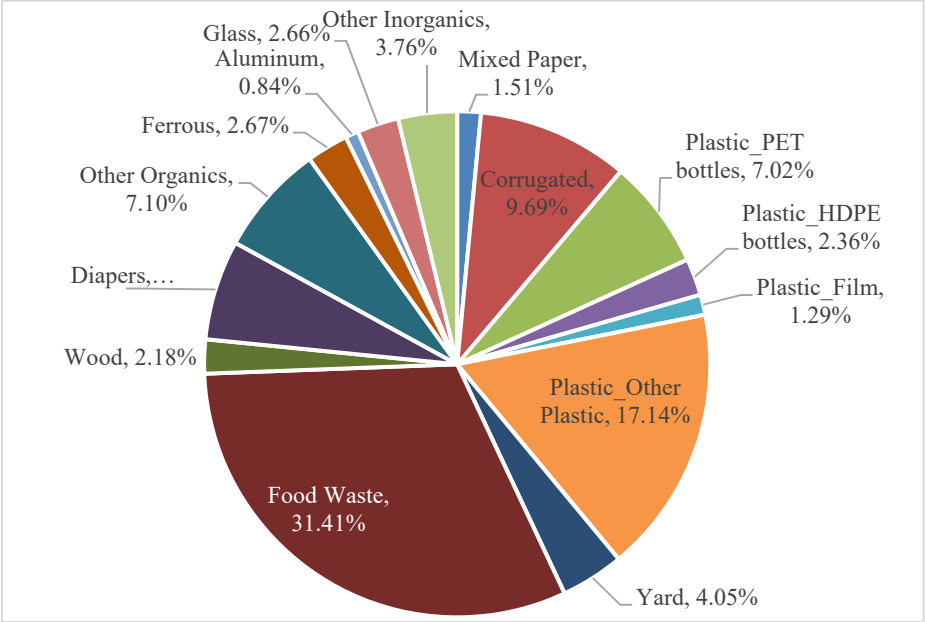
The Draft Policy also included an Appendix which is the draft Solid Waste Management Law. Neither the draft policy nor the draft Law were approved or set to use up to this date.

6.5 Municipal SWM Operation

6.5.1 Waste Generation and Composition

(1) Municipal Solid Waste Basic Data

MOMT provided the result of the waste composition survey as shown in Fig. 6-4. While the food waste and other organics accounted for 38% of the waste, the total of the four different plastic wastes was 28%. Paper and cardboard share was 11%. This composition is slightly different when compared to other Middle Eastern cities, where organic waste shares range between 50 and 60% and plastics are 10 to 20%, the percentage of plastics in Erbil is bit larger than other cities.



Source: Answer of the JST questionnaire (MOMT)

Fig. 6-4 Municipal Solid Waste Composition in Erbil City, 2020

(2) CAMPS for Internally Displaced Person (IDP) and Refugee

IDPs and refugee camps are not under the jurisdiction of MOMT, but information on environmental infrastructure is shown below. The Syrian Civil War which started in 2011, and the ISIS rebellion from 2014 have caused a large number of IDPs in the Kurdistan region, with Erbil Municipality accepting about 125,000 IDPs, the largest in the country. Along with this situation, the demand for water sanitation increased, and between 2012 and 2014, in Erbil Municipality by about 10%. Accepting IDPs has also been affecting waste management.

IDP and refugee camps near Erbil are managed by the Erbil Municipality Joint Crisis Coordination Center (JCC), and water/sewage and waste management services are also under the jurisdiction of JCC. According to the Erbil Directorate of Migration and Crisis Response (EDMC), which is a superordinate organization of JCC, as of May 2021, there are 10 camps for IDPs and refugees managed by JCC.

Regularly collected sewage sludge and waste are collected by trucks and transported to disposal facilities. There are no plans for infrastructure development in the camps.

Table 6-7 Situation of Waste Management at IDP and Refugee Camps around Erbil

	Name of the camp	Number of households	Population	Average amount of waste collection (m^3/day)	Average amount of sludge collection (m^3)	Water source
Refugee camps						
1	Darashakran	2,604	11,640	8.0 to 10.0	85	Well
2	Kawrgosic	1,877	7,795	5.5 to 7.0	45	
3	Qushtapa	2,000	8,301	6.0 to 7.5	15	
4	Basrma	481	2,257	3	40	
IDP camps						
5	Debaga	1,425	7,454	8	15	Well
6	Bahrka	943	4,622	6	20	
7	Harsham	286	1,433	4	15	
8	Hassan sham U2	878	4,053	8 to 10	20	Water distribution truck
9	Hassan sham U3	1,299	5,938	8 to 10	20	
10	Khazir M1	1,064	5,546	8 to 10	20	

Source: Erbil Directorate of Migration and Crisis Response (EDMC)

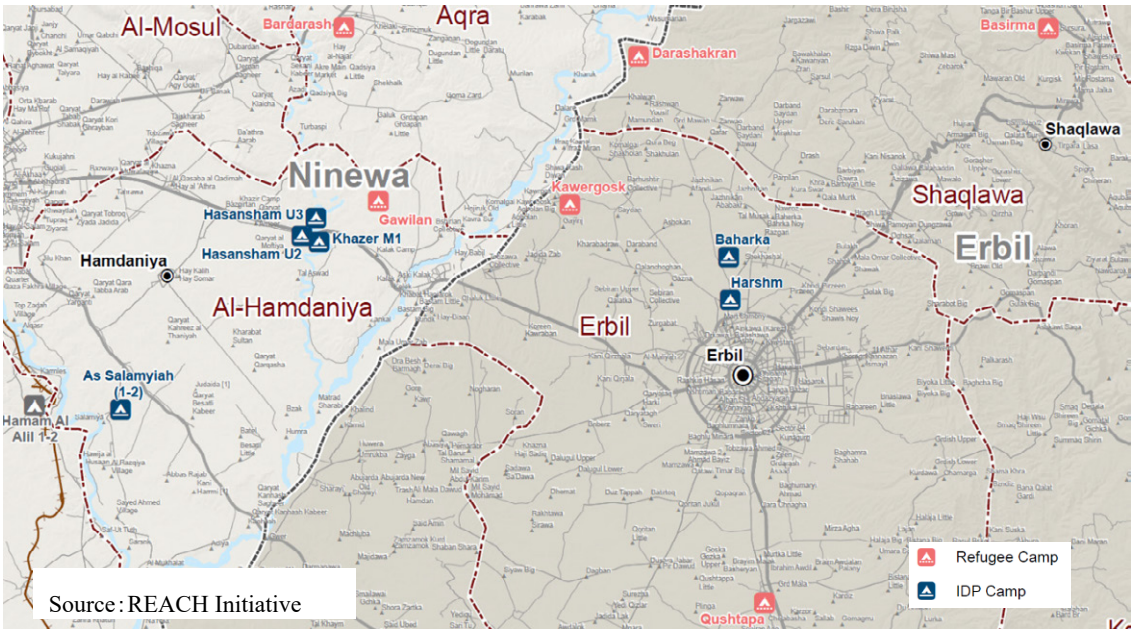
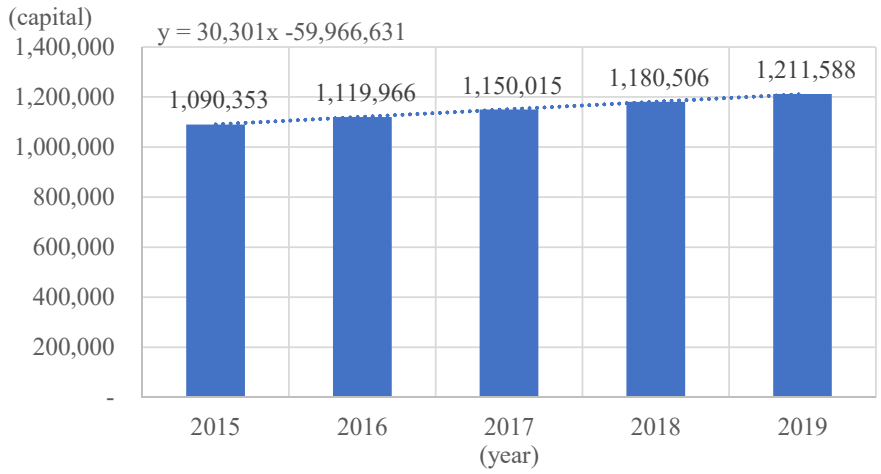


Fig. 6-5 Maps of IDP and Refugee Camps around Erbil (as of December 2020)

(3) Municipal Waste Amount Forecasts

Based on the existing statistics and the master plan, JST projected municipal solid waste (MSW) amount generated after 2020. For the population forecast (2020 - 2030), estimated values of Erbil City (Qadha of Arbil and Dashti Hawler (Benssalawa)) in Population Estimation of Iraq (2015 - 2019) (CSO) were utilized to determine the regression line as below. The coefficients of the regression line are calculated by using the least squares method. The regression line is shown in Fig. 6-6.

・The equation of the regression line: y=30,301x -59,966,631



Source: JST estimate using Population Estimation of Iraq 2015 – 2019, (2019)

Fig. 6-6 Regression Line for Population Forecast in Erbil City

IDPs population should be considered for the population forecast because some IDPs live in camps and outside of camps in Erbil City. In 2020, there were 130,834 IDPs of which 6,220 IDPs[23] were in camps

[23] CCCM CLUSTER, 2020, Iraq Camp Master List and Population Flow-March 2020

and 124,614 (20,769 households) IDPs[24] outside of camps in Erbil City. The report by IOM states that the increase rate of IDPs is 2% in Erbil, and the same increase rate was adopted to IDPs' population forecast from 2021 to 2030.

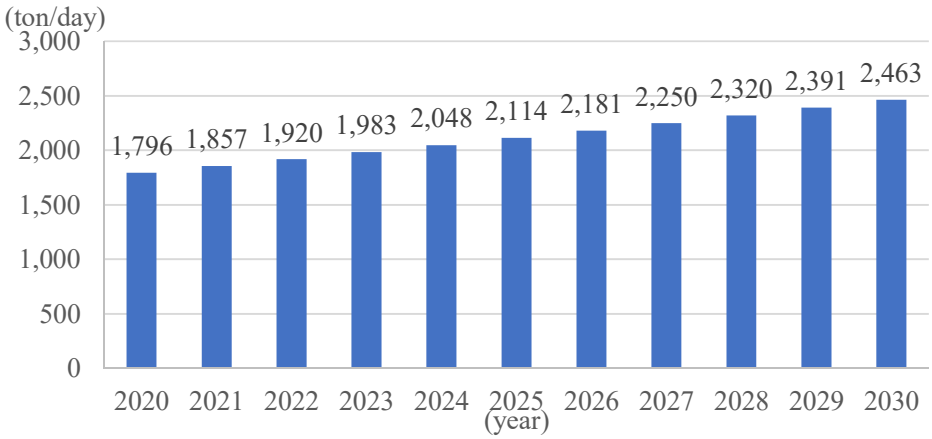
MOMT information provided to JST indicated that Unit generation rate was 1.27 kg/capita/day in 2017. For the Unit generation rate forecast, with consideration on the economic growth in Erbil, the annual growth rate of 1% from the 2017 baseline was adopted. MSW generation can be calculated by multiplying population and Unit generation rate of the same year.

Population and MSW generation in Erbil City are shown in Table 6-8 and forecast of MSW generation in Erbil City is shown in Fig. 6-7.

Table 6-8 Population and Annual MSW Generated in Erbil City

Year	Erbil City Population	IDPs Population	Unit generation rate (kg/cap/day)	MSW generation (ton/day)
2015	1,090,353			
2016	1,119,966			
2017	1,150,015		1.27	
2018	1,180,506		1.28	
2019	1,211,588		1.30	
2020	1,241,389	130,834	1.31	1,796
2021	1,271,690	133,451	1.32	1,857
2022	1,301,991	136,120	1.33	1,920
2023	1,332,292	138,842	1.35	1,983
2024	1,362,593	141,619	1.36	2,048
2025	1,392,894	144,451	1.38	2,114
2026	1,423,195	147,340	1.39	2,181
2027	1,453,496	150,287	1.40	2,250
2028	1,483,797	153,293	1.42	2,320
2029	1,514,098	156,359	1.43	2,391
2030	1,544,399	159,486	1.45	2,463

Source: JST estimated using Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO



Source: JST estimated using Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

Fig. 6-7 Forecast of MSW Generation in Erbil City

[24] IOM Iraq, 2020, URBAN DISPLACEMENT IN IRAQ: A PRELIMINARY ANALYSIS

6.5.2 Waste Collection and Transportation

(1) Waste Collection

Waste amount collected was 1,760 ton/day in 2020 as shown in Table 6-9. Directorate of Services and Environment Protection outsourced the collection and transport service to seven private companies in Erbil City. The city area is divided into nine areas and the seven private companies implement waste collection in each area. The contract durations for the private companies is three years, starting from 1/1/2021 and ending on 31/12/2023. The names of the private companies and their areas of work are shown in Table 6-10. Truck tracking by GPS is included in some of the signed contracts with the private companies. However, the GPS system implementation did not start yet due to financial crisis and the delays in payments to the contractors of their entitlements for the last 6 months.

Table 6-9 Outline of Waste Collection and Transportation in Erbil City

1) Collection system	Door to door
2) Collection frequency	Commercial area: daily collection Residential area: three day per week
3) Collection coverage area	98% of Erbil City
4) Waste amount collected	1,760 ton/day in 2021

Source: Answer of the JST questionnaire

Table 6-10 List of Waste Collection Company and Equipment

Zone	Company	Total number of vehicles	Pickup cars	Total number of staff	Workers	Supervisors	Waste observers	Part time
Zone 1	Hot clean	69	6	154	146	6	6	40
Zone 2	Kahdar	63	6	212	200	6	6	0
Zone 3	Baghi Prghol	73	6	192	180	6	6	0
Zone 4	Dazling future	105	6	295	284	5	6	0
Zone 5	Zok	70	6	210	198	6	6	0
Zone 6	Nrkh	101	6	262	250	6	6	0
Ainkawa	Kahdar	22	1	101	98	3	0	22
Baherka, Chaweis, Kani Qirzhala	Nrkh	60	6	131	125	6	0	0
Banislawa, Daratow	Class Shtutgart	73	4	181	173	8	0	0

Source: Answer of the JST questionnaire

Source: JST

Fig. 6-8 Waste Collection Work

(2) Transfer Station

There are no transfer stations in Erbil and all waste collected by collection trucks is directly transported to the disposal facility.

6.5.3 Intermediate Treatment Facilities

(1) Status of Recycling and Intermediate Treatment Facilities (ITF) in Erbil City

Presently there are no operating activities for recycling and intermediate treatment implemented by Erbil city. On the other hand, MOMT reported the KRG Prime Minister's strong encouragement for the implementation of WtE facilities in Erbil city. MOMT has been directed by the Prime Minister of KRG to find financing for development of such a facility in Erbil city.

Preparatory studies on a number of options for ITF for the city were discussed with KRG. These options included continuation of landfilling with introduction of recycling plants, composting of the waste and WtE facility. It has been decided that the city should adopt the WtE facility option. While the KRG realizes the high costs involved in WtE facility, the advantages in terms of stabilization of the harmful nature of the wastes, generation of energy, and decreased reliability on disposal facilities were considered to outweigh the costs.

At present MOMT has commenced the tendering process to hire consultants to implement the detailed feasibility studies and hopes to complete the construction of the WtE facility within about 3 years.

MOMT of KRG reported that there were two waste sorting plants in Duhok governorate and one Refuse

Derived Fuel (RDF) plant in Sulaymaniyah governorate, both neighboring governorates. The experience gained in planning, designing, constructing, and operating these facilities should be recorded and made available by the Kurdish regional government to Erbil city officials.

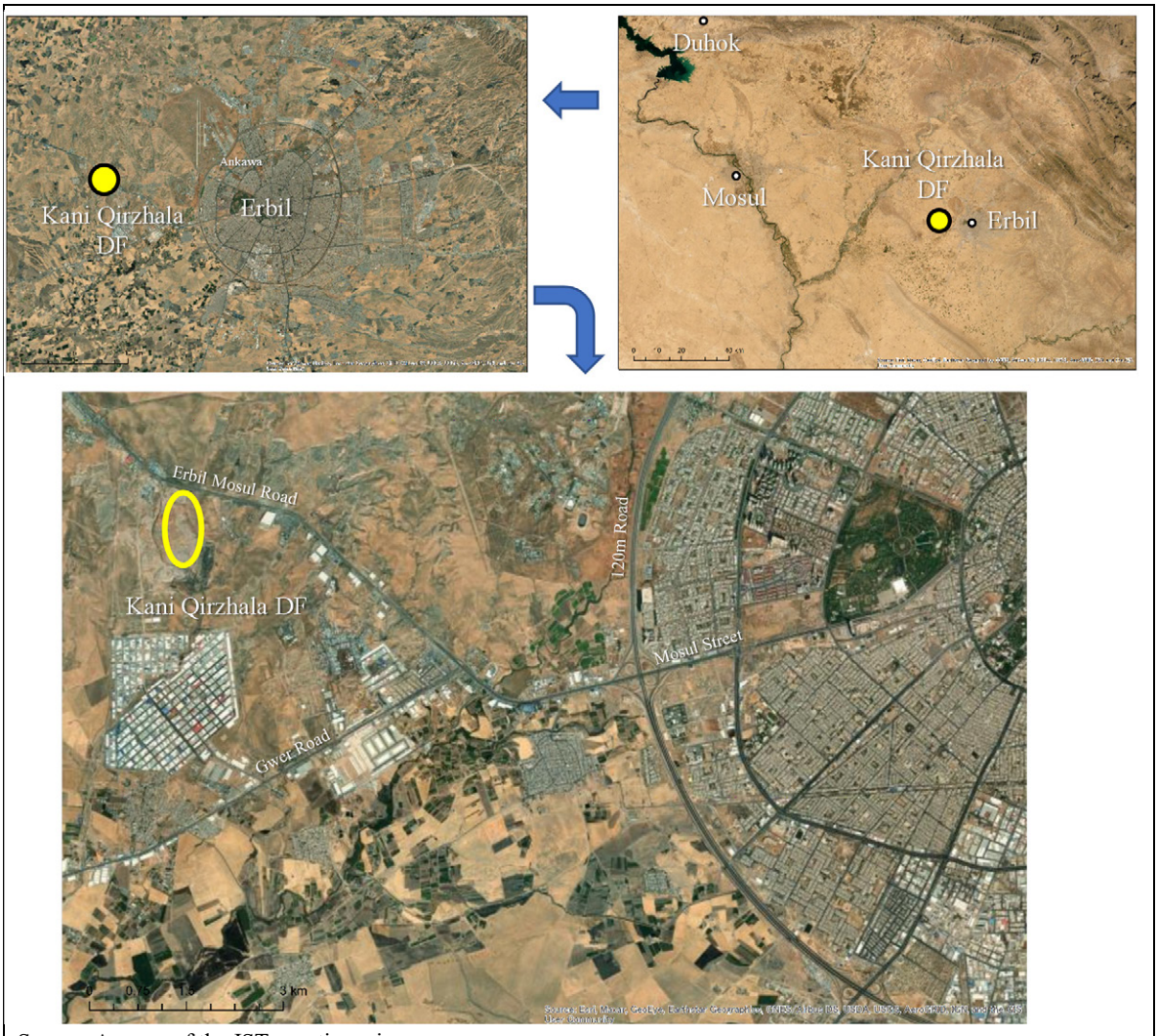
(2) Informal Recycling Activity

There are recycling activities related to cardboard, steel, tires, and plastics by small private initiatives at the collection points. MOMT does not have sufficient data on their activities.

6.5.4 Final Disposal

6.5.4.1 Disposal Facility for Erbil City

There is one disposal facility used for MSW management by Erbil city, the location of which is shown in Fig. 6-9, and is located within Erbil municipality, about 15 kilometers from the city center.



Source: Answer of the JST questionnaire

Fig. 6-9 Location of MSW Disposal Facility Used by Erbil City

An EIA study prepared in 2018[25] for Kani Qirzhala DF, described this area as lying within the Erbil plain, located on a hill conjoined by two drainage valleys. The elevation of the site is about 435 meters above sea level. Depth to groundwater reportedly ranges between 20 – 25 meters. Soil at the site was clay loam to silty clay loam.

The disposal facility is located on a total area of 37 hectares, as shown in Fig. 6-10. Approximately 75% of the disposal area is used and only the remaining 25% is available. Therefore, it is necessary to construct a new disposal facility before the Kani Qirzhala DF is closed, but Erbil City and MOMT have not made any move toward the construction of a new disposal facility.

Source: Answer of the JST questionnaire

Fig. 6-10 Kani Qirzhala DF

6.5.4.2 Disposal Facilities

The facilities available at the Kani Qirzhala DF are identified in Table 6-11.

Table 6-11 Equipment and Facilities at Kani Qirzhala DF Facilities

Facility	Y/N		Facility	Y/N
1. Gate and fence	Yes		13. Weighbridge	Yes
2. Embankment	No		14. Gate house/ office	Yes
3. Storm water drainage	No		15. Control building/ office	Yes
4. Waste cell (above GL)	No		16. Paved access road	Yes
5. Waste cell (sub-GL)	No		17. Internal levelled road	Yes
6. Gas venting	Yes		18. Disposal platform	No
7. Natural liner (clay)	No		19. Tire wash facility	No

[25] Environmental Impact Assessment of Erbil Dumpsite area – West of Erbil City – Iraqi Kurdistan Region, Sirwa Q. Gardi, Salahaddin University, Erbil, March 2018 (https://www.researchgate.net/publication/324262622)

Facility	Y/N		Facility	Y/N
8. Leachate collection pipes	No		20. Site lights	No
9. Leachate pond (tank)	No		21. Groundwater monitor wells	No
10. Leachate recirculation	No		22. Site laboratory	No
11. Leachate treatment	No		23. Gas collection system	No
12. Geomembrane liner	No			

Source: Answer of the JST questionnaire

6.5.4.3 Operations Indicators

The disposal operations indicators were provided by the counterparts as shown in Table 6-12. The remaining life span of the disposal facility is not confirmed.

Table 6-12 Disposal Operations Indicators

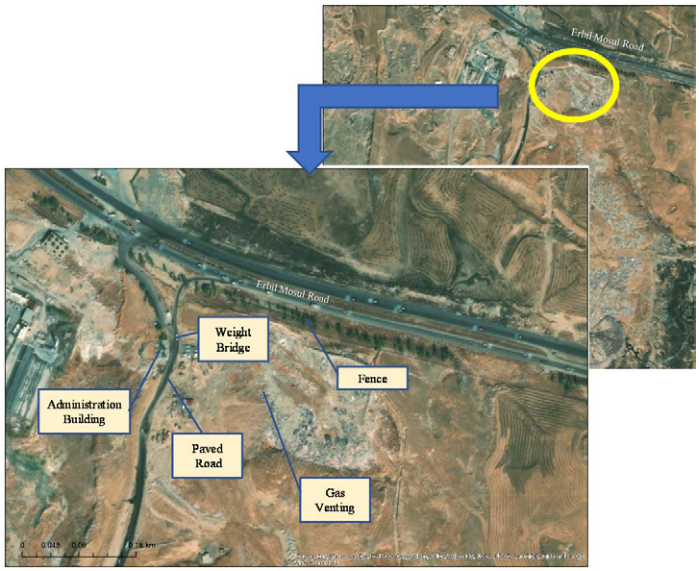
Item	Operation indicator	Description
A	General	
A-1	What is the entity directly operating the site: Municipality (which Department) or Private sector	Presidency of Erbil Municipality
A-2	Waste amount entering the site (ton/day)	1,782 ton/day
A-3	Operating days a week (days/week)	7 days
A-4	Operating hours per day (hours/day)	24 hours
A-5	Number of collection trucks entering the disposal facility	312
A-6	Number of waste pickers at the site (person)	Banned from entering the site due to Covid-19
A-7	Waste height (meters)	4 to 40 meters
A-8	Approx. years remaining to dispose waste at the site (years)	Not confirmed
A-9	Waste types disposed at the site by approximate percentages [Municipal (domestic, commercial, institutional), Hazardous, C&D, Agricultural, Market, Slaughterhouse, Expired goods, etc.]	Municipal, Agricultural, Market, Slaughterhouse, Expired goods
A-10	Utilities available at the site (Power, Water, Communication)	All three available
A-11	Is there an operation manual or guidelines for the site operation?	No
B	Heavy Equipment (Manufacture year, Operating time, Operation rate and condition)	
	First shift – 8:00 AM to 4:00 PM	
B-1	Bulldozer D6	2004, 8hr/d, 75%, good condition
B-2	Bulldozer D6	2003, 8hr/d, 75%, good condition
B-3	Bulldozer D8	2001, 8hr/d, 70%, good condition
B-4	Bulldozer D8	2001, 8hr/d, 65%, good condition
B-5	Bulldozer D8	2000, 8hr/d, 60%, good condition
B-6	Bulldozer D8	2000, 8hr/d, 70%, good condition
B-7	Excavator 375	2004, 8hr/d, 80%, good condition
B-8	Tanker	2009, 8hr/d, 70%, good condition
B-9	Wheel loader	2002, 8hr/d, 80%, good condition
B-10	Wheel loader 270	2001, 8hr/d, 80%, good condition
B-11	Dump truck 12m	2002, 8hr/d, 80%, good condition
B-12	Dump truck 12m	2006, 8hr/d, 80%, good condition
B-13	Dump truck 12m	2000, 8hr/d, 80%, good condition
B-14	Dump truck 12m	2001, 8hr/d, 80%, good condition
B-15	Dump truck 12m	2001, 8hr/d, 75%, good condition
B-16	Dump truck 12m	2001, 8hr/d, 75%, good condition
	Second shift – 4:00 PM to 12:00 AM	
B-17	Bulldozer D8	2000, 8hr/d, 70%, good condition
B-18	Bulldozer D8	2000, 8hr/d, 70%, good condition
B-19	Dump truck 12m	2004, 8hr/d, 70%, good condition
B-20	Dump truck 12m	2003, 8hr/d, 70%, good condition

Item	Operation indicator	Description
B-21	Wheel loader 270	2000, 8hr/d, 70%, good condition
	Third shift – 12:00 midnight to 8:00 AM	
B-22	Bulldozer D8	2003, 8hr/d, 65%, good condition
B-23	Wheel loader 370	2002, 8hr/d, 65%, good condition
B-24	Dump truck 12m	2002, 8hr/d, 70%, good condition
B-25	Dump truck 12m	2001, 8hr/d, 70%, good condition
	As required	
B-26	Toyota Landcruiser	2004, 8hr/d
B-27	Nissan Patrol	2001, 8hr/d
C	Disposal facility staff by position and number of persons per position	
C-1	Manager	1
C-2	Mechanical engineer	NA
C-3	Supervisor	6
C-4	Foreman	NA
C-5	Technician	NA
C-6	Workers	3
C-7	Equipment operators	NA
C-8	Waste recorder	NA
C-9	Security	3
C-10	Driver	8
C-11	Police	1
D	Operational norms at each site	
D-1	Is there a waste disposal platform where trucks discharge the waste?	No
D-2	Are trucks guided to positions in the site for unloading the waste?	Yes
D-3	How often is cover soil applied over the disposed waste?	Daily
D-4	Is soil cover material available nearby?	Yes
D-5	How often does open burning occur?	Never
D-6	Are there daily records of waste arrivals?	No
D-7	In case of re-circulation how many hours are pumps operated per day?	No recirculation
D-8	In case of aeration, how many hours is the aerator operated per day?	No aeration
D-9	In case of using electric power generator, how many hours is it operated per day?	Variable
D-10	Conditions of internal site roads (width, levelling, slope, etc.)	Very good
D-11	General conditions of waste slopes	Flat
D-12	Are the vertical gas vents continuously extended as the waste disposal progresses?	90 vents installed
D-13	Is the storm water drainage system regularly cleared?	NA
D-14	Is the leachate collection system still properly functioning?	NA
E	Environmental effects	
E-1	Is there a bad odor emitted from the site?	Yes
E-2	Is there waste scattering or litter from the site to the surrounding areas?	Yes
E-3	Are there stray dogs or other animals at the site?	Yes
E-4	Are there complaints by the surrounding public about disposal operations?	Yes
E-5	Impacts of site on surrounding water bodies (rivers, lakes, groundwater)	Yes
E-6	Are there frequent collapses of waste slopes at the site? If Yes, how often?	No
E-7	Are there any problems or safety concerns with waste pickers working inside the site?	NA
E-8	Are there any environmental tests done related to site operations (water sampling, soil analysis, air samples,	No

Item	Operation indicator	Description		
	mosquito counts, etc.)? If Yes, please describe what tests.			
E-9	Are there any concerns about the relationship with the residents surrounding the disposal facilities?	No reply		
F	Operational costs annually	2018	2019	2020
F-1	Salaries	No reply	No reply	No reply
F-2	Fuel & lubricants	No reply	No reply	No reply
F-3	Equipment maintenance	No reply	No reply	No reply
F-4	Consumables' procurement	No reply	No reply	No reply
F-5	Utilities	No reply	No reply	No reply
F-6	Total annual DF operation costs (Mln. IQD)	1,554	1,380	1,362

Source: Answer of the JST questionnaire

The facility receives all the collected waste from Erbil City (1,782 ton/day in 2020) plus waste from Salah-eldeen nahia, Khabat Qadha Center and Korakosak nahia, all three outside the city. The amount of waste sent to the disposal facility by the three local units was estimated to be 58 ton/day in 2020, as shall be further discussed later in this chapter. The arriving waste is inspected and weighed at the administrative area. The disposal facility management and waste inspection area is shown in Fig. 6-11.



Weighbridge and control room

Internal road from entrance to disposal area

Source: JST

Fig. 6-11 Disposal Facility Management and Waste Inspection Area

The DF is operated seven days a week, 24 hours a day, since 2004 by MOMT, and cover materials are applied daily. Specific waste cell is not set and disposal platforms are not constructed.

The DF is operated by a staff of 22 persons, headed by a manager and with 8 equipment operators (drivers) and 6 supervisors. There are also 3 security officials and a policeman stationed at the site which underlines the security concerns there.

According to the contract with the supplier, twenty-five heavy equipment units are in operation over three shifts. The equipment is mostly in good condition.

Fig. 6-12 shows photographs of some aspects of the operation.

Passive gas venting

C&D waste disposed together with MSW

Unstable waste slope

Leachate accumulated at the bottom of the waste slope

Collection trucks and heavy equipment at waste disposal area

Source: JST

Fig. 6-12 Photographs of Disposal Operations

6.5.4.4 Sanitary Landfill Category

According to the category in Table 4-15, Kani Qirzhala DF may be defined as in between Categories C and D. While some environmental protection measures are in place such as regular cover material, waste placing and compaction, sufficient heavy equipment and staff, and passive gas venting, the lack of any leachate management system puts the surrounding surface water, groundwater, and agriculture activities at high risk (refer to the EIA report introduced under footnote of 6.5.4.1).

The DF should be improved both to continue to receive the waste until a new disposal facility is prepared and also to prepare for its safe closure.

6.5.5 Erbil City SWM Material Flow

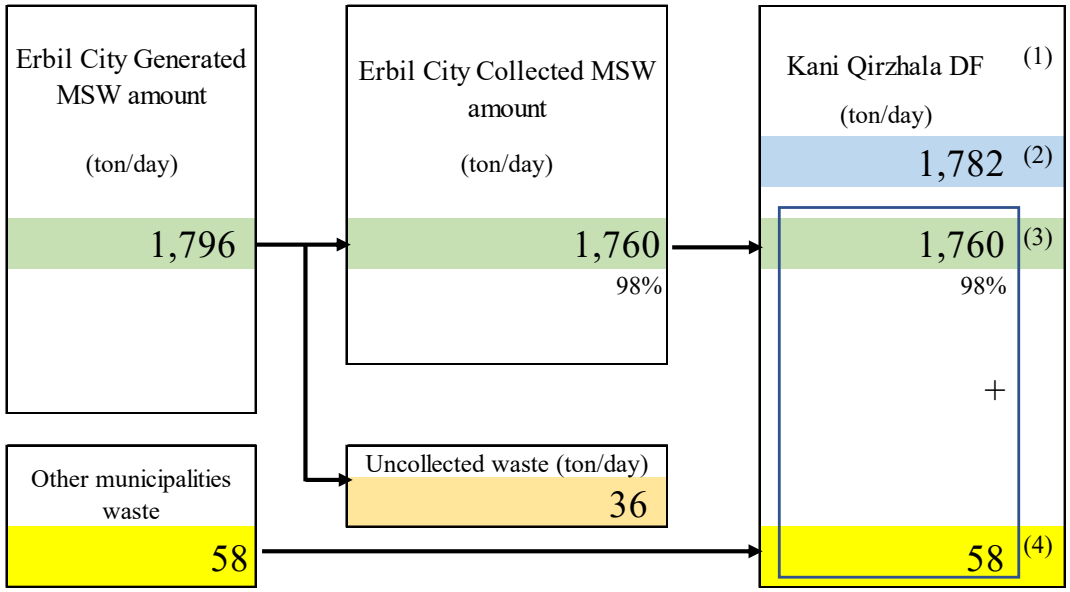
The information collected to prepare the MSW waste flow for Erbil City, together with the information gathering method is shown in Table 6-13. The table also includes information for the two nahia and one center outside Erbil City that dispose their wastes at Kani Qirzhala DF.

Table 6-13 Erbil City Waste Data for Year 2020

Data	Value	Information gathering method
A. Erbil City		
1) Population	1,241,389 person	Trend of CSO population estimates for 2015 to 2019 applied to estimate 2020 population
2) IDPs	130,834 person	IOM, Iraq, 2020
3) Unit Generation Rate (UGR)	1.31 kg/cap/day	MOMT questionnaire reply of 1.27 kg/cap/day in 2017, extended by 1% annual increase to 2020
4) Generated waste amount	1,796 ton/day	(1,241,389+130,834) x 1.31
5) MSW collection rate	98%	MOMT information to survey team
B. Other Towns using Kani Qirzhala DF (Salah-eldeen nahia, Khabat Qadah center and Korakosak nahia)		
6) Population	115,271	Trend of CSO population estimates for 2015 to 2019 applied to estimate 2020 population
7) Unit Generation Rate (UGR)	0.50 kg/cap/day	MOMT information to survey team based on their 2020 survey
8) Waste amount arriving at Kani Qirzhala DF	1,782 ton/day	(0.98x1,796) + (115,271 x 0.50) + α(1)

Source: Answer of the JST questionnaire

Fig. 6-13 shows the solid waste material flow for Erbil City for the year 2021. Ninety-eight percent of the generated waste is collected and transported directly to the disposal facility.



Notes: (1) [Surveyed waste amount (2)] does not equal [Estimated waste amount (3)+(4)] due to error
(2) 1,782 ton/day: Surveyed waste amount
(3) 1,760 ton/day: Erbil city estimated amount
(4) 58 ton/day: Other municipalities estimated waste amount

Source: Answer of the JST questionnaire

Fig. 6-13 Erbil City Municipal Solid Waste Material Flow in 2020

The MSW flow of Erbil City indicates the following:

- As indicated in Fig. 6-13, for the waste amount arriving at the disposal facility there are two values. The first value of 1,782 ton/day is obtained by the survey conducted by MOMT. The second, and larger value of 1,818 ton/day was obtained by multiplying the Unit generation rate for each of Erbil City and the other municipalities with their respective populations. There is a discrepancy of 35 ton/day. This discrepancy may be the result of error in the Unit generation rates, the populations or the survey. Considering the difficulty in determining the error and making the correction and the margin of the error (roughly 2% of either of the waste arrival values surveyed and estimated), the flow is not balanced.
- There is a need to understand the recycling situation and make efforts to promote recycling in order to divert waste from the disposal facility.
- Surveys were implemented at Kani Qirzhala DF in 2017 and 2020. These surveys involved using the weighbridge at the DF continuously for two weeks during each survey and recording the weights of all the MSW entering the DF. It is recommended that the weighbridge at the DF be continuously operated in order to obtain a comprehensive data on the waste arrivals at the site.
- Erbil City should implement waste generation surveys at the generation sources at least once annually to determine the MSW unit generation rates. The survey should cover all MSW generators: residents, commercial activities, institutions, and open spaces.

6.6 Private Companies Involved in Waste Management

In Erbil City, several private companies are involved in waste management as shown in Table 6-14. Seven of the waste collection and transportation companies are involved in waste collection in Erbil city as of 2021, except White Dolphin, Pap group and Maver. The number of collection vehicles owned by the seven companies and the number of staff are already described in Table 6-14. Two recycling companies, Erbil Steel Factory and Med Steel Company, have been identified. Erbil Steel Factory is a subsidiary of Drain Group, a leading group of companies in the Erbil region. Med Steel Company is a steel manufacturer in the Kurdistan region that uses collected iron and other materials as raw materials. Med Steel Company is a steel manufacturer in the Kurdistan region, using collected iron and other raw materials. A manufacturing plant of this company covers 63 hectares and has an annual production capacity of 360,000 tons.

According to Terrapack, a company that manufactures cardboard and other paper products in Erbil City, the raw materials are imported from Turkey, and the paper waste generated in the manufacturing process is sold to a Turkish company, which recycles it and returns some of it to Iraq. In addition, there are no recycling companies of cardboard and paper in Erbil City, and a considerable amount of cardboard and other paper materials are being transported to Turkey. According to Magic Plastic, a company that manufactures plastic products in Erbil City, raw materials are procured from both Turkey and Iraq, and some of them are waste plastics collected in Basrah.

HSE collects and treats sludge, waste oil, and others generated from oil extraction. The company collects 17 tons of wastes per day and separates them into solid waste, liquid waste, plastics, and metals for processing at its plant. The number of employees and workers at Erbil alone is 400 to 500, and there are three other locations.

Table 6-14 Private Companies Involved in Waste Management

Field of Work	Name of Company
Collection and Transportation	Hot Clean, Kahdar, Baghi Prghol, Dazling Future, Zok, Nrkh, Class Shtutgart, White Dolphin, Pap group, Maver
Recycling	Erbil Steel Factory, Med Steel Company
Hazardous Waste Treatment	Green Environment, HSE

Source: Answer of the JST questionnaire

6.7 Impact on Medical Waste Associated with COVID-19

The management of medical and hazardous wastes in Kurdistan Region is under the jurisdiction of the Ministry of Health. The Ministry of Health has instructed hospitals to incinerate all medical wastes, including those related to COVID-19, within the hospital and transport the ashes to a final disposal site. Ministry of Health has not been able to ascertain the actual situation of medical waste generation, and there is no related data. Ministry of Health and Environment in the Federal Government has established a committee to study medical wastes, but the Kurdistan region is not included in this study. According to the UNDP report[26], the spread of COVID-19 has led to an increase in the use of disposable medical protective equipment such as masks and gowns, which is estimated to increase the amount of medical solid waste by 1-3 kg per hospitalized patient compared to normal.

6.8 Issues on SWM for Erbil City

JST summarized solid waste management issues in Table 6-15 from three viewpoints, 1) Policy and Plan, 2) Institutional system and 3) Operation.

Table 6-15 Present Situation and Issues on SWM for Erbil City

Sector	Issues
1. Policy and Plan	
① Master Plan	Present situation: A solid waste management master plan was formulated in 2012. The target area was Erbil State, and the planning horizon was 20 years subdivided into short, medium, and long terms. Issue: The master plan has not been authorized and not been implemented. A new master plan shall be formulated in consideration of current situation, needs and available techniques. Issue: The latest population census was carried out in 1987. There is only population projection from 1988.
2. Institutional system	
① Data management	Present situation: There is weighbridge installed at the final disposal facility however it is not operated every day. Therefore, the amounts of waste collected and disposed are not measured on a regular basis and are estimated. As for estimates of the amount of waste generated, there is room for improvement in the accuracy of the data because surveys for both the unit generation rate (in terms of kilogram per person per day) and the population census have not been carried out in recent years. Issue:

[26] The Impact of COVID-19 on Environmental Sustainability in Iraq (February 2021)

Sector	Issues
	In order to accurately grasp the amount of waste collected and disposed of, it is necessary to continuously operate the weighbridge in the final disposal facility. Issue: Waste amount survey should be implemented in order to grasp the waste unit generation rate. Issue: Data related to SWM, such as collection amount, budget, SWM facilities and so on is stored among some divisions and directorates and is not integrated.
② Collection of waste management fees	Present situation: Regarding fee collection, there are two instructions: Instruction No. 80 (2016) "collection of fees for Solid waste collection from houses" and Ministerial Order 4528 "Collection of fees from commercial entities". Issue: Waste management fee is not collected from residents and is also not collected from private companies.
③ Private sector management	Present situation: Waste collection is outsourced to seven private companies. The commission fee is based on a fixed rate system. Issue: In 2021, only 60% of the contract amount has been paid to the private company because of budgetary problem.
④ Training system	Present situation: There is no own training system on solid waste management expect for the training provided by the donors. Issue: It is necessary to develop skills for operating intermediate treatment facility to be constructed.
3. SWM Operation	
① Street sweeping and waste collection and transport	Present situation: Waste collection is outsourced to seven private companies. The waste collection rate (in terms of population coverage) is nearly 100%, and most part of the generated waste can be collected. Issue: None
② Transfer station	Present situation: There are no transfer stations, and all the collected waste is transported directly to the disposal facility. Issue: Depending on the location of any candidate site for a new disposal facility, it may be necessary to develop transfer stations.
③ Intermediate treatment and recycling	Present situation: There are no intermediate processing facilities currently in operation. MOMT made a tender announcement for a survey and design consultancy service in August 2021 for the construction of an incineration power plant. Issue: The consultancy services procurement for developing a waste to energy facility is moving ahead. There are still many hurdles ahead, such as preparing the large investment costs, contractual comments of all sides under BOT (or similar) systems, ensuring highly technical skills in operation and monitoring, public support for source separation, etc.
④ Final disposal facility	Present situation: Kani Qirzhala is the only final disposal facility in Erbil City. The disposal facility does not have an environmental permit. The daily waste arriving at the disposal facility is 1,782 ton per day, of which 1,666 tons is estimated to be MSW collected from Erbil City, with the difference being non-MSW and waste from other municipalities. The remaining lifespan of the disposal facility is estimated to be 4-5 years. Issue: Development of a sanitary landfill final disposal site to replace the Kani Qirzhala

Sector	Issues
	disposal facility which is nearing the end of its lifespan is urgently required. It is necessary to immediately identify candidate sites, select the most suitable site, acquire the land, and hire consultants and contractors to design and construct the new disposal facility as a sanitary landfill. Issue: It is expected that there will be at least a few more years before the new disposal facility is developed. During this time, it is necessary to continue using the Kani Qirzhala disposal facility, and to implement the disposal operation plan that will allow for extending the disposal facility's lifespan as much as possible.
⑤ Environmental education and public awareness	Present situation: There are hardly any environmental education and residents' awareness activities related to solid waste management and recycling under implementation. Issue: A plan related to environmental education and public awareness-raising activities will be prepared and implemented at the time of commencement of the source separation.

Source: JST

Among the issues mentioned in the above table, more detailed explanations and recommendations are provided hereafter for some of them.

6.8.1 Capacity Development of Related Staff and Training System

As mentioned in 4.8.1, Basrah City also needs to develop the skills of staff regarding "recycling and intermediate treatment" and "final disposal" and a training system for that purpose.

6.8.2 Intermediate Treatment

(1) Forming a Recycling and Intermediate Treatment Unit within Directorate of Services and Environment Protection (DSEP)

Erbil City has indicated a strong interest in developing intermediate treatment facilities in the city. In order to study, plan, develop operate, and monitor operations in such facilities it is necessary to have dedicated staff within DSEP for these purposes. As a first step, it is recommended that DSEP set up a Waste Recycling and Intermediate Treatment Unit to oversee recycling and intermediate treatment.

(2) Study on Intermediate Treatment

Erbil City is considering to introduce incinerators. These facilities require large capital to construct and operate initially for a number of years before yielding returns on investments, as well as highly technical skills to operate and monitor operation.

The studies MOMT is currently implementing need to include preparing the technical standards that are essential to safely design, construct and operate these facilities.

6.8.3 Final Disposal

(1) Development of the New Sanitary Disposal Facility

Even though MOMT is proceeding with the development of a WtE facility in Erbil, some portion of municipal solid waste not treated by the WtE facility shall be disposed at Kani Qirzhala DF after operation of the WtE facility. However, Kani Qirzhala DF has only 25% of unutilized area at present and therefore MOMT will construct a new sanitary landfill in future as the replacement. To develop a new sanitary landfill, it is necessary to follow a transparent process to obtain understandings from residents as discussed in 5.8.3.

(2) Extension of the Disposal Facility Utilization Period

Kani Qirzhala DF has been operating for the last 17 years. Considering the area of the site, and the accumulated volume of waste disposed there as well as the soil cover it is roughly estimated that the average height of disposed waste may have reached 35 meters already (at the upper limit of the margin of 4 to 40 meters mentioned in the replies by MOMT). A rough estimate on the relation between disposal height and remaining capacity is shown in Table 6-16.

Table 6-16 Estimated Height of Disposed Waste at Kani Qirzhala DF in 2021

A - Disposal volume according to disposal height						
(1) Disposal height	m	10	20.0	30.0	40.0	50.0
(2) Disposal volume	m^3	2,724,924	5,346,447	7,866,570	10,287,294	12,610,617
B - Disposal volume used from 2004 to 2020						
(1) Number of years waste disposed at site	year	17				
(2) Average waste disposed annually	ton/year	328,500				
(3) Compaction	ton/m^3	0.7				
(4) Volume of disposed waste annually	m^3/year	469,286				
(5) Total volume for 17 years	m^3	7,977,857				
(6) Volume plus soil cover volume	m^3	8,775,643				
C- Disposal volume remaining in 2021						
(1) Volume remaining at height of 50m	m^3	3,834,974				

Source: JST

If the disposal height is further raised to 50 meters, the total available disposal volume increases to 12,610,617 m^3 as shown in Table 6-17. On the other hand, the disposal volume actually consumed for the waste disposed of at the site in the last 17 years, the soil cover applied to that waste and considering compaction is roughly estimated at 8,775,643 m^3. Considering the space taken by the waste disposal in the last 17 years of 8,775,643 m^3, then from 2021 the remaining disposal volume is estimated to be 3,834,974 m^3. Based on this estimate the disposal facility will last up to about 2025, even though the disposal height is set 50 m.

Table 6-17 Waste Disposal Volume Required Up to 2025

Items	unit	2021	2022	2023	2024	2025
1. Erbil city population (including IDPs)	capita	1,405,141	1,438,111	1,471,134	1,504,212	1,537,345
2. Unit generation rate	kg/cap/day	1.32	1.33	1.35	1.36	1.38
3. MSW amount generated	ton/day	1,857	1,920	1,983	2,048	2,114
4. Waste collection rate	%	98%	100%	100%	100%	100%
5. Recycling rate	%	0%	2%	3%	5%	6%
6. Waste disposal amount(1) - daily	ton/day	1,880	1,944	1,990	2,015	2,060
- annual	ton/year	686,267	709,674	726,287	735,405	751,732
7. Compacted waste density	ton/m^3	0.9	0.9	0.9	0.9	0.9
8. Waste disposal volume	m^3/year	762,519	788,526	806,986	817,116	835,258
9. Cummulative waste disposal volume	m^3	762,519	1,551,045	2,358,031	3,175,147	4,010,405
10. Cover soil volume (10% of waste volume)	m^3	76,252	155,104	235,803	317,515	401,040
11. Total Cummulative waste disposal volume	m^3	838,771	1,706,149	2,593,834	3,492,661	4,411,445
Note: (1) Waste disposal amount includes MSW collected from Erbil City, IDPs residing in Erbil City, and other towns						

Source: JST

(3) Action Plan Required for Kani Qirzhala DF

An action plan to operate the site for the next 5 years and at the same time start preparing for its safe closure needs to be prepared as soon as possible. Some of the activities required are listed below:

1. Prepare the DF utilization plan for the next five years
   a. Survey the site topography to determine the waste heights, areas of waste disposal, etc.
   b. Identify the older waste disposal areas at the site.
   c. Prepare the plan of operation for the DF considering the extension of the DF life for at least 5 years and the requirements for safe closure.
   d. Consider the mining of the old waste and using it as a source of cover materials for the new waste disposal, as well as using the mined space for disposal of new waste.
2. Prepare the DF safe closure plan
   a. The DF utilization plan after closure should be prepared at the same time as the safe closure plan.
   b. The closure plan should address such aspects as the waste slopes inclinations, final cover gradients, thicknesses of the closure layers, storm water drainage and leachate monitoring systems.
   c. The environmental monitoring plan which should be implemented for at least 10 years after DF closure is an important part of the safe closure plan.
   d. A temporary land use plan for the closed disposal facility during the interim period of 10 years as well as a more permanent land use plan after that should be considered. During that period land use of the site should be limited to open space, parking areas, other SWM activities, etc. and no large structures should be constructed in that time.

Chapter 7 Support from Donors and Others in the SWM Sector

7.1 UNDP

UNDP has recently supported Muthanna governorate and Karbala governorate in Iraq, in the following solid waste management projects. However, UNDP does not have any official projects related to SWM in Baghdad Mayoralty, Basrah City and Erbil City at present.

Table 7-1 List of UNDP's Solid Waste Management Projects in Iraq

Project Name	Promote green practices on waste management - Healthcare sector	Sustainable Solutions of Compost Production-Iraq
Project Site	Muthanna Governorate	Karbala Governorate
Counterpart	Muthanna Health Directorate	Karbala Governor Office and Municipality
Period	December 2020 - December 2021	April 2021 – September 2021
Purpose	The project aims to prevent the health risks associated with exposure to healthcare waste for health workers, public and the environment by promoting environmentally sound management practices for healthcare waste in health facilities in Al Muthana and developing self-help capacities within local institutions.	The main objective of the programme is to promote environmentally sound waste management in Iraq by creating a value chain for compost for the private sector and encourage efficient management of sustainable production and utilization of compost. In addition, the proposed programme aims to pilot a best practice on composting benefits in Karbala Governorate, Iraq. The core technology to be supported will be the production of organic compost to be generated from waste at the household level and at municipal disposal facilities, augmented by decomposition technology at disposal facilities to reduce methane emissions. The programme will incentivize the use of compost over chemical fertilizers by progressively integrating compost into the existing fertilizer market and demonstrating its proven advantages.
Result	1. Assessment of the current medical waste management in Al Muthana 2. Training in Al Muthana governorate on dealing with the HCW management 3. Update COVID-19 HCW management guideline/ procedure nationwide. 4. Conduct two hygiene awareness campaigns targeting healthcare workers and the public 5. Procurement of shredder, autoclave and essential supplies	1. Identification and mapping of the key stakeholders 2. Measure the willingness of the waste generators to participate in the collection process of organic waste 3. Assess the actual needs of the community 4. Design and conduct awareness activities aiming at ensuring the delivery of a feasible quantity and good quality of the generated food waste 5. Assessment of the current capacity of the local authority in collecting and delivering organic waste 6. SOP of compost handling and management and conduct training 7. Prepare a market supply and demand study of the compost in Iraq 8. Conduct consultations with the importers and sellers of the chemical fertilizers 9. Spread awareness on the benefits of using compost as a main fertilizer in the agricultural sector 10. Develop a national strategy for promoting waste to compost in Iraq 11. Conduct EIA and site selection for the construction of the composting facility. 12. Construction and training of pilot composting facility 13. Technical and economic evaluation of pilot composting plant products 14. Prepare a detailed design and specifications for the

		most appropriate treatment technologies aiming at commercializing the facility

Source: Answer of the JST questionnaire

For the future support activities in the waste sector, UNDP is focusing on relevant projects from an environmental point of view such as capacity development and compost introduction rather than infrastructure. (Composting and capacity development of total waste management system)

7.2 UNICEF

UNICEF has been supporting Basrah governorate to develop solid waste management for some years since 2009 aiming to improve public and environmental health and to build the capacities of the related section staff. UNICEF implemented the following activities:

- To study future strategy on solid waste management and to formulate the Basrah solid waste management master plan.
- To construct the first waste cell in Basrah disposal facility together with access road, administration building and weighbridge control room.
- To supply disposal facility equipment, weighbridge, waste compactors, semi-trailers and tractor heads for solid waste transfer station and track wheel loader

Recently UNICEF has supported Baghdad Mayoralty and Baghdad governorate through the following solid waste management projects.

Table 7-2 List of UNICEF's Solid Waste Management Project in Iraq

Project Name	Provision of seven units of weighbridges for weighing waste collection trucks to be installed at the transfer stations in the municipalities	Provision, Installation and Operation of nine Compaction units for treating medical waste with spare parts in Baghdad governorate
Project Site	Baghdad Mayoralty	Baghdad governorate
Counterpart	Baghdad Mayoralty	Ministry of Health and Environment
Period	2019 – 2021	2020 - 2021
Purpose	The installation of weighbridges in the municipalities is a critical step to control the management system, grasping the daily waste collection amount, waste disposal amount and waste collection cost.	Supporting new technology with low carbon emission in healthcare facilities to mitigate the risk of negative environmental impact on healthcare waste and neighboring households instead of traditional incinerators, through the provision, installation and operation of medical waste treatment units and to ensure a safer management of the solid wastes generated by facilities in urban areas with densely populated geographical area and substantial infrastructure of public services.
Result	Improve the performance of the solid waste management system and strengthen digital monitoring platform of waste collection and disposal operations, and the control of fuel costs, as well as to generate reports on the quantity of waste, etc. Identify the actual collected waste rather than estimation	Reduce the impact of climate change and mitigate the exposure of healthcare workers, clinics and neighboring household to the risk of hazardous medical waste generation

Source: Answer of the JST questionnaire

7.3 USAID

USAID is currently involved in the SWM activities in Iraq through the Iraq Governance and Performance Accountability (IGPA/TAKAMUL) Project the agency is implementing.

(1) Project Snapshot

- Project Duration: 2017-2023
- Locations: All regions and provinces of Iraq with a special focus on Anbar, Basrah, Babel, Erbil, and Ninewa
- Budget: USD 172 million

(2) Project Purpose and Outline

USAID's Iraq Governance Performance and Accountability (IGPA, known as "Takamul" or "integration" in Arabic) project supports the GOI's efforts to combat corruption by strengthening public financial management and tangibly improving the delivery of essential services through locally led reform initiatives. IGPA seeks to establish a collaborative process between the federal and provincial governments and integrate civil society actors into this process to ensure greater accountability, transparency, and citizen buy-in by providing support in four key areas. Their project supports the following sectors.

- E-Governance and Public Financial Management
- Service Delivery
- Economic Reform and Public Financial Management
- Monitoring and Oversight
- Community Outreach & Support to Emerging Leaders

Working together with government and civil society, IGPA/Takamul helps to improve service delivery in provinces by providing technical assistance and supporting the implementation of laws to decentralize decision-making. Priority service sectors include water supply, solid waste management, and electricity (in the KRG), all of which align with GOI priorities.

(3) Assistance Packages for the Solid Waste Management Sector

IGPA/Takamul designed assistance packages for water and solid waste management for each of the Project's target provinces: Baghdad, Basrah, Babel, Anbar, and Ninewa.

For the solid waste management (SWM) sector, assistance packages improve availability, quality, presentation, and use of information to enable improved planning, monitoring of service provision, and private sector engagement. IGPA/Takamul conducted a cost recovery ratio and optimization analysis of SWM at the municipal level as part of a comprehensive budgeting exercise to assist in advocacy efforts for improved funding.

The second SWM support package includes: 1) Integrated Solid Waste Management Law, 2) training for the landfill operators, 3) rehabilitation of a number of open dumping sites, 4) preparation of a landfill operations manual, and 5) environmental monitoring training to build the capacity of the operators. Regarding Integrated Solid Waste Management Law, it is reported to recommend key legal reforms to improve the SWM system, clarify the roles of different players, and remove overlaps and duplications.

7.4 GIZ

GIZ working in Iraq is mainly covering (1) Security, reconstruction, peace, (2) Social development, (3) Economic development and employment, and (4) Governance and democracy. GIZ has no projects in the field of SWM in Iraq and currently there is no officer from GIZ engaged in this sector. And GIZ has not been engaged in SWM projects in Iraq in the past.

Chapter 8 Draft Support Policy related to Solid Waste Management

8.1 Analysis and Recommendations on Solid Waste Management in Other Neighboring Countries

JST has collected information on the present SWM conditions on the neighboring countries of Iran, Jordan and Palestine (Annex-1). The lessons and recommendations learned from the SWM conditions in these countries are summarized below.

(1) Setting Target Values for the National Solid Waste Management Master Plan

National Solid Waste Management Master Plan in Iraq was formulated in 2007, however there is no revised plan with an interim assessment of achievement. This master plan describes a detailed schedule for each action, but does not provide target values (indicators) such as waste collection rate and recycling rate. At the time of revision, it is recommended to consider the target values of the master plan. For reference, Table 8-1 shows the target values of the national solid waste management master plans of Iran and Jordan.

Table 8-1 Target Values of National Waste Management Master Plans in Iran and Jordan

	Target of Master Plans
Iran	National Waste Management Master Plan (2015-2020) Terms: From 2015 to 2020 Target: • Reducing waste generation by 10% • Increasing average percentage of separated waste collection from 7% to 30% • Increasing mechanized waste collection from 40% to 60% • Increasing organic waste recycling from 12% to 80% • Increasing energy recovery from waste from 1% to 3% • Increasing waste recycling percentage from 23% to 90% • Increasing percentage of regulated landfilling from 7% to 20%
Jordan	National Municipal Solid Waste Management Strategy Terms: From 2015 to 2034 Target: • Increasing coverage rate of MSW street-cleansing and collection services to 100% by 2024. • Setting-up of separate collection systems for recyclables (at least paper, metal, plastic and glass) by 2034. • Improving re-use and recycling rates of MSW materials (at least paper, metal, plastic and glass) to 50% by 2034. • Ceasing operations of uncontrolled or unlicensed disposal facilities 50% by 2019 and 100% by 2024. • Reducing rate (on a weight basis in 2024) of bio-waste ending-up at disposal facilities to 75% by 2034. • Increasing Recovery rate (on a weight basis in 2024) of packaging waste (including reuse, materials' recovery and energy recovery) to 25% by 2034. • Increasing recycling rate of packaging waste to 15% by 2034.

Source: Iran: National Waste Management Master Plan 2015-2020, Jordan: Development of a National Strategy to improve the Municipal Solid Waste Management Sector in the Hashemite Kingdom of Jordan (NSWMS)

(2) Recommendation related to Waste Management Fee

In Iraq, the collection of waste management fees from residents has not progressed, which is an issue that needs to be solved. Iran has established guidelines for calculating waste management fees, and Jordan collects waste management fees with electricity fees. Regarding fee collection, the introduction of a nationwide system with a consideration to setting fees that provide incentives to reduce the amount

of waste generation and an efficient collection system is recommended. Table 8-2 shows collection of waste management fees in Iran and Jordan.

Table 8-2 Collection of Waste Management Fees in Iran and Jordan

	Collection of Waste Management Fees
Iran	• In Iran, "Guidelines for calculating urban waste management fees" was formulated, and waste management fees are stipulated based on the size of the building. • The fees are calculated in accordance with the guidelines, and the municipalities levy waste management fees of EUR 9-21 per household per annum. However, Willingness to pay from residents is a challenge and attempts are being made to collect outstanding fees.
Jordan	• In order to ensure effective waste management fee collection, all the municipalities set the amount of waste collection fee for each electricity meter and have the fees collected by the electricity companies in Jordan. • In Great Amman Municipality (GAM), the waste management fee is stipulated on each electricity meter as below. ➢ **Household**: 20 JD/electricity meter/year + 0.005JD/KWh (for >200 KWh per month) ➢ **Business**: 24 JD/electricity meter/year + additional fee (10 to 1,500 JD/year depending on the contract) • Annual collection amount of fees in GAM (2015) was 18,260 thousand JD, and it is equivalent to 67% of annual budget 27,303 thousand JD.

Source: Iran: National Waste Management Master Plan 2015-2020, Jordan: Development of a National Strategy to improve the Municipal Solid Waste Management Sector in the Hashemite Kingdom of Jordan (NSWMS)

The following figure shows data of the World Bank report for reference in setting the fee.

What a Waste 2.0: A Global Snapshot of Solid Waste management to 2050 (World Bank, 2018)

Table 5.4 Waste Management User Fees by Region

Region	Average user fee in selected cities (US$/year, as reported in data)
East Asia and Pacific	46
Europe and Central Asia	83
Latin America and the Caribbean	80
Middle East and North Africa	55
South Asia	34
Sub-Saharan Africa	10–40 (based on World Bank estimates)

Table 5.5 Waste Management User Fees by Income Level

	Average fees, US$ per year	
Income group	Household	Commercial
High income	$168	$314
Upper-middle income	$52	$235
Lower-middle income	$47	$173
Low income	$37	$155

Note: All currency amounts are in US$.

(3) The Lessons Learned and Recommendation on introducing WtE in Iran

In recent years, the demand to introduce WtE facilities has been increasing in Iraq, and there are concrete moves toward the introduction of WtE facilities in Baghdad and Erbil. The introduction of WtE facilities, especially incineration facilities, has technical issues such as the calorific value generated by waste, and the following is an example of the introduction of WtE facilities in Iran.

Achievements on WtE in Iran

- Of the 15 planned WtE facilities, the first was opened in Tehran in 2015. The facility was built by Eco-Waste Technology Co., Ltd. in Zhejiang Province, China and is operated by the TSS Group in Iran. The facility can handle 200 tons of waste daily and has an output capacity of 3 MW. According to the Municipality and Rural Management Organization, there is a problem keeping the incinerator temperature constant in the waste incineration process of the facility.
- The calorific value of general waste is an important consideration in the development of WtE facilities. The average calorific value of general waste in Iran is estimated to be 6,000 kJ/kg to 7,100 kJ/kg. The calorific value of the ratio of RDF obtained at the waste disposal facility in Tehran is 8,500 kJ/kg.

Source: Waste Management in Iran, Adelphi, October 2016

In Iran, the Waste Management Law requires the introduction of a separated waste collection system. In the WtE business, it is important to secure stable waste quality, and in order to prevent deterioration of calorific value, it is essential to establish the source separation of waste by residents before the operation of the WtE facility. In Iraq as well, it is recommended to start preparations and awareness raising activities for the source separation of waste, not only from the viewpoint of promoting recycling but also to ensure stable waste quality.

8.2 Questionnaire Survey of Japanese Private Companies

8.2.1 Barriers to Entry and Business risks of Japanese Companies Entering the Waste Business in Iraq

JST conducted a survey on the possibility of six Japanese companies entering the waste business in the three cities of Baghdad, Basrah and Erbil in Iraq.

The surveyed companies were six plant manufacturers that are developing waste business overseas, centering on companies that have conducted or considered waste business in the Middle East in the past.

When considering to enter into a waste business in Iraq, the main answers regarding issues and risks that can be barriers to entry are as follows.

(1) Legal System

The issues were the status of legal development and the status of system operation such as waste-related laws, Feed-in Tariff (hereinafter referred to as FIT) system for waste to energy from the viewpoint of business certainty and continuity, system for permitting and applying of construction, taxation on expatriates and representative offices.

(2) Politics

The safety of expatriates and business continuity due to political instability were raised as risks. In other opinions, the issues were the existence of a master plan of waste management and the ability to implement the master plan, which was important not only to confirming the position of the project on the master plan but also to consider a future business development.

(3) Technical Aspect

The issues were the differences in regulations, technical standards, codes, and other rules. In addition, there was an opinion that setting excessive specifications for combustion temperature and exhaust gas

regulation values is not appropriate from the viewpoint of cost, but there was also an opinion that even high regulation values comparable to those in Europe can be technically dealt with.

(4) Cost Aspect

Payment risk and cost overrun risk were mentioned.

(5) Business Continuity

Guaranteeing or compensating for the quantity and quality of waste was raised as an issue. In particular, with regard to industrial waste, there was an opinion that it is presumed that stable operation will be difficult due to the drastic decrease in the amount of industrial waste generated due to the influence of the crude oil market, etc., because the industry is heavily focused on petroleum.

In addition, Citizens' acceptability for paying for waste sanitation was also raised as an issue.

(6) Procurement / Contract

It was pointed out that there should be an internationally acceptable general contract, such as FIDIC, with conditions that do not pose disadvantages or significant risks to the contractor.

8.2.2 Government Support Measures

The main responses regarding government support measures required to avoid, pass on, and mitigate barriers to entry and business risks are as follows.

Table 8-3 Government Support Measures

Government	Required support measures
Japanese Government	- Support for smooth discussions with the government of the partner country and the implementing organization - Contribution of low interest rate loans to businesses - Support for trade insurance, etc.
Iraqi government	- Development of FIT system - Establishment of regulatory requirements for furnaces, exhaust gas and ash - Allocation of subsidies for the introduction of equipment in local cities - Providing government guarantee

Source: Answer of the JST questionnaire

8.2.3 Summary

Two of the six companies were interested in entering the waste business in the three Iraqi cities in this survey. Both companies have no conditions for the business method such as DBO (Design Build Operate), BOT (Build Operate Transfer), BTO (Build Transfer Operate) etc., but the entry form is EPC or subcontracting of EPC contractors. The main reasons for the four companies that answered that they were not interested in entering the market were risks due to uncertainties in the situation and lack of knowledge in the Middle East region, and a shortage of human resources.

Regarding barriers to entry and business risks, some issues and risks were raised for all six questions (legal system, politics, technology, cost, business continuity, procurement / contract).

The issues and risks particular to Iraq were that the political situation was unstable, and that stable operation was difficult because the amount of industrial waste generated was affected by the crude oil market. Other general opinions included the status of legal systems, licensing systems, etc., the status of regulations, etc., the setting of regulatory values, the existence of master plans, the acceptability of citizens to bear the costs, and contract conditions. However, it should be noted that some companies have different perceptions of issues and risks depending on the type of entry they envision. Naturally, each company recognizes the risks and challenges depending on the scope of entry. Therefore, for example, while some companies place importance on the existence of a FIT system from the perspective

of business certainty and continuity, some companies that limit their entry into the business to equipment delivery have said that they do not consider the FIT system very much.

Regarding government support measures, the Japanese government was requested to support smooth discussions with the governments of partner countries, contribute low interest rate loans to businesses, and support trade insurance. The Iraqi government was requested to provide subsidies and government guarantees for the introduction of equipment in local cities, in addition to the development of laws and regulations that were mentioned as issues.

Japan's Ministry of Economy, Trade and Industry and the Ministry of the Environment are focusing on exporting environment-related infrastructure in Asia. Due to the favorable Asian markets such as China in recent years, Japanese companies are not aggressive in their high-risk businesses in the Middle East such as Iraq. Considering a future project in Iraq, Japanese ODA projects such as ODA loan projects and grant aid are desired.

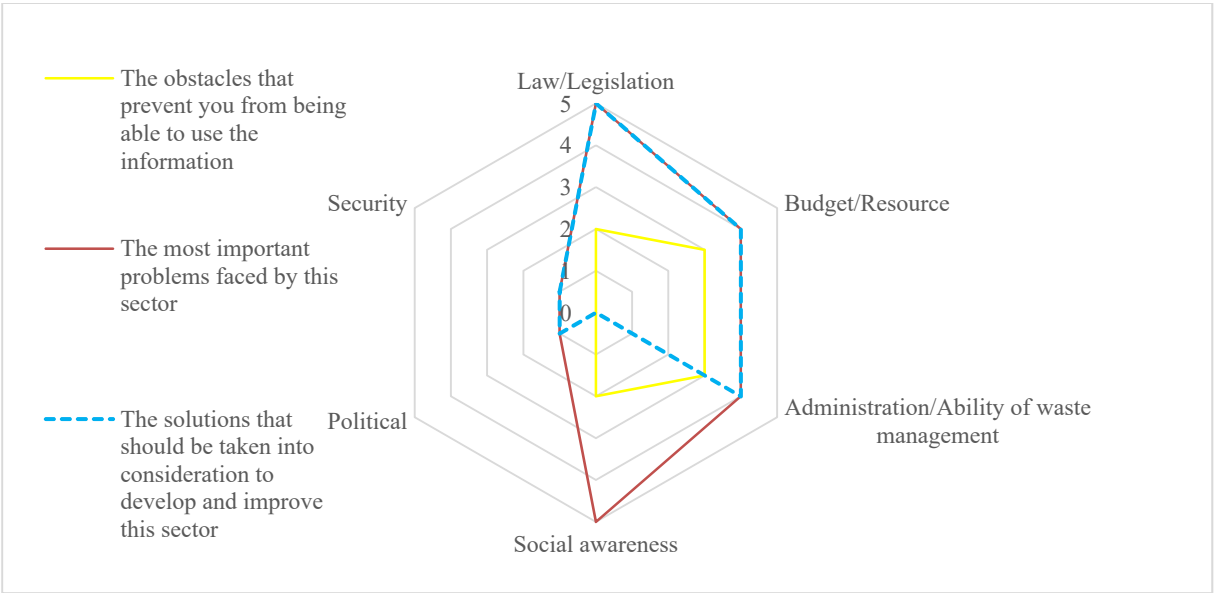
8.3 Needs Suggested by Participants of Training in Japan

8.3.1 Summary of Questionnaires from Previous Trainees in Japan

The questionnaires were filled by 6 Iraqi trainees (Federal government and KRG: 2 persons, Municipalities: 4 persons) who have taken SWM training courses in Japan by JICA's support. Answers against the following questions are categorized by 6 items, such as Law/Legislation, Budget/Resource etc.

- The obstacles that prevent the trainee from being able to use the information
- The most important problems faced by this sector
- The solutions that should be taken into consideration to develop and improve this sector

The trainees think that Political and Security issues are not obstacles, problems and solutions to all questions. Law/Legislation and Social Awareness are considered as important problems and solutions for solid waste management as well. On the other hand, Social awareness is not considered as a solution despite a lot of answers of it being an important problem. It may therefore be suggested that problems of solid waste management cannot be solved by Social awareness.



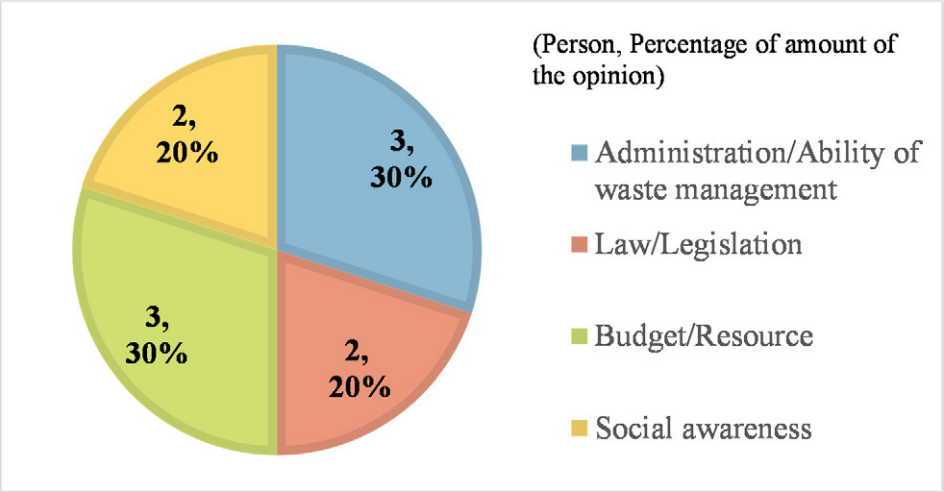
Source: Answer of the JST questionnaire

Fig. 8-1 Erbil City Municipal Solid Waste Material Flow in 2020

The main results of the questionnaires obtained from the trainees are shown hereafter.

Question: What are the obstacles that prevent the trainee from being able to use the information gained in Japan in developing the work of your institutions?

The obstacles are classified into 4 types, and the number of trainees who mentioned each obstacle is shown in Fig. 8-2.



Source: Answer of the JST questionnaire

Fig. 8-2 Obstacles that Prevent the Trainees from being able to Use the Gained Knowledge

A. Law / Legislation
   - Lack of legislation of the solid waste management

B. Budget / Resource
   - Lack of financial allocations to the waste sector to implement waste treatment projects
   - Poor capabilities in equipment and machinery and a weak financial budget

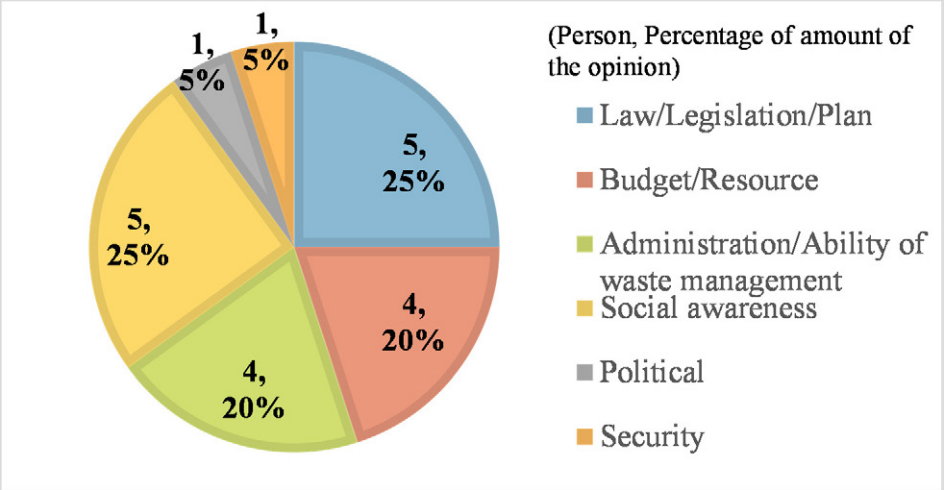
C. Administration / Ability of waste management
   - Presence of officers who do not deal with the sector with technical and scientific viewpoints
   - Work behavior of staff who align current strategies without taking considerations of new advice and consultations.
   - Administrative corruption
   - Lack of seriousness on the part of the decision-makers

D. Social awareness
   - Lack of social awareness, and lack of interaction between the citizen and the competent institutions
   - Persistence on the conventional ways and low acceptance of the society's new culture

Question: What are the most important problems faced by the sector?

The problems are classified into 6 types, and the number of trainees who mentioned each problem is

shown in Fig. 8-3.



Source: Answer of the JST questionnaire

Fig. 8-3 Important Problems Faced by this Sector

A. Law/Legislation
- The absence of an applicable solid waste management legislation that is compatible with the developing the purpose of solid waste management such as improving public health to enhancing recycling activity
- The lack of legislation of solid waste management
- Preventing the export of recyclable materials outside Iraq
- The absence of decisions to activate the relationship between municipalities in charge of waste management including WtE facilities and Ministry of Electricity's passive behavior
- Not activating the relevant laws on the environment
- The lack of imposing strict laws that oblige the citizens to sort the waste at source

B. Political
- Political stability
- Low prioritizing of waste management sector except for the capital or pivotal cities

C. Security
- Unstable security situation

D. Budget / Resource
- The low effect of budgets allocations to the waste management of the sector because of insufficient amount and delay of the disbursement.
- The financial allocations for waste management are not disbursed fairly between city centers, districts and administrative units outside the municipality's borders
- The lack of facilities for intermediate and final treatment of solid wastes
- Not allocating the necessary funds for environmental protection projects

E. Administration / Ability of the organization
- The lack of qualified human resources that have experience in this sector
- Financial and administrative corruption prevents the implementation of solid waste

management legislation

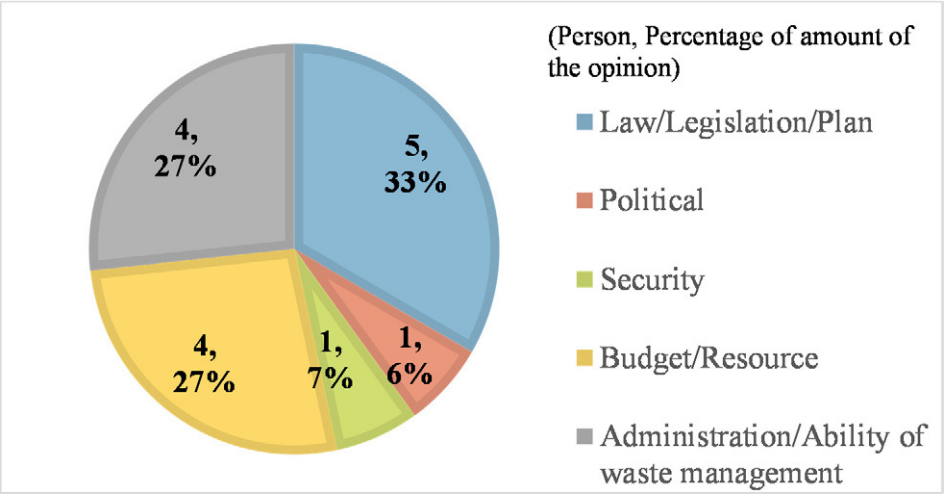
- Not supporting the private sector in waste management investment projects for collection & transportation, sorting and recycling waste, as well as final disposal.
- Waste is randomly dumped without the establishment of formal disposal facilities that comply with environmental determinants
- Solid waste in Iraq is still disposed of by burying in irregular disposal facilities, and there is no treatment or recycling at the present

F. Social awareness

- The prevailing societal behavior and culture, where citizens discharge large amounts of waste at multiple times a day and in many places
- The lack of awareness among the officials and the citizens alike
- The weakness in the aspect of awareness and education in the waste management in general and the failure to give importance to supporting education and environmental awareness in the field of waste management by the institutions concerned with waste management
- The lack of material and support system for civil society organizations to enable them to play a role in the areas of awareness and education to increase public participation in waste management
- Lack of the citizen's cooperation with the municipalities
- Source separation is not applied

Question: What are your perceptions of the solutions that should be taken into consideration to develop and improve this sector?

The perceptions are classified into 5 types, and the number of trainees who mentioned each type is shown in Fig. 8-4.



Source: Answer of the JST questionnaire

Fig. 8-4 Perceptions of the Solutions that should be taken into Consideration to Develop and Improve this Sector

A. Law/Legislation/Plan

- Legislation of solid waste management
- Legislating laws or instructions to privatize waste management, and encouraging international investment companies in this field
- Legislating strict laws for industrialists to encourage building recycling system
- Develop future plans for social practices that will reduce the waste amount
- Legislation of a clean energy law that allows for cooperation between municipal institutions and the Ministry of Electricity for waste investment and energy production
- Activating environmental regulations and laws in holding negligent people accountable
- Develop a system for the management of solid and hazardous waste
- The participation of the private sector in the field of waste recycling
- Land acquisition for candidate areas to establish SWM infrastructure projects
- Appointing leading organization among the concerned institutions for decision making for investment projects of waste management
- Formulating strict regulation on solid waste management
- Formulating inclusive plan to raise public awareness

B. Political

- Political stability
- Prioritizing waste management sector in remote municipalizes which generally put low priority on waste management.
- Urging the Ministry of Health and Environment teams to take their supervisory role seriously and strictly in the field of waste

C. Security

- Stable security situation

D. Budget / Resource

- Implementation of waste management works by completing the infrastructure (building transfer stations and sanitary disposal facilities), purchasing compactor trucks of different capacities sizes, and organizing work
- Requiring municipal institutions to establish sanitary landfills in accordance with sound environmental standards
- Establishing projects for intermediate treatment of solid waste
- Supporting environmental projects by the state by setting financial allocations for their feasibility studies and preparing the necessary environmental impact assessment reports

E. Administration / Ability of the organization

- Utilizing private companies that handle collection and transfer operations under the supervision of the competent (governmental) department
- Activating environmental control authorities in disposal facility management
- Correctly identifying candidate sites for disposal facilities of solid waste and preparing an environmental impact report for each proposed site
- Preparing training programs on waste management in various sectors of the government

- Selecting a proven technical system of solid waste management taking into account the current mixed nature (not sorted) of the solid waste discharge

8.4 Issues and Proposed Support Policies

8.4.1 Federal Government

Table 8-4 shows the issues and the need for support for waste management related to the Federal Government. In response to the issues described so far, the need for support from JICA and the contents of support are organized in consideration of the support status of other donors.

Table 8-4 Waste Management Issues and Need for Support for the Federal Government

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
Capacity Development	1. Formulation of policies and plans			
	Master plan	Ten years have passed since the Master Plan formulation, but it has not been evaluated or revised.	None	A: To conduct an interim evaluation of the master plan, and to provide support for its revision, adding items on setting targets, recycling and public awareness, and closing inappropriate disposal sites
	2. Improvement of laws and systems			
	Waste Management Law	Basic waste management law does not exist.	USAID is supporting the development of a waste management law.	C: USAID is supporting the development of a waste management law.
	Individual laws and systems related to recycling	Laws and institutions related to recycling are not yet in place.	None	A: To present policies in a master plan and support the establishment of laws and institutions to realize them.
	Technical standards and systems for treatment and disposal	There are no standards for intermediate treatment facilities.		A: To support the establishment of technical standards and promotion systems. Add items to WtE, such as combustion temperature, incinerator ash disposal, and electricity sales price.
		There are no specific design standards for final disposal sites.		A: To support the development of technical standards, especially to establish standards for liners, leachate collection and treatment.
	Data management	New data, such as outlines of the facility and incoming waste amount to the facilities, needs to be added to the CSO data book and definitions of terms need to be aligned with laws and regulations.		A: To support the improvement of data collection and systems, including the use of IT technology. To update survey forms, etc., in line with laws and regulations.
	3. Improvement of waste management services			
	Collection and transportation	The national waste collection rate is about 60%, and the low waste collection rate, especially	None	C: It is difficult for the Federal Government to support this issue because it is a municipality

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
		in suburban areas, is a problem.		undertaking.
	Transfer stations	Transfer stations need to be constructed. At least in urban areas, it is desirable to have formal transfer stations.		A: To support the establishment of a system (subsidies, penalties) that encourages the construction of formal transfer stations while discouraging the construction of informal ones.
	Intermediate treatment	As described in "Technical standards and systems for treatment and disposal" above.		A: As described in "Technical standards and systems for treatment and disposal"
	Final disposal	New construction of disposal sites should be restricted to facilities that have obtained environmental approvals.		A: To support the establishment of a system (subsidies, penalties) to encourage the construction of sanitary landfills.
		It is necessary to identify the actual status of open dumping sites across the country, define safe closure methods, and close these sites.		A: To support the development of guidelines for the safe closure of open dumping sites.
				A: To support the development of a phased safe closure plan.

A: Very high need for support, B: Need for support, C: Low need for support
Source: JST

8.4.2 Baghdad Mayoralty

Table 8-5 shows the issues and the need for support for waste management related to Baghdad City. Proposed support policies. The proposed support policies are divided into two categories: capacity development, which is expected to include technical cooperation projects, dispatch of experts, and training in Japan; and financial support, which is expected to include the use of Japanese ODA loan.

Table 8-5 Waste Management Issues and Need for Support for Baghdad City

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
Capacity Development	1. Formulation of policies and plans			
	Master plan	Ten years have passed since its formulation, but it has not been evaluated or revised.	None	A: To conduct an interim evaluation of the master plan, and to provide support for its revision.
	2. Improvement of laws and systems			
	Data management	There are no weighbridges at disposal sites and informal transfer stations, so the amount of collected waste cannot be monitored. Waste management data is scattered across several departments.	UNICEF will install weighbridges at informal transfer stations.	B: To support installation of weighbridges at final disposal sites and improvement of data management systems.
	Management of private contractors	None (all under direct management)		
	3. Improvement of waste management services			
	Collection and transportation	10-15% of waste is not being collected.	None	A: To support improvement of operation management and guidance for drivers and workers.

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
	Transfer stations	Sixteen informal transfer stations are still in operation, and there are problems such as bad odors and scattered wastes.	UNICEF will install weighbridges at informal transfer stations.	B: To identify the actual status of informal transfer stations and support improvement of management and renovation of facilities.
	Intermediate treatment	The construction of a WtE facility and two recycling facilities is being considered and should proceed without delay.	None	A: To support the development of manuals for facility operation/management in preparation for future facility operations.
	Final disposal	Since the capacity of a new landfill is not sufficient, it is necessary to extend the lifetime of existing disposal facilities and improve them.	USAID conducted a survey of one existing disposal facility and made recommendations.	A: To support the development of a work plan and environmental management plan for lifetime extension and improvement, and to construct pilot facilities
		The disposal facilities are located outside the city.	None	A: To support the study of operating the disposal facilities as regional landfills.
	Public awareness	Little is done and no need is felt.	None	C: There is little significance in raising awareness since collection of separated wastes has not been introduced.
Financial support	4. Development of waste management facilities			
	Collection and transportation	Already mentioned in the "Capacity development" section above	None	B: To support for upgrading of existing facilities
	Transfer stations	Already mentioned in the "Capacity development" section above		A: To support the construction of new transfer stations
	Intermediate treatment	Already mentioned in the "Capacity development" section above		C: Less likely to be supported as construction is already underway
	Final disposal	Already mentioned in the "Capacity development" section above		C: Less likely to be supported as construction is already underway
Possibility of private sector participation		As for the intermediate treatment, the facilities are already under construction, so there is little possibility for the private sector to participate. As for collection and transportation, there is no possibility for the private sector to participate since the collection is done directly by the city.		

A: Very high need for support, B: Need for support, C: Low need for support
Source: JST

8.4.3 Basrah City

Table 8-6 shows the issues and the need for support for waste management related to Basrah City. Proposed support policies.

Table 8-6 Waste Management Issues and Need for Support for Basrah City

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
Capa	1. Formulation of policies and plans			
	Master	Ten years have passed since its	None	A: To conduct an interim

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
	plan	formulation, but it has not been evaluated or revised.		evaluation of the master plan, and to provide support for its revision.
	2. Improvement of laws and systems			
	Data management	Data on the waste unit amount and composition have not been updated.	None	B: To support the implementation of waste quantity and quality surveys and the improvement of data management methods.
		Waste management data is scattered across several departments		B: To examine data management methods and support the establishment of a system for centralized management.
	Management of private contractors	Bidding for collection and transportation consignment has been delayed due to the delay in budget execution.		C: Difficult to provide support as this is a budget execution issue from the Federal Government.
	3. Improvement of waste management services			
	Collection and transportation	Approximately 24% of waste is not being collected.	None	B: To support improvement of operation management and guidance for drivers and workers.
	Transfer stations	Construction of the formal transfer station has been delayed due to opposition from local residents.		C: Difficult to provide support as this is an on-going construction project.
	Intermediate treatment	There are no intermediate treatment facilities in operation or under planning.		A: To support the investigation and study of intermediate treatment facilities at the same time as the revision of the master plan
	Final disposal	The remaining lifetime of the existing disposal facility is about 5 years, and a new landfill site is needed.		A: To support the planning and design of a new landfill once a candidate site is found, and the study of its operation as a regional landfill at the same time.
		It is necessary to extend the lifetime of existing disposal facility until a new landfill is constructed.		A: To support the development of a work plan and environmental management plan to extend the lifetime of the existing disposal facility.
	Public awareness	It is necessary to develop a plan for public awareness and coordinate with USAID activities.	Being implemented by USAID	C: It is required to coordinate with activity of USAID
Financial support	4. Development of waste management facilities			
	Collection and transportation	Already mentioned in the "Capacity development" section above	None	C: Less need for direct collection as private sector outsourcing is well underway
	Transfer stations	Already mentioned in the "Capacity development" section above		C: A new transfer station is under construction.
	Intermediate treatment	Already mentioned in the "Capacity development" section above		C: There is no plan.
	Final disposal	Already mentioned in the "Capacity development" section above		A: To support the development of a new landfill site when a potential site is found.
Possibility of		There is no specific plan for the development of intermediate treatment facilities. It is still		

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
	private sector participation	at the stage of examining the necessity of intermediate treatment facilities in the master plan. Collection and transportation is outsourced to the private sector, but there is little possibility for foreign companies to participate.		

A: Very high need for support, B: Need for support, C: Low need for support
Source: JST

8.4.4 Erbil City

Table 8-7 shows the issues and the need for support for waste management related to Erbil City. Proposed support policies.

Table 8-7 Waste Management Issues and Need for Support for Erbil City

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
Capacity Development	1. Formulation of policies and plans			
	Master plan	The proposed master plan has not been approved and is not applicable.	None	A: To support the development of the master plan.
	2. Improvement of laws and systems			
	Data management	The weighbridge at the disposal site is not in continuous daily use.	None	B: To ensure that the weighbridge are used continuously and to support data collection and analysis.
		Data on the waste unit amount and composition have not been updated.		B: To support the implementation of waste quantity and quality surveys
		Waste management data is scattered across several departments		B: To examine data management methods and support the establishment of a system for centralized management.
	Management of private contractors	Some payments to collection and transportation companies have not been made.		C: Difficult to provide support as this is a budget execution issue
	3. Improvement of waste management services			
	Collection and transportation	None	None	C
	Transfer stations	None		C
	Intermediate treatment	For construction of WtE facility, it is necessary to secure a budget of operation and management and develop facility operation and monitoring systems.		B: To support the development of operation and management/monitoring manuals in preparation for future facility operations.
	Final disposal	The remaining lifetime of the existing disposal site is about 5 years, but a new landfill site is not planned.		A: To support the development of a work plan and environmental management plan in order to extend the lifetime of the existing disposal site and to implement the sanitary disposal.
	Public awareness	Little is done and no need is felt.		C: There is little significance in raising awareness since collection of separated wastes has not been introduced.
Financia	4. Development of waste management facilities			
	Collection and transportation	Already mentioned in the "Capacity development" section	None	C

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
		above		
	Transfer stations	Already mentioned in the "Capacity development" section above		C
	Intermediate treatment	Already mentioned in the "Capacity development" section above		B: To support the development of WtE facility, currently under consultant procurement.
	Final disposal	Already mentioned in the "Capacity development" section above		A: To support the construction of a new landfill site
Possibility of private sector participation		For intermediate treatment, private companies can participate in the process because facilities will be constructed through BOT. As for collection and transportation, it will be difficult for new companies to enter the market since private companies are already collecting wastes on consignment throughout the city.		

A: Very high need for support, B: Need for support, C: Low need for support
Source: JST

8.5 Proposed Priority Projects

Based on the issues mentioned in 8.4, proposed priority projects are assumed as follows. In Iraq, there is a growing need for the introduction of WtE facilities particularly in Baghdad Mayoralty and Erbil city, but the environmental and technical standards for the introduction of such facilities are not yet developed. It is considered that the priority project for the federal government aiming at capacity development has the highest priority. Besides, Baghdad Mayoralty collects only around 90% of the generated waste in their jurisdiction despite being the capital of Iraq. In addition, there are disposal facilities in Baghdad Mayoralty which require improvement. Consequently, the priority project for Baghdad Mayoralty also has a high priority, the same as for the federal government.

8.5.1 Priority Project for the Federal government

Items with very high need for support mentioned in 8.4.1 are summarized and categorized as shown in Table 8-8. Support policy by JICA to the federal government are categorized in three groups, 1) Masterplan, 2) Technical standards, and 3) System for developing facilities.

Table 8-8 Support Policy by JICA to the Federal Government

Group	Items with very high need	Assumed activity
Masterplan	Masterplan Individual laws and systems related to recycling Data management Final disposal (Safe closure plan)	Individual laws and systems related to recycling and the safe closure plan will be studied as a part of revision of the masterplan. In the course of evaluating the existing masterplan, solid waste data will be collected, and the data collection system will be improved.
Technical standards	Technical standards and systems for treatment and disposal Final disposal (Guidelines for the safe closure)	Technical standards and guidelines for intermediate treatment, sanitary landfill and safe closure of the open dumping site will be formulated.
System for developing facilities	Transfer stations Final disposal (Construction of sanitary landfills)	Institutional system (subsidies, penalties) for developing formal transfer station and sanitary landfill and their suitable operations will be established

Source: JST

Based on the support policy, the priority project for the federal government is proposed as Technical Cooperation Project in Table 8-9. Technical standards for the intermediate treatment facility (WtE facility) and the landfill site will be separately formulated by each committee because of the different technical origins and concerned government organizations for each. The technical standards and systems on a broad range of intermediate treatment technologies are focused on WtE because of the need for this technology, the lack of any similar facilities in Iraq, and the very advanced nature of the WtE technology. Baghdad Mayoralty has proceeded with developing WtE facility and therefore the Mayoralty is recommended to be C/P together with MCHMPW for Output 2.

Japanese experience and knowledge shall be applicable input for the 2nd outcome and the 3rd outcome of the proposed technical cooperation project. It will be valuable for the federal government and Baghdad Mayoralty that their staff will participate in training in Japan and a capable Japanese expert will be dispatched to the federal government if the security situation is deemed to be safe.

Table 8-9 Prioritized Future Project (Federal Government: SWM Strategy and Intuitional Development Project)

Scheme	Technical Cooperation Project
C/P organization	MCHMPW and Baghdad Mayoralty
Period	3 years
Expected outcomes	1. National Waste Management Master Plan will be revised. 2. Guidelines for introducing WtE facilities (technical requirement and promotion plan) will be formulated 3. Guidelines for developing sanitary landfill facility and safe closure of dumping site will be formulated. 4. System for developing solid waste management facility will be proposed.
Activities	1. National Waste Management Master Plan will be revised. (1) To setup a committee for revising the master plan (2) To collect national level solid waste data and then to evaluate the achievement levels of the current master plan (3) To revise the master plan (4) To improve the current solid waste data collection system and establish operational standards 2. Guidelines for introducing WtE facilities (technical requirement and promotion plan) will be formulated (1) To setup a committee for the guidelines that will be established (Baghdad Mayoralty will be a member of the committee) (2) To implement case survey in Japan and other foreign countries (Desktop survey, Site visit survey) (3) To formulate the draft guideline (4) To install laboratory equipment for solid waste testing and analysis 3. Guidelines for developing sanitary landfill facility and safe closure of dumping site will be formulated. (1) To setup a committee for the guidelines that will be established (2) To implement case survey in Japan and other foreign countries (Desktop survey, Site visit survey) (3) To formulate the draft guideline 4. System for developing solid waste management facility will be proposed. (1) To setup a committee for the system that will be established (2) To implement case survey in Japan and other foreign countries (Desktop survey, Site visit survey) (3) To formulate the draft system
Assumed input from JICA	Japanese experts (60 MMs), local experts, Training in Japan, Survey in Japan and other foreign countries, fund for building the information platform related to SWM

Source: JST

8.5.2 Priority Project for Baghdad Mayoralty

Items with very high need for support mentioned in 8.4.2 are summarized and categorized as shown in Table 8-10. Support policy by JICA to Baghdad Mayoralty are categorized as four groups, 1) Masterplan, 2) Improving existing disposal facilities, 3) Strengthening waste collection and transportation and 4) Operation and management of the facilities. Group 4) Operation and management of the facilities will be implemented in coordination with support to the federal government mentioned in "Technical standards"

Table 8-10 Support policy by JICA to Baghdad Mayoralty

Group	Items with very high need	Assumed activity
Masterplan	Masterplan Final disposal (regional landfill)	Regional utilization of the landfill facilities will be studied as a part of revision of the masterplan.
Improving existing disposal facilities	Final disposal (existing disposal facility)	Work plan and environmental management plan will be formulated for expanding the life span of the facilities. And a pilot project for improving disposal facility will be implemented.
Strengthening waste collection and transportation	Collection and transportation (capacity development) Transfer station (financial support)	Instruction and management of drivers will be improved. Transfer stations will be constructed.
Operation and management of the facilities	Intermediate treatment (capacity development)	This activity will be implemented in coordination with support to the federal government mentioned in "Technical standards"

Source: JST

The priority project for Baghdad Mayoralty is proposed as Technical Cooperation with financial support. It is considered that participation in specialized training in Japan on the FUKUOKA method of final disposal will be a valuable input to the 2nd outcome "Disposal facilities utilized by Baghdad Mayoralty will be improved" of the technical cooperation project.

Table 8-11 Prioritized Future Project (Baghdad Mayoralty: SWM Masterplan and Disposal Facility Improvement Project)

Scheme	Technical Cooperation Project
C/P organization	MCHMPW and Baghdad Mayoralty
Period	3 years
Expected outcomes	1. SWM masterplan in Baghdad Mayoralty will be revised 2. Disposal facilities utilized by Baghdad Mayoralty will be improved 3. Waste collection and transportation will be strengthened
Activities	1. SWM masterplan in Baghdad Mayoralty will be revised (1) To evaluate the progress of SWM masterplan in Baghdad Mayoralty (2) To build the system of SWM data collection (including intermediate facility, Management of landfill facilities' waste collection data) (3) To study the current situation (Waste amount and composition) (4) To revise the SWM masterplan 2. Disposal facilities utilized by Baghdad Mayoralty will be improved (1) To study current situation of disposal facilities (including Topographic survey, environmental monitoring) (2) To prepare operation plan and environment protection plan of the existing disposal facilities (3) To prepare operation plan and environment protection plan of the new landfill site (4) To implement a pilot project for improving the existing disposal facility(s) 3. Waste collection and transportation will be strengthened (1) To improve work attitude of drivers and workers (2) To strengthen management of drivers by data collection and GPS tracking

Assumed input from JICA	Japanese experts (50 MMs) and local experts, Training in Japan, Site surveys (Waste amount and composition, Topographic survey etc.), Cost for the pilot project (Weighbridge, Administrative office, Gate fence, some earth works etc.)

Source: JST

In addition to the technical cooperation project, an ODA loan project described below is also assumed as a priority project for Baghdad Mayoralty. The project for developing five formal transfer stations had been commenced in 2014 and then suspended as referred to in section 4.5.2 of this report. At the time of formulation of the ODA loan project, it is required to study the circumstances and difficulties of the suspended project.

Table 8-12 Prioritized Future Project (Baghdad Mayoralty: Improvement of Waste Collection & Transportation Project)

Scheme	ODA Loan Project
Executing organization	Baghdad Mayoralty
Period	5 years
Expected outcomes	Uncollected waste will be decreased through strengthening waste collection capacity.
Components	1. Improvement of existing informal transfer stations To install fence & gate, compaction machine and administrative building 2. Development of new formal transfer stations To construct new transfer stations including separation lines for recyclables aiming to reduce waste amount transported to landfill site and to increase recyclables amount collected 3. Procurement of transfer trucks To procure transfer truck adopting the specialized container to the transfer station.

Source: JST

8.5.3 Priority Project for Basrah City

Items with very high need of support mentioned in 8.4.3 are summarized and categorized as shown in Table 8-13. Support policy by JICA to Basrah city are categorized as two groups, 1) Masterplan and 2) Improving existing landfill facility.

Table 8-13 Support policy by JICA to Basrah City

Group	Items with very high need	Assumed activity
Masterplan	Masterplan Intermediate treatment (capacity development) Final disposal (capacity development / new landfill site) Final disposal (financial support)	Intermediate treatment and new landfill site will be studied as a part of revision of the masterplan. If candidate area for the new landfill site will be secured, construction of the landfill site will be supported.
Improving existing landfill facility	Final disposal (existing landfill facility)	Work plan and environmental management plan will be formulated for expanding the life span of the facility.

Source: JST

The priority project for Basrah city is considered as Technical Cooperation Project including revision of master plan and improvement of the existing landfill facility. In case of securing available land for new sanitary landfill site, construction of the new landfill site may be supported as an ODA loan project. In addition to Basrah City, MCHMPW also has responsibility for solid waste management in Basrah in a supervisory role. The existing master plan to be revised was targeted to Basrah governorate. It is therefore recommended that the C/P organizations shall be MCHMPW, Basrah Governorate and Basrah City.

It is considered that participation in specialized training in Japan focused on the FUKUOKA method of final disposal will be a valuable input to the 2nd outcome "Landfill facility utilized by Basrah City will be improved" of the technical cooperation project.

Table 8-14 Prioritized Future Project (Basrah City: SWM Masterplan and Landfill Improvement Project)

Scheme	Technical Cooperation Project
C/P organization	MCHMPW, Basrah Governorate and Basrah City
Period	3 years
Expected outcomes	1. SWM masterplan in Basrah governorate will be revised 2. Landfill facility utilized by Basrah city will be improved
Activities	1. SWM masterplan in Basrah governorate will be revised (1) To evaluate the progress of SWM masterplan in Basrah Governorate (2) To build the system of SWM data collection (including intermediate facility, Management of landfill facilities' waste collection data) (3) To study the current situation (Waste amount and composition) (4) To revise SWM masterplan 2. Landfill facility utilized by Basrah City will be improved (1) To study current situation of disposal facilities (including Topographic survey, environmental monitoring) (2) To prepare operation plan and environment protection plan of the existing disposal facilities (3) To implement a pilot project for improving the existing disposal facility(s)
Assumed input from JICA	Japanese experts (40 MMs) and local experts, Training in Japan, Site surveys (Waste amount and composition, Topographic survey etc.), Cost for the pilot project (Weighbridge, Administrative office, Gate fence, some earth works etc.)

Source: JST

8.5.4 Priority Project for Erbil City

Items with very high need for support mentioned in 8.4.4 are summarized and categorized as shown in Table 8-15. Support policy by JICA to Erbil city are categorized as two groups, 1) Masterplan and 2) Improving existing disposal facility.

Table 8-15 Support policy by JICA to Erbil City

Group	Items with very high need	Assumed activity
Masterplan	Masterplan Final disposal (financial support)	New landfill site will be studied as a part of revision of the masterplan. If candidate area for the new landfill site will be secured, construction of the landfill site will be supported.
Improving existing disposal facility	Final disposal (capacity development / existing disposal facility)	Work plan and environmental management plan will be formulated for expanding the life span of the facility.

Source: JST

The priority project for Erbil city is considered as Technical Cooperation Project including formulation of master plan and improvement of the existing disposal facility. It is considered that participation in specialized training in Japan focused on the FUKUOKA method of final disposal will be a valuable input to the 2nd outcome "Operation of existing disposal facility will be improved" of the technical cooperation project.

Table 8-16 Prioritized Future Project (Erbil City: SWM Masterplan and Disposal Facility Improvement Project)

Scheme	Technical Cooperation Project
C/P organization	MOMT, KRG
Period	3 years
Expected outcomes	1. SWM Masterplan in Erbil governorate will be formulated 2. Operation of existing disposal facility will be improved
Activities	1. SWM Masterplan in Erbil governorate will be formulated (1) To build the system of SWM data collection (including intermediate facility, Management of landfill facilities' waste collection data) (2) To study the current situation (Waste amount and composition) (3) To revise SWM masterplan 2. Operation of the existing disposal facility will be improved (1) To study current situation of disposal facilities (including Topographic survey, environmental monitoring) (2) To prepare operation plan and environment protection plan of the existing disposal facilities (3) To implement a pilot project for improving the existing disposal facility(ies)
Assumed input from JICA	Japanese experts (40 MMs) and local experts, Training in Japan, Site surveys (Waste amount and composition, Topographic survey, Environmental study, etc.), Cost for the pilot project (Some earth works, etc.)

Source: JST

MOMT has proceeded with procurement of consultant for the feasibility study for incineration plant with electricity generation (WtE). In case of lack of progress in the procurement, a technical cooperation project for the feasibility study and then in future an ODA loan or PPP project for developing the plant will be considered as shown Table 8-17. At the time of formulation of the project and especially the PPP Project, the risks and issues mentioned in 8.2 shall be solved.

Table 8-17 Prioritized Future Project (Erbil City: Development of Waste Incineration Plant with Electricity Generation Project)

Scheme	ODA Loan or PPP Project
Executing organization	MOMT, KRG
Period	7 years
Expected outcomes	Through incinerating part of solid waste, waste disposal amount will be reduced and electricity will be generated.
Component	Development of waste incineration plant with electricity generation

Source: JST

Annex-1 Solid Waste Management in Neighboring Countries

Iran: Whole Country

SN	Item/ Description
1	Basic Information
	Total population: 78.1 million Population growth (2015): 1.2% Urban population (2015): 73.4% of total population Annual urbanization rate (2010-'15): 2% GDP (2015): Euro 360.3 bln. GDP growth (2014) : 4.3% Unemployment rate (2015): 11.7% Economic structure (2013): Services: 52.3% of GDP Industry: 38.4% Agriculture: 9.3%
2	Environment and waste policies and legislation
	(1) 1979 Constitution – Article 50 This article includes a public duty to protect the environment, forbidding environmentally harmful economic activities. The Islamic Penal Code of Iran (1996), in keeping with the constitution lists among other things sanctions for environmental pollution.
	(2) Environmental Impact Assessment Guidelines (1996) Passed by parliament the guidelines cover the planning and building of landfills
	(3) Waste Management Act (2004) • In 2016 the Act was under revision. • The act states that cities, municipalities, and local authorities are responsible for SWM (Article 7). • It forms the framework for establishing Solid Waste Management Organizations (SWMO) and their cooperation with private companies. • The Act differentiates between household, hospital, agricultural and industrial waste and outlines standards regarding their separation, recycling, and disposal. • It outlines concrete specifications for waste collection: according to Article 4, all cities with more than one million residents are obligated to introduce a system of collecting separated waste by 2012; smaller cities have until 2014. (*As of 2016, separate collection systems had not yet been introduced*).
	(4) Cabinet decisions on SWM made in 2015 • Building and operation of 15 waste incineration facilities • Acquisition guarantee for electricity generated within waste management for the next 20 years • Revision of requirements for building waste incinerators in urban areas • Development of standards regarding air pollution, leachate, and disposal of ash residue • Improved cooperation with private sector
	(5) National Waste Management Master Plan 2015-2020 • Reducing waste generation by 10% • Increasing average percentage of separated waste collection from 7% to 30% • Increasing mechanized waste collection from 40% to 60% • Increasing organic waste recycling from 12% to 80% • Increasing energy recovery from waste from 1% to 3% • Increasing waste recycling percentage from 23% to 90% • Increasing percentage of regulated landfilling from 7% to 20%
3	Waste production (2016)

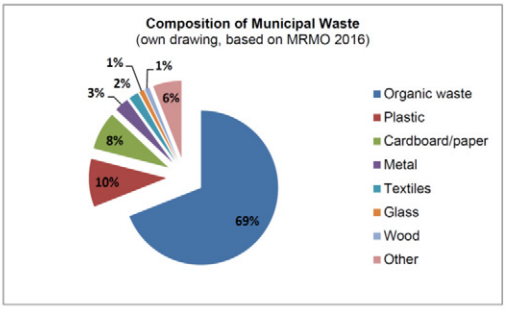
<table>
<tr><th>SN</th><th colspan="2">Item/ Description</th></tr>
<tr><td></td><td>Total municipal waste (2015) = 10.4 mln. ton
Waste production in urban areas = 650-700 kg/day
Waste production in rural areas = 220-340 kg/day
Average waste production in Iran = 650 kg/day
Waste production in Tehran = 1.23 kg/cap/day
Average waste density = 253.73 kg/m^3
Total C&D waste (2016) = 60 mln. ton
Total Agricultural waste (2016) = 6.9 mln. ton
Total Electronic waste (2012) = 100,000 ton
Total Hospital waste (2016) = 29,000 ton</td><td>Municipal waste composition (2016)
 

Figure 2: Composition of municipal waste</td></tr>
<tr><td>4</td><td colspan="2">Municipal SWM Operations</td></tr>
<tr><td></td><td colspan="2">(1) Separate waste collection (2016, Municipality and Rural Management Organization (MRMO))
• Government separate waste collection rate estimates (2016) were 3.5-4% in northern coastal areas and rural regions and up to 16% in urban areas
• In Kermanshah city, with the highest rate of 30% blue plastic bags are distributed and every Saturday recyclable materials such as glass, paper and plastics are picked up.
• In Tehran the common methods for the separated collection of recyclable materials include collection at special drop-off centres, door-to-door collection with plastic bags, as well as collection by curbside containers.</td></tr>
<tr><td></td><td colspan="2">(2) Collection and transportation (2016)
• Private companies have a share of 80% in the collection and transport of waste
• In urban areas almost 90% of the produced municipal waste is collected
• Iran manufacturers vehicles for waste collection itself, some of which are also imported
• Municipalities that organize their own collection are supported by MRMO with vehicles
• In most Iranian cities (57%) municipal waste is collected at least 6 days a week. Approximately 7% of the cities have daily waste collection and a third have regular but not daily collection. A fortnightly collection schedule exists in less than 5% of cities.
• In Tehran municipal waste is collected every night by compactor trucks and taken to one of eleven transfer stations, for further transfer to Arad Khou Dispossing and Processing Complex located approximately 40 kilometers from the city center.</td></tr>
<tr><td></td><td colspan="2">(3) Informal waste collection
• Informal waste collection is officially banned, at least in Tehran. In practice however informal waste collection sell recyclable materials to recycling facilities.
• No statistical information was available as to the share of informal waste collection
• Ministry for Energy considers informal waste collection a problem because it reduces the calorific value of municipal waste dur to removal of certain recyclable materials
• Approaches have been made to bring informal waste collectors into formal employment</td></tr>
<tr><td></td><td colspan="2">(4) Recycling and disposal of municipal waste
• Up to 90% of waste is deposited in disposal facilityies, without treatment or pre-treatment.
• Main stakeholders in the recycling industry are private companies which either operate their own recycling stations or purchase recyclable materials directly from sorting facility operators. A number of these companies have formed the Iranian Recycling Federation, which works on recycling different materials in 15 focus groups.</td></tr>
</table>

SN	Item/ Description
	Recycling and disposal of municipal waste (Mir/Nabavi 2015; DoE interview 2016b; DoE interview 2016c; Malmir/Tojo 2016; UNIDO 2016)
	Unregulated landfill — 77-90 %
	Regulated landfill — 2.5 %
	Composting — 5-10 %
	Recycling — in urban areas up to 20 %
	(5) Waste to Energy (WtE) facilities • The first of the 15 planned WtE facilities was opened in 2015 in Tehran. The facillity was produced and installed by the Chinese company Zhejiang Eco-Waste Technology Co., and is operated by the Iranian TSS group. The facility has a capacity of 200 tons of waste daily, and an output capacity of 3 MW. MRMO reports that in waste incineration processes at the facility, problems arise regarding maintaining a constant incineration temperature. • Calorific value of municipal waste is an important consideration in development of WtE facilities. Average calorific values of Iranian municipal wastes are estimated to be 6,000 kJ/kg to 7,100 kJ/kg. Calorific value of the RDF proportion obtained at Arad Khou is 8,500 kJ/kg. In comparison the calorific value of German municipal waste is at least 11,000 kJ/kg (Federal Environment Agency of Germany, 2008)
	(6) Composting (2016) • Most common form of composting in Iran is open composting with active aeration through turning. The produced compost is either sold or used by the city itself. • As a result of inadequate separation, the compost cannot be used in agriculture
	(7) Waste disposal facility • Unregulated disposal facilityies are found in 80% of Iran's provinces. Only 2.5% of municipal wastes is disposed in regulated landills. • MRMO has a target to reduce the existing 3,000 unregulated disposal facilityies to 600; in 2015 alone 500 unregulated disposal facilityies were closed • The Arad Khou Disposing and Processing Complex in Tehran was developed in 2010. The complex, with an area of 1,500 hectares has various recycling facilities and a capacity to treat and dispose of 7,500 tons of waste daily. Operation of recycling and disposal facilities is largely done by private companies. About 1,300 employees work on the site.
5	Financing of SWM
	• To finance municipal waste management, the municipalities levy waste management fees of 9-21 Euro per household per annum. The fees are calculated in accordance with the "Guidelines for calculating urban waste management fees" and based on the size of the building. • Willingness to pay from residents is a challenge and sanctions are attempts are being made to collect outstanding fees. • Additional revenuse are transfer payments from the central government and subsidies from the Ministry of Interior. • Costs for waste collection amount to an average of 26-40 euros per ton; in Tehran the cost is 42 euros per ton. (UNIDO, 2016).

Source: Waste Management in Iran, Adelphi, October 2016

Palestine: Whole Country

<table>
<tr><th>SN</th><th>Item/ Description</th></tr>
<tr><td>1</td><td>Basic Information</td></tr>
<tr><td></td><td>Population (2019, PCBS): 4,970,000
(West bank: 2,980,000, Gaza Strip: 1,990,000)
GDP (2020, IMF estimation): 14,750 Million USD
GDP per capita (2020, IMF estimation): 2,894.07USD</td></tr>
<tr><td>2</td><td>Responsible Department of MSWM</td></tr>
<tr><td></td><td>Solid waste management has been carried out by local governments with support of Ministry of Local Government (hereinafter referred to as “MoLG”). The Palestinian Local Government Law of 1997 allows Local Government Unit (hereinafter referred to as “LGU”) to organize a Joint Service Council (hereinafter referred to as “JSC”) related to local administration services. For solid waste management, small-scale LGUs have cooperated with each other to conduct the waste management services because it is difficult to provide the services on their own.</td></tr>
<tr><td>3</td><td>National MSWM strategy, Master Plan</td></tr>
<tr><td></td><td>National Strategy for Solid Waste Management in Palestine 2017-2022
Palestine's first national waste strategy was formulated in 2010, and this national waste strategy was formulated in 2017 as a second strategy. Based on the challenges facing Palestine, this strategy lists eight strategic goals and 19 sectoral policies for future waste management.
<table>
<tr><td colspan="2">Strategic Objective One: A Modern and effective legal and organizational framework for SWM</td></tr>
<tr><td>Policy 1</td><td>Development and update of the legislative framework supporting integrated SWM</td></tr>
<tr><td>Policy 2</td><td>Strengthening the organizational frame of national institutions and supporting their complementary roles in SWM</td></tr>
<tr><td colspan="2">Strategic Objective Two: Strong institutions capable of performing its duties</td></tr>
<tr><td>Policy 3</td><td>Enhancing institutional capacity building and expertise in SWM</td></tr>
<tr><td colspan="2">Strategic Objective Three: Effective and environmentally-safe management of SW services</td></tr>
<tr><td>Policy 4</td><td>Developing the current management systems for SW collection and transport, in order to improve the quality and effectiveness of services and its availability to all citizens</td></tr>
<tr><td>Policy 5</td><td>Safe and efficient disposal of SW in regional sanitary landfills servicing all communities or using proper advanced technological methods</td></tr>
<tr><td>Policy 6</td><td>Encouraging policies and methods of SW reduction, recycling, reusing, and recovery before final disposal at regional sanitary landfills</td></tr>
<tr><td>Policy 7</td><td>Prohibiting the use of random dumpsites and closing or rehabilitating the existing sites gradually to limit their negative impact on health and environment</td></tr>
<tr><td>Policy 8</td><td>Minimize the amounts of greenhouse gases (GHG) emitted as a result of SW activities to reduce its impact on climate change</td></tr>
<tr><td colspan="2">Strategic Objective Four: Financially viable and efficient SWM services and activities</td></tr>
<tr><td>Policy 9</td><td>Reducing the cost for SW collection and transport</td></tr>
<tr><td>Policy 10</td><td>Achieving cost recovery and self-financing for SWM operating costs</td></tr>
<tr><td colspan="2">Strategic Objective Five: Principles and mechanisms suitable for managing medical, hazardous, and special wastes</td></tr>
<tr><td>Policy 11</td><td>Creating appropriate inventory and tracking systems for hazardous waste, and availability of necessary information, setting a sound and safe systems (separation, collection, transfer, and disposal processes) to manage it</td></tr>
<tr><td>Policy 12</td><td>Treatment of medical waste before its final disposal, according to the "polluter pays" principle, to limit its negative health and environmental impacts</td></tr>
<tr><td>Policy 13</td><td>Management of special waste in a manner that ensures protection of health and the environment</td></tr>
<tr><td colspan="2">Strategic Objective Six: Increasing the participation of the private sector in SWM</td></tr>
<tr><td>Policy 14</td><td>Raising awareness and setting foundations and necessary measurements to create an</td></tr>
</table></td></tr>
</table>

SN	Item/ Description	
		enabling investment environment that encourages the private sector to participate and invest
	Strategic Objective Seven: A more participating and aware community	
	Policy 15	Deepening environmental, social, and institutional awareness and knowledge of SW issues and impact
	Policy 16	Raising students' environmental awareness, developing their skills and orientations in the aspects of SW reduction and recycling
	Policy 17	Providing students with equipment and tools that will enable them to acquire knowledge and skills required for SW recycling (e.g., recycling tools, compost)
	Strategic Objective Eight: Effective information and monitoring systems	
	Policy 18	Establishing a unified national database for SWM
	Policy 19	Developing and enhancing administrative, financial and environmental monitoring systems
4	Legal status	
	・**Municipal and Local government Law or Local Authorities Law No. 1 (1997)**: defines the roles and responsibilities of the local authorities (LGU and JSC), supervised by the MoLG. ・**Environmental Law No.7 (1999, revised in 2003)**: establishes the general legal framework for SWM in Palestine, including also hazardous waste management ・**Palestinian Environmental Impact Assessment Policy (2000)**: describes the conditions, through standards and guidelines, under which any private or public development activity, in terms of environment protection, shall be implemented ・**Palestinian Law (2003)**: asserts the right, in its article 33, to a "clean and a balanced environment as a basic right of every Palestinian" and the national duty for "preservation of the Palestinian environment for the sake of both present and future generations" (Soufan 2012, page 70). ・**Public Health Law No.20 (2004)**: defines the Ministry of Health (MoH) as the institution responsible for licensing SWM facilities (article 2.12). ・**Medical Waste Management Bylaw (2012)**: gives a definition of medical waste and a classification of its different types (articles 9 and 10), as well as instructions for its identification (art.12). ・**Law on the Encouragement of Investment in Palestine Law No. (1) of 1998 amended in 2004, 2011 and in 2014 (decree No. (7) Of 2014)**: aims to provide guarantees and incentives to private investment, through the Palestinian Investment Promotion Agency. ・**Basic regulation on the Joint Service Councils of year 1996 (updated in 2006)**: defines the role and responsibilities of Joint Service councils. ・**JSC Bylaw (2016)**: describes the conditions for forming/ending a JSC, the roles of the different members and representatives of the JSC, as well as the tasks and activities of the JSC ・**Solid Waste Management Bylaw (2019)**	
5	SWM Data	
	Generation: 4,356 ton/day (2018), Generation rate: 0.9 kg per person per day Composition: Organic 50.0%, Paper & Cardboard 12.5%, Plastic 14.6%, Glass 1.9%, Metal 2.4%, Others 18.6% (West Bank) Collection coverage: 94% Treatment: NA Disposal: It is estimated that about 30-35% of municipal waste is illegally dumped and 65-70% is disposed in one of the six operational disposal facilities existing in Palestine. Recycle: NA	

Source: Solid Waste Management in the Occupied Palestinian Territory, West Bank including East Jerusalem & Gaza Strip, Overview Report, 2019

Jordan: Whole Country

<table>
<tr><th>SN</th><th>Item/ Description</th></tr>
<tr><td>1</td><td>Basic Information</td></tr>
<tr><td></td><td>Population (2018)[*1]: 9,956,000
GDP (World Bank, 2018)[*1]: 42,291million USD
GDP per capita (World Bank, 2018)[*1]: 4,247.8 USD</td></tr>
<tr><td>2</td><td>Responsible Department of MSWM</td></tr>
<tr><td></td><td>The Ministry of Municipal Affairs: at the national level, which operates through its executive arms: the municipalities (at the local level), and Joint Services Councils (JSCs) at the regional level.
The Ministry of Environment is in charge of relevant planning, policy and legislative frameworks of the municipal SWM systems, as well as monitoring of the environmental performance of the official disposal practices.</td></tr>
<tr><td>3</td><td>National MSWM strategy, Master Plan</td></tr>
<tr><td></td><td>1. Development of a National Strategy to improve the Municipal Solid Waste Management Sector in the Hashemite Kingdom of Jordan (NSWMS)
NSWMS was developed in the Regional and Local Development Project (2007-2015) financed by the World Bank and AFD with a Greek company, LDK Consultants, and a Jordanian partner MOSTAQBAL consultants, entrusted by MOMA and CVDB.
1) Area of the plan
The NSWMS divides the country into the following three regions. The underlines show the present survey area.
- Northern Region: Irbid, Ajloun, Jerash and Mafraq Governorates
- Central Region: Amman (including GAM), Balqa, Madaba and Zarqa Governorates
- Southern Region: Karak, Tafilah, Aqaba and Ma’an Governorates
2) Planning Period
The NSWMS has the following three target periods.
- Short-term period: 2015 - 2019 (5-years duration)
- Mid-term period: 2020 - 2024 (5-years duration)
- Long-term period: 2025 - 2034 (10-years duration)
3) Targets of Planning Periods
The following targets were set for each planning period.
- Short-term actions: focus on resolving the extreme problems of today and preparatory actions for the next period.
- Mid-term actions: supplement the short-term ones and evolve towards set targets for materials or other (e.g. energy) recovery.
- Long-term actions: focus on achieving a state-of-the-art level of MSWM and bring Jordan in-line with the European and International state.
4) Targets and Strategies
The NSWMS shows the quantitative targets for Jordan as below.
<table>
<tr><th colspan="2" rowspan="2">Subject</th><th colspan="3">Targets</th></tr>
<tr><th>Short-term (2015-2019)</th><th>Mid-term (2020-2024)</th><th>Long-term (2025-2034)</th></tr>
<tr><td>1</td><td>Catering to the emergency needs for MSWM due to the refugees’ influx</td><td>✓</td><td>✓(if the situation continues)</td><td>✓(if the situation continues)</td></tr>
<tr><td>2</td><td>Coverage of MSW street-cleansing
and collection services</td><td></td><td>100% by 2024</td><td>100%</td></tr>
<tr><td>3</td><td>Set-up of separate collection systems for recyclables (at</td><td></td><td></td><td>✓(by 2034)</td></tr>
</table>
</td></tr>
</table>

SN	Item/ Description				
		least paper, metal, plastic and glass)			
	4	Preparing for re-use and recycling of MSW materials (at least paper, metal, plastic and glass)			50% by weight by 2034
	5	Cease operations of uncontrolled or unlicensed disposal facilities	50% by 2019	100% by 2024	
	6	Reduction of bio-waste ending-up at disposal facilities			75% by weight by 2034 (according to 2024 amount)
	7	Recovery of packaging waste (including reuse, materials' recovery and energy recovery)			25% by 2034
	8	Recycling of packaging waste			15% by 2034

2. WASTE SECTOR Green Growth National Action Plan 2021-2025

The Green Growth National Action Plan 2021-2025 (GG-NAP) was developed by the Ministry of Environment with the support of the Global Green Growth Institute (GGGI).

The Waste Sector Green Growth Action National Action Plan 2021-2025 (GG-NAP) outlines a green growth framework and actions for the sector aligned with the National Green Growth Plan (NGGP), Jordan Vision 2025, and Nationally Determined Contributions (NDCs) under the Paris agreement.

The following 16 priority actions have been identified for implementation in the 2021-2025 period. These interventions are estimated to cost USD 248,250,000.

	Action Title	Total Estimated Implementation Cost (USD)
1	Review and update the National Strategy and Action Plan for Municipal Solid Waste (NSAP) 2015-2034 to integrate non-municipal solid waste and elaborate integrated waste management approaches	1,500,000
2	Enhance the financial management and strategic planning capacity of municipal waste management authorities	600,000
3	Introduce a policy dialogue platform for implementing extended producer responsibility in the waste sector	1,000,000
4	Establish a national center for excellence on waste management and circular economy to promote innovation, training, R&D, investment and policy work	15,000,000
5	Design and implement a national behavior change campaign about circular economy and waste management	10,000,000
6	Enhance the financial viability of SMEs in the waste sector through targeted business development support	5,000,000
7	Conduct market assessment and feasibility study to identify potential projects and programs to divert organic waste from municipal solid waste streams	14,500,000
8	Develop and implement a Master Plan for National Hazardous Waste Management and the rehabilitation of Swaqa Hazardous Waste Landfill	35,000,000

SN	Item/ Description		
	9	Develop and implement a national policy and regulations for the management of construction and demolition waste	3,000,000
	10	Implement pilot extended producer responsibility program for e-waste	33,300,000
	11	Implement program for waste tire disposal and reuse	22,850,000
	12	Develop a joint public-private roadmap to transition to reduce the use of single use plastics at the household and commercial levels	3,000,000
	13	Develop a baseline study and roadmap to transition toward green jobs in the waste sector	1,000,000
	14	Establish a national upcycling hub nearby appropriate waste management infrastructure	16,500,000
	15	Develop municipal solid waste infrastructure to promote recycling and the use of sanitary landfills	81,000,000
	16	Implement a comprehensive national cleanup campaign for solid waste littering	5,000,000
4	Legal status		
	(1) Legal System The Jordanian legal system is based on legal hierarchy. It is the Parliament that reviews, approves, and produces "Laws". Then the Council of Ministers is sufficient to review and produce "Regulations" stemming from any specific law. Each Ministry may also produce so-called "Instructions" to specify the procedures and mechanisms for the implementation of the laws or regulations. The legislation of SWM is broadly categorized into that related to MOMA, MOE and other governmental organizations. (2) Legislation related to MOMA The legislation related to MOMA is as follows: ● Municipalities Law No. 41 of 2015: Sets municipal responsibilities including municipal cleaning, waste collection, and disposal ● Joint services council regulation No. 75/2009: Sets the JSCs' responsibility for the construction and operation of disposal facilities/dumpsites. ● Supplies, Purchases, and Civil Works for Municipalities Regulation No. 70/2009: Controls all supplies, purchases, and civil works performed by Municipalities as part of MoMA services and daily activities. By this regulation JSCs are obligated to obtain the approval of the Minister of Municipal Affairs for any direct purchase that exceeds JD 300 especially for maintenance and daily activities. ● Regulation for the Prevention of Health Nuisances No. 8/2014: Prohibits any person, entity, or activity from causing any nuisance to anybody or from damaging public health. Such nuisances may include bad odors, noise, waste (solid waste, effluents), or any other practice deemed harmful to public health or sanity. It states waste collection fee as well as penalty of violators, etc. (3) Legislation related to MOE ● Environment Protection Law No. 52 of 2006: Sets the direct responsibilities for the Ministry of Environment and overarching principles for environmental protection. At present, revised law is under discussion in the parliament. ● Solid waste management regulation No. 27 of 2005: Defines solid and semi-solid materials, to be treated or disposed of, resulting from any activity and not included in the definition of harmful and hazardous waste defined by "Management, Transportation and Handling of Harmful and Hazardous Substances Regulation No. 24/2005". Demands general requirements in terms of manpower, equipment, monitoring, container management, separation of hazardous wastes, documentation, and final treatment or disposal control for every party that generates and/or manages solid waste. According to the hearing from MOE, the regulation has been revised as a Law and is waiting for the		

SN	Item/ Description
	discussion in the parliament. ● Management, Transportation and Handling of Harmful and Hazardous Substances Regulation No. 24/2005: Defines harmful and hazardous substances and waste. Instructs method of their treatment and disposal. ● Waste oil handling and management instructions of 2003: Licensing requirements and documentation for generators, transporters, and treatment of waste oil. Technical requirements for generators, transporters, and treatment of waste oil in terms of storage, spill management, emergency, fuel specs, etc. ● Hazardous waste handling and management instructions of 2003: Licensing requirements and documentation for generators, transporters, and treatment/disposal of hazardous waste. Technical requirements of hazardous waste for central storage, wrapping, transport, treatment, disposal, emergency, empty containers, etc. ● Organic compost (animal and plant origin) storage, production, trading, and use instructions of 2009: Licensing requirements for compost plants and trading. Technical requirements including location for composting, storage, processing, etc. (4) Legislation related to organizations other than MOMA and MOE ● Medical waste management instructions No. 1/2001: Sets the technical definitions and classification for medical waste, technical requirements for segregation, central storage, transport, and treatment/disposal technologies. ● Nuisance prevention and waste collection fees for the Greater Amman Municipality No. 83 of 2009: Sets the different types of nuisances and municipal control measures, including the municipal responsibilities for waste collection, transport, treatment, and disposal, and the attached fee system. ● Buildings and zoning regulation in the City of Amman No. 67 of 1979 and amendments (latest No. 21 of 2005): Sets permit requirements for excavations and renovations to control illegal dumping open dumping of construction and demolition waste. ● Agriculture Law No. 44/2002 and amendment No. 22/2005: Sets the mandate for agriculture waste management. ● Renewable Energy and Energy Efficiency Law No. 13 of 2012: Promotes development of renewable energy projects including Waste to Energy (WtE) projects which include landfill gas and bio-gas utilization.
5	Technical guideline
	NA
6	SWM Data
	Waste Generation Rate[*2]: 0.99 kg per person per day for urban areas, 0.87 kg per person per day for rural areas, (2015) Composition[*2]: Bio-waste 51%, Paper/ Cardboard 14%, Plastics 15%, Metals 4%, Glass 4%, Textile 1%, Wood and garden waste 1%, Others 10% Collection coverage[*2]: 90% for urban areas, 70% for rural areas Treatment[*3]: Digested 0.2% Disposal[*3]: Landfilled 53%, Openly Dumped 39.8% Recycle[*3]: Recycled 7%

Source; *1: World Bank
*2: Your Guide to Waste Management in Jordan (2016)
*: Data Collection Survey on Waste Management in Northern Region Accepting Syrian Refugees in the Hashemite Kingdom of Jordan Final Report, JICA, 2016

Jordan: Great Amman Municipality (GAM)

SN	Item/ Description
1	Basic Information
	Population (2018)[*1]: 9,956,000

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NSWMS was developed in the Regional and Local Development Project (2007-2015) financed by the World Bank and AFD with a Greek company, LDK Consultants, and a Jordanian partner MOSTAQBAL consultants, entrusted by MOMA and CVDB.
1) Area of the plan
The NSWMS divides the country into the following three regions. The underlines show the present survey area.
- Northern Region: Irbid, Ajloun, Jerash and Mafraq Governorates
- Central Region: Amman (including GAM), Balqa, Madaba and Zarqa Governorates
- Southern Region: Karak, Tafilah, Aqaba and Ma’an Governorates
2) Planning Period
The NSWMS has the following three target periods.
- Short-term period: 2015 - 2019 (5-years duration)
- Mid-term period: 2020 - 2024 (5-years duration)
- Long-term period: 2025 - 2034 (10-years duration)
3) Targets of Planning Periods
The following targets were set for each planning period.
- Short-term actions: focus on resolving the extreme problems of today and preparatory actions for the next period.
- Mid-term actions: supplement the short-term ones and evolve towards set targets for materials or other (e.g. energy) recovery.
- Long-term actions: focus on achieving a state-of-the-art level of MSWM and bring Jordan in-line with the European and International state.
4) Targets and Strategies
The NSWMS shows the quantitative targets for Jordan as below.
<table>
<tr><th colspan="2" rowspan="2">Subject</th><th colspan="3">Targets</th></tr>
<tr><th>Short-term (2015-2019)</th><th>Mid-term (2020-2024)</th><th>Long-term (2025-2034)</th></tr>
<tr><td>1</td><td>Catering to the emergency needs for MSWM due to the refugees’ influx</td><td>✓</td><td>✓(if the situation continues)</td><td>✓(if the situation continues)</td></tr>
<tr><td>2</td><td>Coverage of MSW street-cleansing
and collection services</td><td></td><td>100% by 2024</td><td>100%</td></tr>
<tr><td>3</td><td>Set-up of separate collection systems for recyclables (at least paper, metal, plastic and glass)</td><td></td><td></td><td>✓(by 2034)</td></tr>
<tr><td>4</td><td>Preparing for re-use and recycling of MSW materials</td><td></td><td></td><td>50% by weight by 2034</td></tr>
</table></td></tr>
</table>

SN	Item/ Description				
		(at least paper, metal, plastic and glass)			
	5	Cease operations of uncontrolled or unlicensed disposal facilities	50% by 2019	100% by 2024	
	6	Reduction of bio-waste ending-up at disposal facilities			75% by weight by 2034 (according to 2024 amount)
	7	Recovery of packaging waste (including reuse, materials' recovery and energy recovery)			25% by 2034
	8	Recycling of packaging waste			15% by 2034

2. WASTE SECTOR Green Growth National Action Plan 2021-2025

The Green Growth National Action Plan 2021-2025 (GG-NAP) was developed by the Ministry of Environment with the support of the Global Green Growth Institute (GGGI).

The Waste Sector Green Growth Action National Action Plan 2021-2025 (GG-NAP) outlines a green growth framework and actions for the sector aligned with the National Green Growth Plan (NGGP), Jordan Vision 2025, and Nationally Determined Contributions (NDCs) under the Paris agreement.

The following 16 priority actions have been identified for implementation in the 2021-2025 period. These interventions are estimated to cost USD 248,250,000.

	Action Title	Total Estimated Implementation Cost (USD)
1	Review and update the National Strategy and Action Plan for Municipal Solid Waste (NSAP) 2015-2034 to integrate non-municipal solid waste and elaborate integrated waste management approaches	1,500,000
2	Enhance the financial management and strategic planning capacity of municipal waste management authorities	600,000
3	Introduce a policy dialogue platform for implementing extended producer responsibility in the waste sector	1,000,000
4	Establish a national center for excellence on waste management and circular economy to promote innovation, training, R&D, investment and policy work	15,000,000
5	Design and implement a national behavior change campaign about circular economy and waste management	10,000,000
6	Enhance the financial viability of SMEs in the waste sector through targeted business development support	5,000,000
7	Conduct market assessment and feasibility study to identify potential projects and programs to divert organic waste from municipal solid waste streams	14,500,000
8	Develop and implement a Master Plan for National Hazardous Waste Management and the rehabilitation of Swaqa Hazardous Waste Landfill	35,000,000
9	Develop and implement a national policy and regulations for the management of construction and demolition waste	3,000,000
10	Implement pilot extended producer responsibility program for e-waste	33,300,000

SN	Item/ Description		
	11	Implement program for waste tire disposal and reuse	22,850,000
	12	Develop a joint public-private roadmap to transition to reduce the use of single use plastics at the household and commercial levels	3,000,000
	13	Develop a baseline study and roadmap to transition toward green jobs in the waste sector	1,000,000
	14	Establish a national upcycling hub nearby appropriate waste management infrastructure	16,500,000
	15	Develop municipal solid waste infrastructure to promote recycling and the use of sanitary landfills	81,000,000
	16	Implement a comprehensive national cleanup campaign for solid waste littering	5,000,000
4	Legal status		
	(1) Legal System The Jordanian legal system is based on legal hierarchy. It is the Parliament that reviews, approves, and produces "Laws". Then the Council of Ministers is sufficient to review and produce "Regulations" stemming from any specific law. Each Ministry may also produce so-called "Instructions" to specify the procedures and mechanisms for the implementation of the laws or regulations. The legislation of SWM is broadly categorized into that related to MOMA, MOE and other governmental organizations. (2) Legislation related to MOMA The legislation related to MOMA is as follows: ● Municipalities Law No. 41 of 2015: Sets municipal responsibilities including municipal cleaning, waste collection, and disposal ● Joint services council regulation No. 75/2009: Sets the JSCs' responsibility for the construction and operation of disposal facilities/dumpsites. ● Supplies, Purchases, and Civil Works for Municipalities Regulation No. 70/2009: Controls all supplies, purchases, and civil works performed by Municipalities as part of MoMA services and daily activities. By this regulation JSCs are obligated to obtain the approval of the Minister of Municipal Affairs for any direct purchase that exceeds JD 300 especially for maintenance and daily activities. ● Regulation for the Prevention of Health Nuisances No. 8/2014: Prohibits any person, entity, or activity from causing any nuisance to anybody or from damaging public health. Such nuisances may include bad odors, noise, waste (solid waste, effluents), or any other practice deemed harmful to public health or sanity. It states waste collection fee as well as penalty of violators, etc. (3) Legislation related to MOE ● Environment Protection Law No. 52 of 2006: Sets the direct responsibilities for the Ministry of Environment and overarching principles for environmental protection. At present, revised law is under discussion in the parliament. ● Solid waste management regulation No. 27 of 2005: Defines solid and semi-solid materials, to be treated or disposed of, resulting from any activity and not included in the definition of harmful and hazardous waste defined by "Management, Transportation and Handling of Harmful and Hazardous Substances Regulation No. 24/2005". Demands general requirements in terms of manpower, equipment, monitoring, container management, separation of hazardous wastes, documentation, and final treatment or disposal control for every party that generates and/or manages solid waste. According to the hearing from MOE, the regulation has been revised as a Law and is waiting for the discussion in the parliament. ● Management, Transportation and Handling of Harmful and Hazardous Substances Regulation No. 24/2005: Defines harmful and hazardous substances and waste. Instructs method of their treatment and disposal.		

SN	Item/ Description
	● Waste oil handling and management instructions of 2003: Licensing requirements and documentation for generators, transporters, and treatment of waste oil. Technical requirements for generators, transporters, and treatment of waste oil in terms of storage, spill management, emergency, fuel specs, etc. ● Hazardous waste handling and management instructions of 2003: Licensing requirements and documentation for generators, transporters, and treatment/disposal of hazardous waste. Technical requirements of hazardous waste for central storage, wrapping, transport, treatment, disposal, emergency, empty containers, etc. ● Organic compost (animal and plant origin) storage, production, trading, and use instructions of 2009: Licensing requirements for compost plants and trading. Technical requirements including location for composting, storage, processing, etc. (4) Legislation related to organizations other than MOMA and MOE ● Medical waste management instructions No. 1/2001: Sets the technical definitions and classification for medical waste, technical requirements for segregation, central storage, transport, and treatment/disposal technologies. ● Nuisance prevention and waste collection fees for the Greater Amman Municipality No. 83 of 2009: Sets the different types of nuisances and municipal control measures, including the municipal responsibilities for waste collection, transport, treatment, and disposal, and the attached fee system. ● Buildings and zoning regulation in the City of Amman No. 67 of 1979 and amendments (latest No. 21 of 2005): Sets permit requirements for excavations and renovations to control illegal dumping open dumping of construction and demolition waste. ● Agriculture Law No. 44/2002 and amendment No. 22/2005: Sets the mandate for agriculture waste management. ● Renewable Energy and Energy Efficiency Law No. 13 of 2012: Promotes development of renewable energy projects including Waste to Energy (WtE) projects which include landfill gas and bio-gas utilization.
5	Technical guideline
	NA
6	SWM Data
	Waste Generation Rate[*2]: 0.99 kg per person per day for urban areas, 0.87 kg per person per day for rural areas, (2015) Composition[*2]: Bio-waste 51%, Paper/ Cardboard 14%, Plastics 15%, Metals 4%, Glass 4%, Textile 1%, Wood and garden waste 1%, Others 10% Collection coverage[*2]: 90% for urban areas, 70% for rural areas Treatment[*3]: Digested 0.2% Disposal[*3]: Landfilled 53%, Openly Dumped 39.8% Recycle[*3] : Recycled 7%

Source: Data Collection Survey on Waste Management in Northern Region Accepting Syrian Refugees in the Hashemite Kingdom of Jordan Final Report, JICA, 2016