

**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 SUMMARY

JANUARY 2022

JAPAN INTERNATIONAL COOPERATION AGENCY

YACHIYO ENGINEERING CO., LTD.

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DATA COLLECTION STUDY

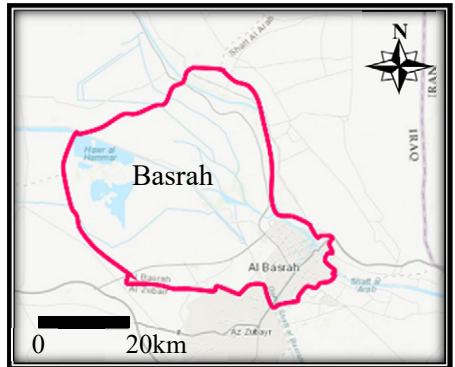
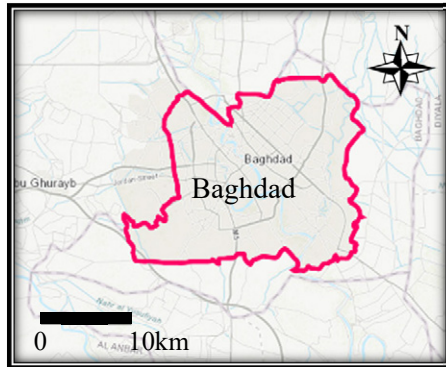
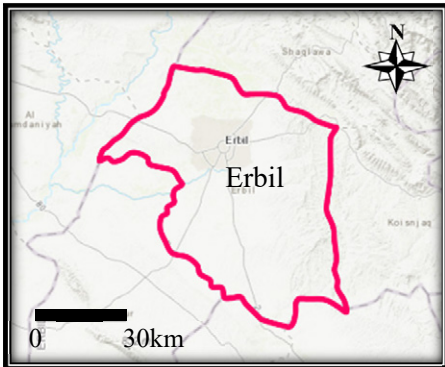
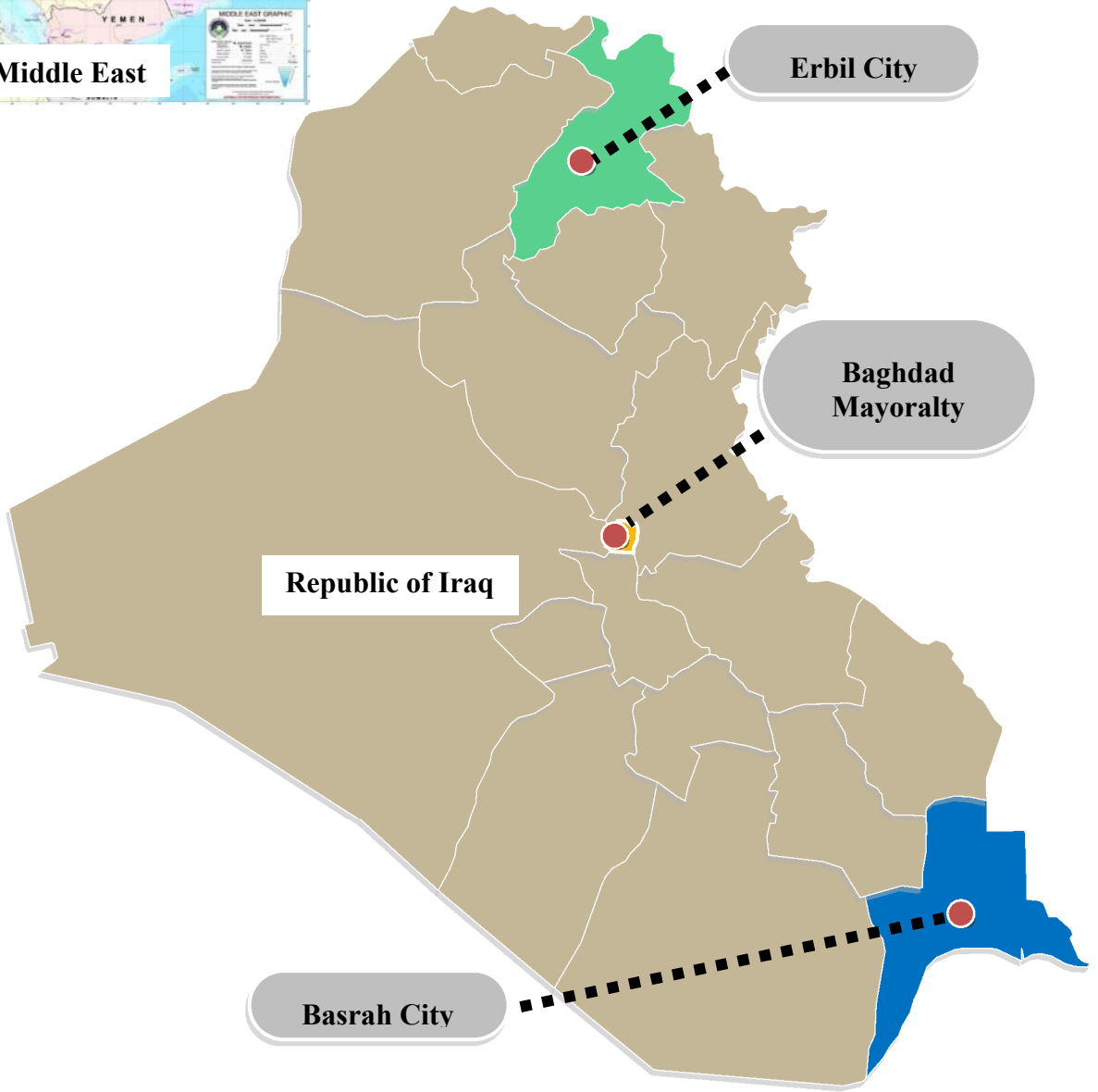
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Source: Esri, HERE, Garmin, Earthstar Geographics (c), Esri Japan

Location of Map

Data Collection Study on Solid Waste Management in Iraq
Final Report Summary

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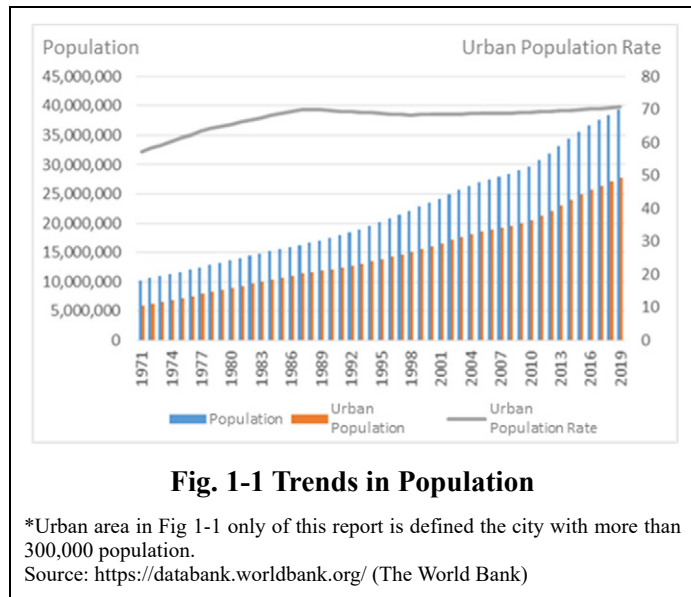
List of Abbreviation

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 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. 1-1 only of this report has remained around 70% since the late 1980s.



According to the Environmental Statistics of Iraq - Municipal Service sector (2019) issued by Central Statistical Organization (hereinafter referred to as “CSO”), 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. 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.

1.2 Study Objectives

Objectives of this study are to grasp the contents, implementation status and issues of national policies in the solid waste sector and related sectors and to collect information of actual conditions, issues, and progress to improve municipal waste management in the target cities including the private sector. And the actual conditions and issues of solid waste management (hereinafter referred to as SWM) are systemically arranged in order to identify the cooperation needs, direction of improvement, and points of concern on project formulation.

1.3 Study Period and Schedule

The study period is from March 2021 to January 2022.

1.4 Area Covered in the Study

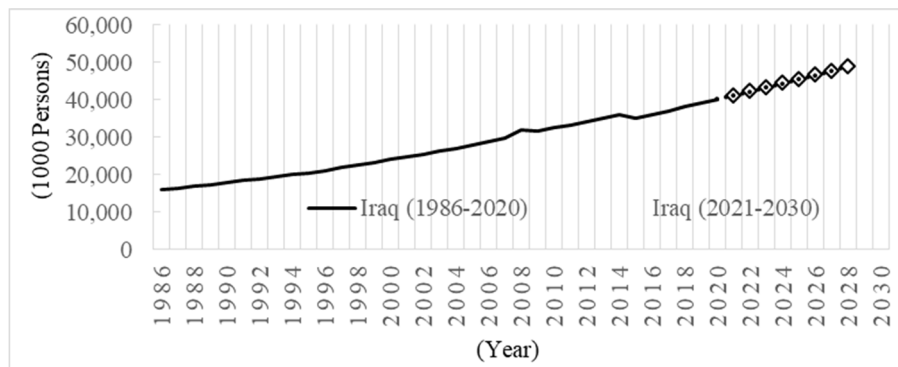
The target area in this study are the three (3) cities of Baghdad, Basrah, and Erbil.

Chapter 2 Republic of Iraq Basic Information

2.1 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 is shown in Fig. 2-1.

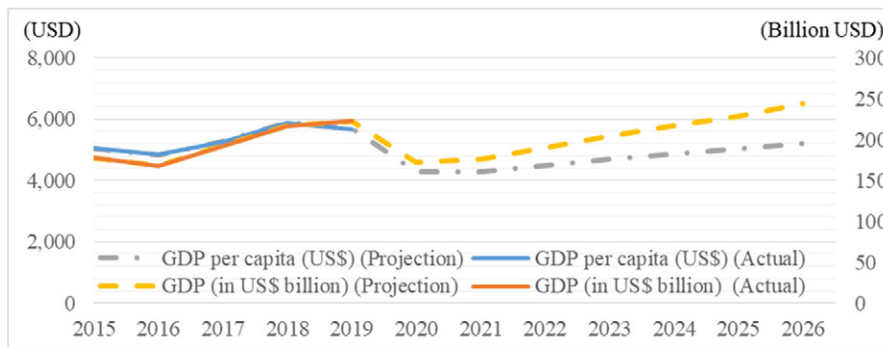


Source: Population Estimation of Iraq 2015 – 2018, (2018), CSO

Fig. 2-1 Population Forecast of Iraq

2.2 Industrial Structure

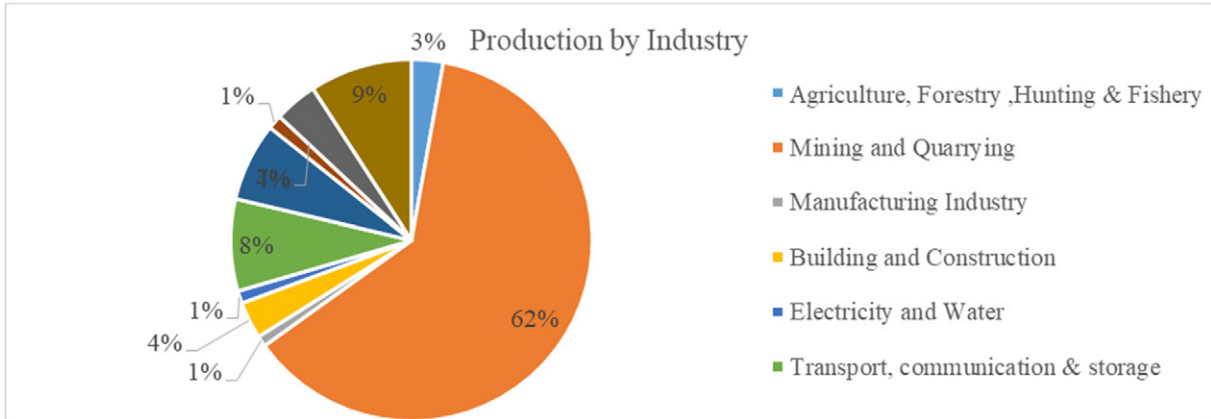
Fig. 2-2 shows the economic trends of Iraq. GDP and GDP per capita were 222.4 billion USD and 5,687 billion USD in the latest actual data in 2019, respectively. The COVID-19 pandemic and a sharp decline in oil revenues have exacerbated Iraq’s longstanding economic vulnerabilities. Real GDP contracted 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.



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

Fig. 2-2 GDP Trend and GDP per Capita

Fig. 2-3 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.



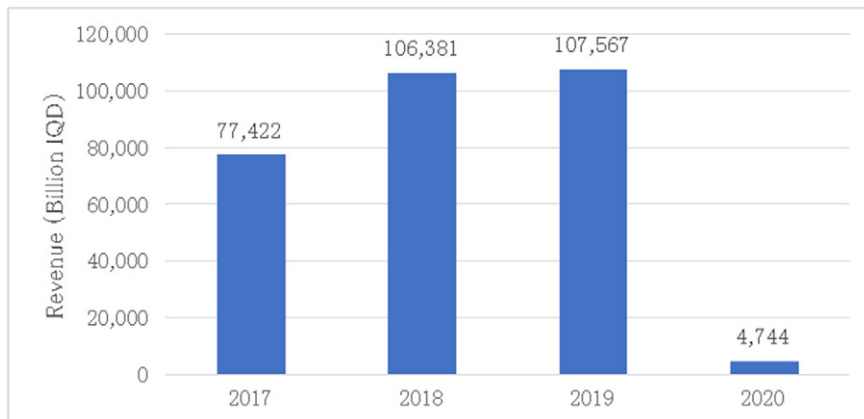
Source: Statistical Group –Industrial Statistics, (2018-2019), CSO

Fig. 2-3 Production by Industry in 2019

2.3 Financial Conditions

(1) Trends in Revenue

Trends in Iraq's revenue are shown in Fig. 2-4. 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. 2-4 Trends in Revenue

(2) Trends in Expenditure

The actual expenditures of Iraq are shown in Table 2-1. 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.

Table 2-1 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
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
KRG	-	2,860	2,860	-	5,444	5,444	-	2,402	2,402
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 sides¹.

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.

¹ <https://auis.edu.krd/iris/sites/default/files/20210516-IER2-Final.pdf>

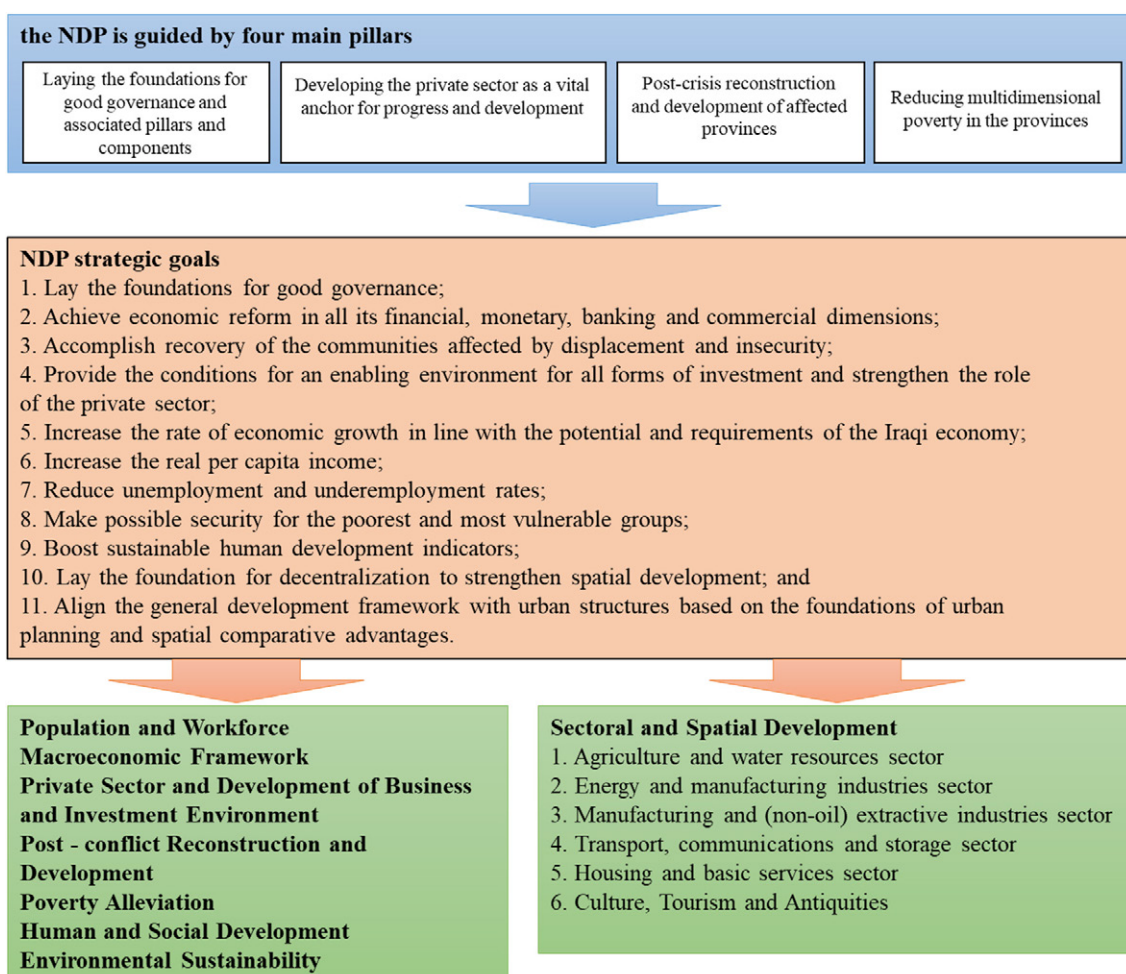
Chapter 3 National level Solid Waste Management

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.

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. 3-1 Basic Framework of National Development Plan 2018-2022

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. The actions planned in the National Waste Management Master Plan are shown in Table 3-1. Regarding the progress and achievement of the activities, Ministry of Construction, Housing and Municipalities and Public Works 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, Establishment 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 Assessment / Needs Assessment	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			
	Alternative Funding	Direct Charging			
		Intersection Subsidisation			
Revenue - Fines, etc					
	Funds - Loans		Private Sector Investment / Privatization		

Source: National Waste Management Master Plan (2007)

3.2 Laws and Regulations on SWM and Other Related Sectors

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:

3.2.1.1 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) 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

There are requirements for SWM facilities, Landfill sites for hazardous waste (Article 15), Landfill sites for municipal waste (Article 24), Sorting and recycling plans for waste (Article 48) and Municipal waste transfer station (Article 74). Requirement for Landfill sites for municipal waste stated in Article 24 is shown in below as reference.

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 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.

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. 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 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.

3.2.1.2 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

3.2.1.3 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.

3.3 Related Government Organization

3.3.1 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..

Table 3-2 shows the roles among the related government organizations from the operation viewpoint. In addition, Ministry of Electricity is responsible to identify the tariff for Waste to Energy (hereinafter referred to as WtE) project. The Ministry of Planning is responsible for overall budget allocation for each ministry and governorate.

Table 3-2 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

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

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

Stakeholder	Directorate	Responsibility
Federal Government (MCHMPW)	General Directorate of Municipalities	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> ▪ Financing and implementation
Municipality		<ul style="list-style-type: none"> ▪ Database ▪ Collection of wastes ▪ Operation of facilities

Source: Answers of the JST questionnaire

3.3.2 Kurdistan Region

There are some organizations related to waste management in Kurdistan Region as shown in Table 3-4, namely Board of Environmental Protection, Ministry of Municipalities and Tourism (MOMT), Ministry of Natural Resources (MNR), Ministry of Health (MOH), etc..

Table 3-4 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 3-5 shows the main stakeholders and their respective responsibilities.

Table 3-5 Responsibility of the Main Organizations for SWM in Kurdistan Region

Stakeholder	Directorate	Responsibility
KRG (MOMT)	Directorate of Services, Environment Protection and Solid Waste Treatment	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> ▪ Financing and implementation ▪ Database ▪ Collection of wastes ▪ Operation of facilities

Source: Answers of the JST questionnaire

3.4 Current Status of National Level SWM

3.4.1 Waste Generation and Composition

Fig. 3-2 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.

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, UK: 1.33, Italy: 1.34 Canada: 1.94, Germany: 1.72, France: 1.38).

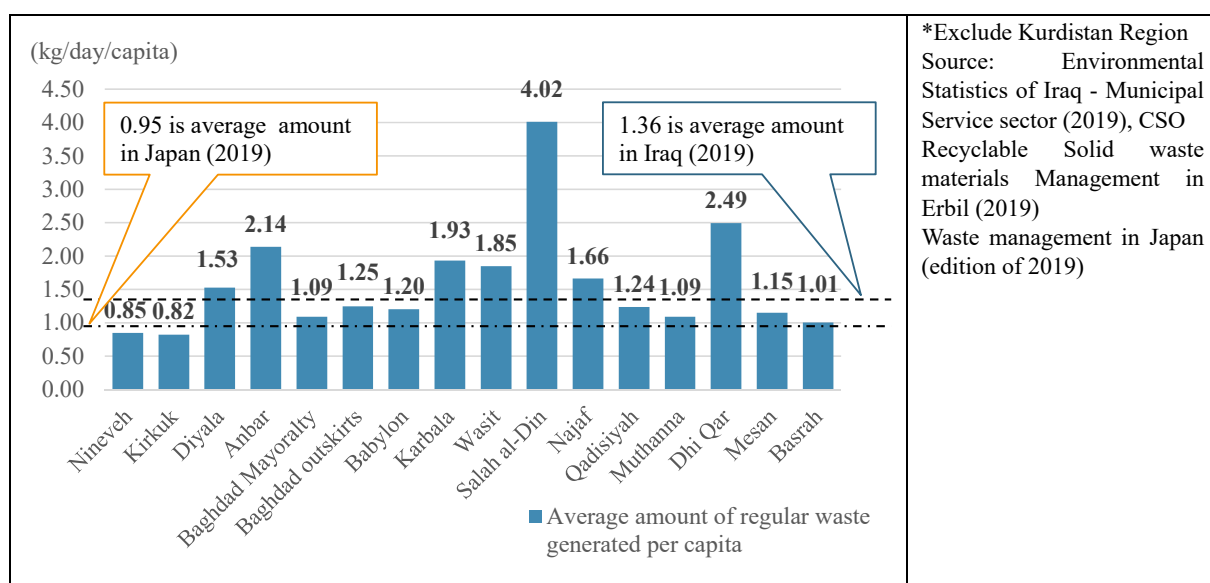


Fig. 3-2 Average Amount of Municipal Waste Generated per Capita

3.4.2 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.

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.

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

Fig. 3-3 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.

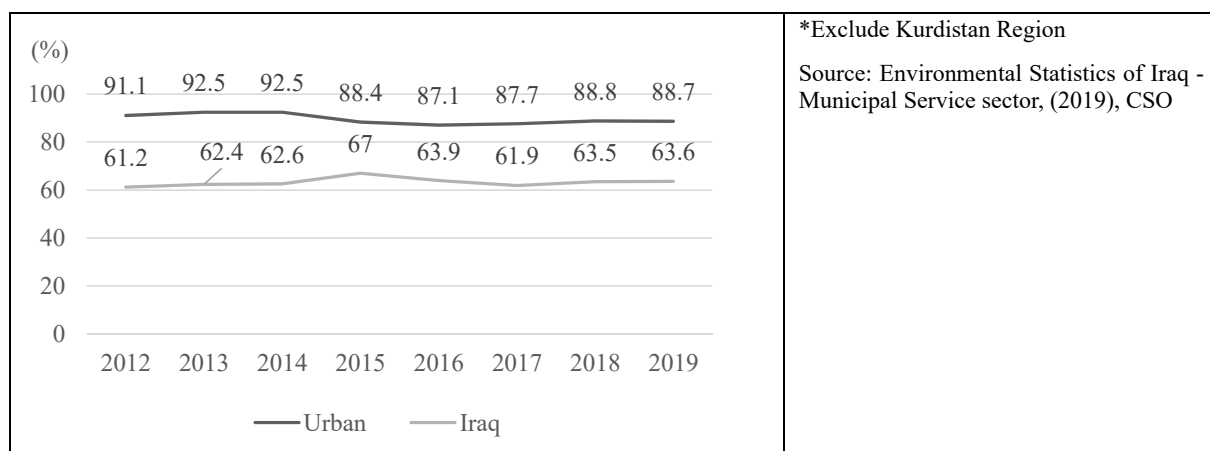


Fig. 3-3 Percentage of Population Served by Waste Collection Service

Fig. 3-4 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.

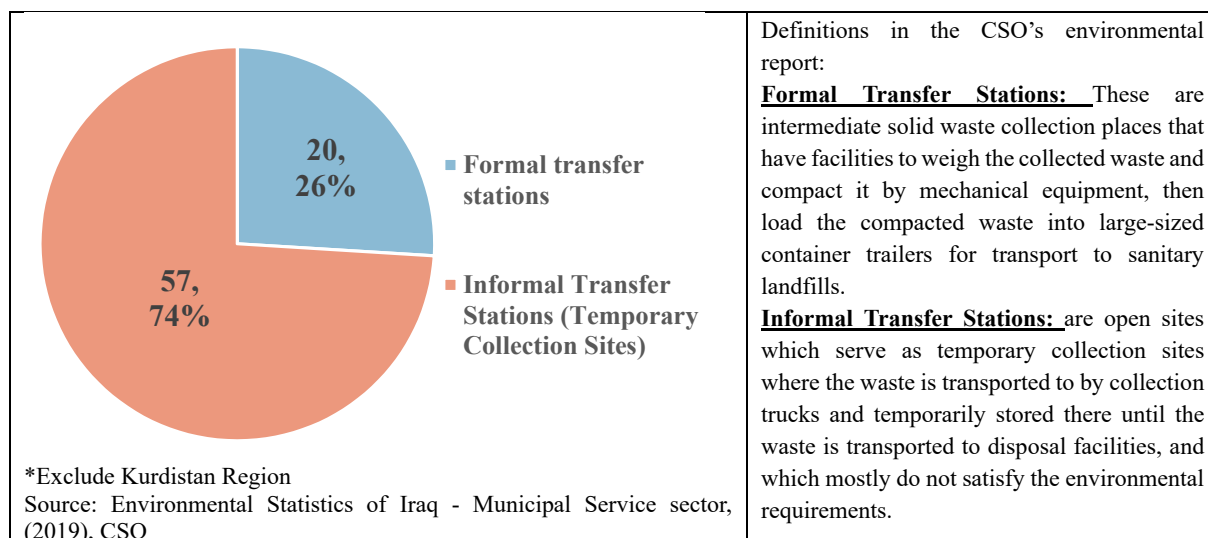


Fig. 3-4 Number of Transfer Stations

3.4.3 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. Baghdad Outskirts Governorate and Dhi Qar Governorate have facilities for recycling and reuse and Salah al-Dine Governorate has incineration.

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:

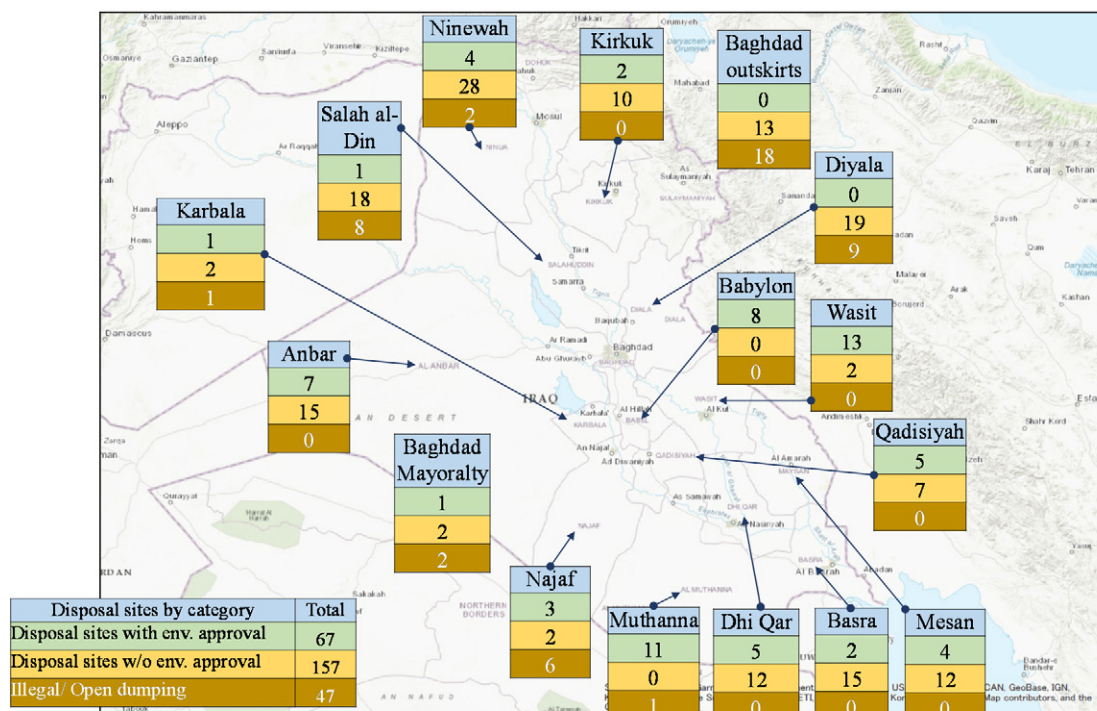
- Rainwater that percolates from the surface through the waste layers to the bottom layer.
- Water formed due to aerobic and anaerobic biodegradation of the disposed wastes.

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.

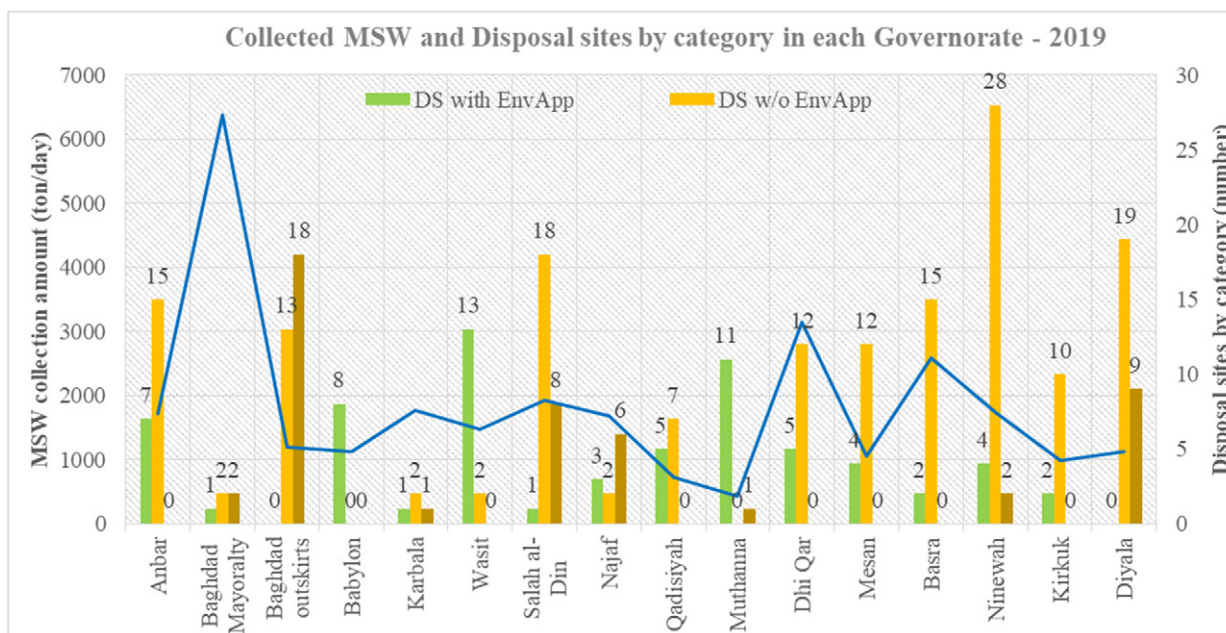
Fig. 3-5 shows the number of disposal facilities by category in each of the surveyed governorates. There are 271 sites in total, of which 67 disposal facilities (25%) have been environmentally approved. On the other hand, 17% of the sites in use are illegal open dumping sites. Fig. 3-5 is a graphical 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. 3-5 Distribution of Disposal Facilities by Category

Fig. 3-6 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. 3-6 Graphical Presentation of Disposal Facilities and Collected MSW Amounts by Governorate

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 3-6 Characteristics and Proposed Policy for Future Actions in Each Group

Group		Characteristics and problems	Proposed policy for future actions
1	Baghdad Mayoralty	<ul style="list-style-type: none"> ● 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%. ● Most of MSW is disposed at disposal sites without environmental approvals. 	To improve disposal sites without environmental approvals and bring them closer to sanitary landfills. To construct landfills with environmental permits.
2	Salah al-Din, Najaf	<ul style="list-style-type: none"> ● The waste collection rate is as low as 40%. ● Approximately 30% of open dumping sites are found in this group. 	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	Anbar, Qadesiyah, Dhi Qir, Mesan, Basrah, Kirkuk, Ninewah	<ul style="list-style-type: none"> ● The waste collection rate is relatively high at 72%. ● 67% of disposal sites without environmental approvals are found in this group. 	To improve disposal sites without environmental approvals and bring them closer to sanitary landfills. To construct landfills with environmental permits.
4	Babylon, Muthana, Wasit	<ul style="list-style-type: none"> ● The waste collection rate is low at 49%. ● The percentage of disposal sites with environmental approvals is the highest. 	To expand collection services while maintaining little to no open dumping or disposal sites without environmental approvals.
5	Baghdad Outskirts, Diyala	<ul style="list-style-type: none"> ● It is geographically adjacent to Baghdad City and accepts wastes from Baghdad City. ● The collection rate is low at 44%. ● 57% of open dumping sites are located in this area. 	To strengthen the waste collection capacity and close open dumping sites. To consider the development of a regional landfill site used with Baghdad City.

Source: JST

3.5 Impact on Medical Waste Associated with COVID-19

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 in Iraq is 251 ton/day excluding KRG. 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.

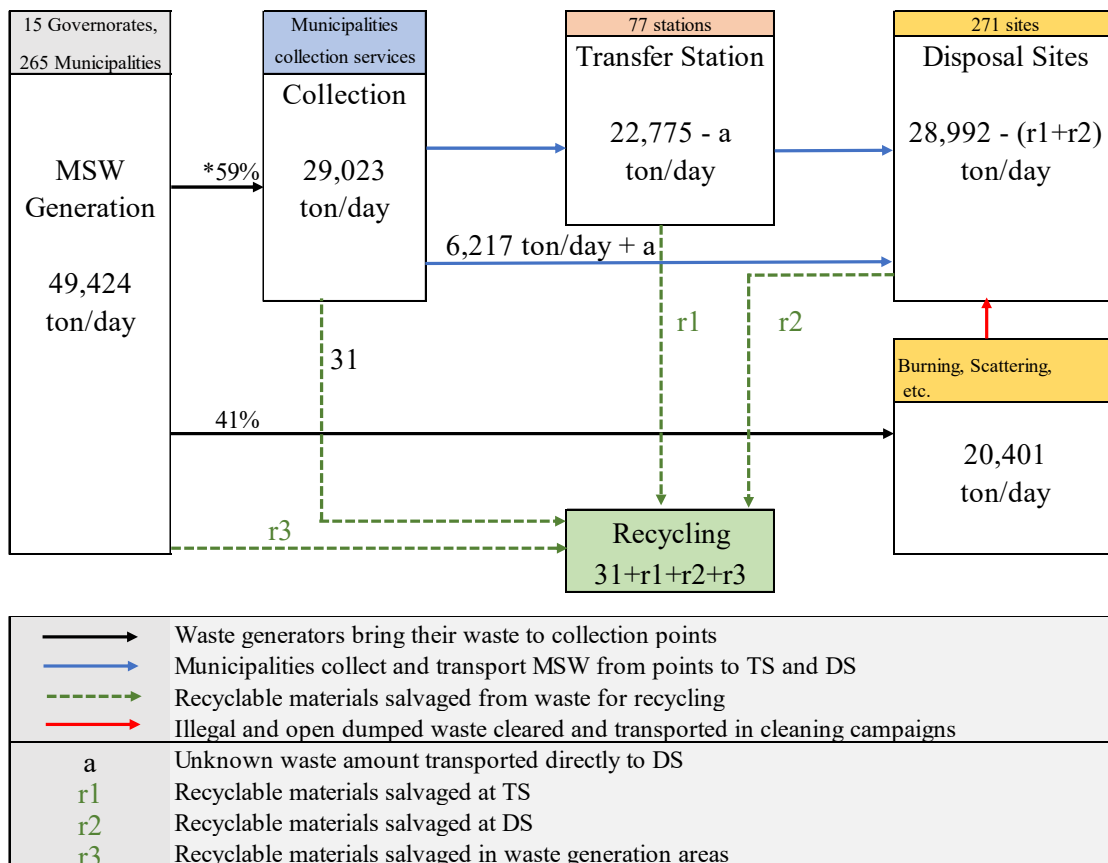
According to "The Impact of COVID-19 on Environmental Sustainability in Iraq (February 2021)" conducted by UNDP, although data support is lacking, the impact of COVID-19 has led to an increase

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.

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

The MSW flow in Iraq excluding KRG for 2019 is shown in Fig. 3-7 below. 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.

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”.



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

Fig. 3-7 MSW Waste Flow

3.7 National Level SWM Issues

JST summarized the national level solid waste management issues in Table 3-7 from three viewpoints, 1) Policy and Plan, 2) Institutional system and 3) Operation.

Table 3-7 National Level Issues on SWM

Sector	Issues
1. Policy and Plan	
① Master Plan	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. 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. The latest population census was carried out in 1987. There is only population projection from 1988.
2. Institutional system	
① Basic law on SWM	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. 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 is one of the Key Principles of the National Solid Waste Management Plan (2007).
② Specific laws and systems related to recycling	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.
③ Technical standards for treatment, disposal, etc.	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. 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	In order to improve the efficiency of data collection, it is desirable to create a database using cloud services. As much as possible data should be collected in terms of waste amounts (tons) for waste operations and area (m ²) for waste facilities, in order to make a more effective quantitative and comparative analysis. 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	The strengthening of the waste collection capacity is an urgent requirement, and the low waste collection rate especially in rural areas is a problem.

Sector	Issues
collection	
② Transfer stations	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	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	<p>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.</p> <p>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.</p> <p>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.</p>

Source: JST

Chapter 4 Solid Waste Management in Baghdad Mayoralty

4.1 General Conditions

The current population of Baghdad Mayoralty was estimated by CSO to be 6,150,828 for the year 2019. 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 for the production of tobacco, leather and cement is located in Baghdad, except for heavy industry. The governorate of Baghdad is the center of the Iraqi economic, commercial, banking and financial sectors. 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).

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

4.2 Institutional and Legal Framework

Baghdad Mayoralty is divided into 17 administrative divisions composed of 14 municipal departments and 3 units. The Mayoralty is linked directly to the secretariat of council of ministers and the Mayor of Baghdad has a rank equivalent to Minister.

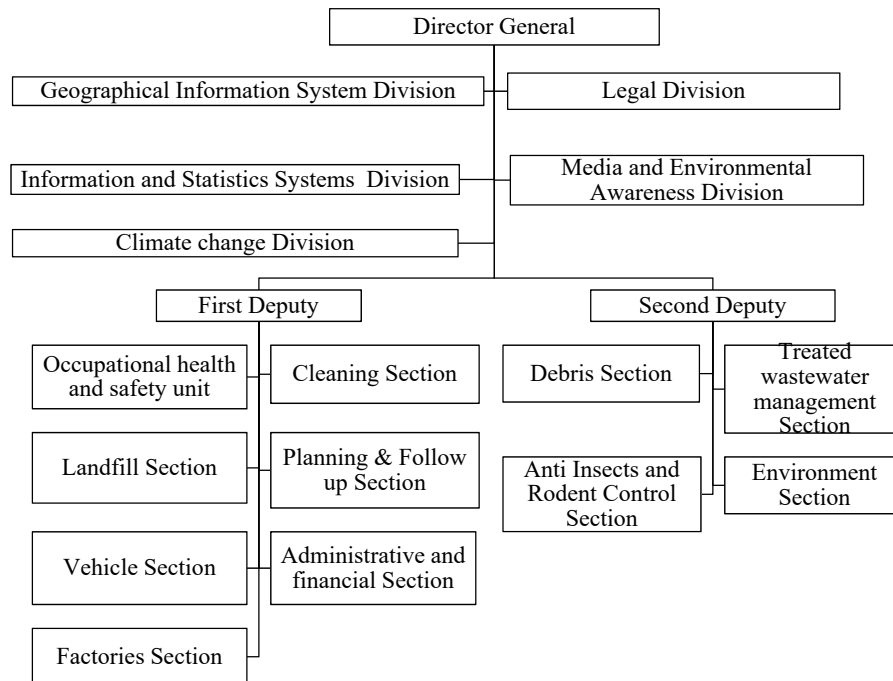
4.2.1 Organization on SWM

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 4-2.

Table 4-2 SWM Organization of Baghdad Mayoralty

Stakeholder	Organization	Responsibility for SWM
Baghdad Mayoralty	Solid Waste and Environment Directorate. SWED has more than 100 employees, and the organization structure is shown in Fig. 4-1.	<ul style="list-style-type: none"> ▪ Formulations of plans, laws, regulations, standards, etc. ▪ Financing and implementation ▪ Database ▪ Operation of the disposal facilities. ▪ Transporting rubble and industrial waste
	Each Municipal Department Municipalities are responsible for every municipal activities	<ul style="list-style-type: none"> ▪ Cleaning activity ▪ Waste collection and transportation ▪ Operation of the transfer stations

Source: Answers of the JST questionnaire



Source: Answers of the JST questionnaire

Fig. 4-1 Organization Structure of SWED

4.2.2 Bylaw and Guidelines Related to SWM

There is no specific bylaw for the SWM in Baghdad Mayoralty. Baghdad Mayoralty executes solid waste management in accordance with the laws and regulation of the federal government.

4.3 Financial Information

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. 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**

The main actions of the master plan and their progress is shown in Table 4-3. Baghdad Mayoralty has implemented most of the activities stipulated in the master plan except for source separation.

Table 4-3 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] <u>Promotion of waste segregation/collection/waste reduction (Discharge control)</u>	Short term: There is continuous training to workers and staff. Medium/Long term: pilot projects were conducted in Alsalihiya and Zaytona areas, however this initiative did not 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	Request for proposals were issued and several investors submitted offers for WtE projects of which 3 were selected so far and the mayorality is still evaluating other offers being received. As for segregation, it is still under consideration.
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	Only two sites were identified which are Nabaai and Nahrwan landfills. The Mayorality has got the approval from ministry of health to use Nabaai landfill until 2022. Other landfills were closed like Abu Ghareib 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.

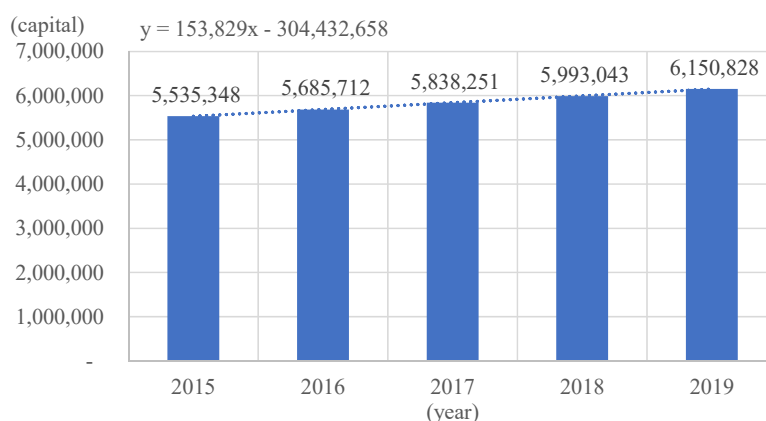
Notes: Activities of Long term are not included due to ones in future

Source: SWED

4.5 Municipal SWM Operation

4.5.1 Waste Generation and Composition

There are two scenarios that the JST considered to forecast the population of Baghdad Mayorality. 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.



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

Fig. 4-2 Regression Line for Population Forecast in Baghdad Mayorality 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 Mayorality 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 Mayorality. 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 more free, 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 Mayorality. 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 Mayorality. 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. 3-2, 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 Mayorality is 1.09 kg/capita/day. As a result of discussions with Baghdad Mayorality, 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 Mayorality in Scenario1: $10,427 \text{ ton/day} \div 6,302,124 \text{ people} = 1.65 \text{ kg/capita/day}$
- Unit generation rate of Baghdad Mayorality in Scenario2: $10,427 \text{ ton/day} \div 8,547,729 \text{ people} = 1.22 \text{ kg/capita/day}$

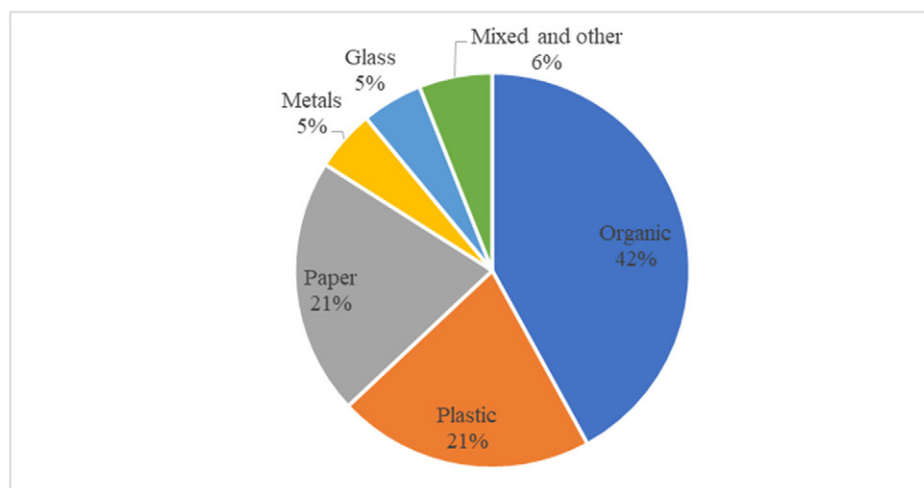
Table 4-4 shows the population and waste generation of Baghdad Mayorality. Using the annual growth rate of 1% as the Unit generation rate of both scenarios, the amount of waste generated in each was estimated.

Table 4-4 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
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

Baghdad Mayorality has a record of wastes arriving to the disposal facilities for the year 2021 (from January to August) per each municipal department. The result of the implemented survey of waste composition is shown in Fig. 4-3.



Source: Interview to SWED, Baghdad Mayoralty

Fig. 4-3 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 4-5 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.

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.

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 Mayorality 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 Mayorality. At that time, budget disbursement from Ministry of Finance to the mayorality was tentatively stopped and Baghdad Mayorality was required to pay the contract amount to the companies by the mayorality's income only such as local taxes, public utility charges and so on. And therefore, Baghdad mayorality 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. 4-4 Waste Collection Work

(2) Transfer Stations

There are nine formal transfer stations and 16 informal transfer stations in Baghdad Mayorality as far as confirmed. All solid waste collected in Baghdad Mayorality 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 regardless of formal and informal ones.

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 Mayorality or leased vehicles. The stations have fence & gate, administration building, weighbridge and mechanical compactors.



Source: JST

Fig. 4-5 Al Dora and Al Rasheed Transfer Stations

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. 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.



Source: JST

Fig. 4-6 Informal Transfer Station

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 4-6. 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 4-6 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 Mayorality 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 Mayorality shall not immediately close the informal transfer stations and shall 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.

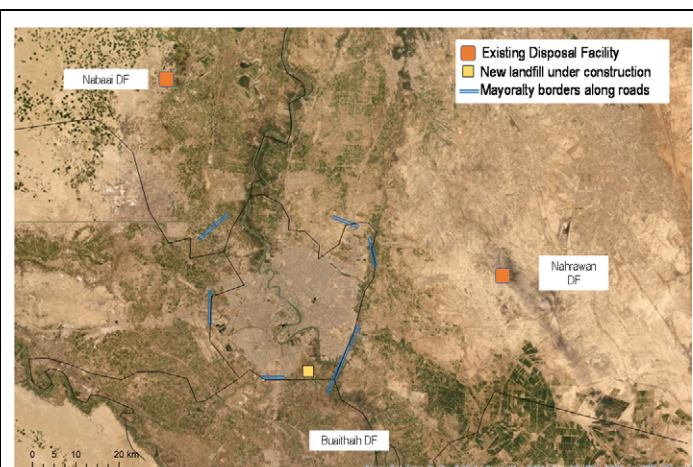
4.5.3 Intermediate Treatment

Baghdad Mayorality 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 Mayorality 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 mayorality. 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.

4.5.4 Final Disposal

Baghdad Mayorality 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. 4-7. 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, Buathaih disposal facility is within the boundaries of Baghdad Mayorality. The amounts of disposed municipal solid waste, based on the data provided by the Baghdad Mayorality for May 2021, were 1,416 tons/day in Nahrawan DF and 7,969 tons/day in Nabaai DF respectively.



Source: JST

Fig. 4-7 Location of MSW Disposal Facilities Used by Baghdad Mayorality

(1) Current Situation of the Existing Disposal Facilities

Baghdad Mayorality estimates the remaining capacities of Nabaai DF and Nahrawan DF as 2 years or more, and 3 year or more, respectively. The facilities available at the two operating disposal facilities are identified in Table 4-7. 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 4-7 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
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: JST

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



Source: JST

Fig. 4-8 Nahrawan Disposal Facility Visit

In September 2020, a USAID team visited the site to make a preliminary analysis and improvement recommendations. Based on the preliminary report² 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. JST studied the remaining capacity of the existing landfill sites from viewpoint of waste disposal height and distributing the total required waste disposal volume over all the sites. An example where the waste disposal heights required up to 2030 at both disposal facilities have been roughly computed is shown in Table 4-8. 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 condition of intermediate treatment facilities. In this assumption for the first 5 years Buaitaih landfill will also receive the waste up to 2026.

² Al Nehrawan Landfill Life Extension and Rehabilitation – Preliminary Report, September 2020

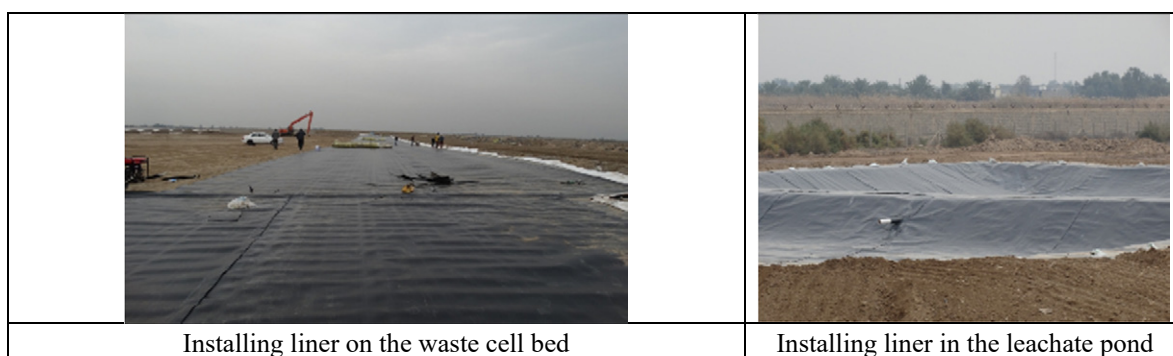
Table 4-8 Waste Disposal Heights Required at Nabaai and Nahrawan DF Up to 2030

Items	unit	Value	Graphs
A - Accumulated waste disposal requirement by 2030			<p>Nabaai DF</p>
(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	<p>Nahrwan DF</p>
(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	<p>● With ITF 45,090,425 m³ volume > 44,907,316 m³ waste</p> <p>● Without ITF 51,945,161 m³ volume > 51,656,441 m³ waste</p>
(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 - Buathaih 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	
<p>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 Buathiah LF fixed so it is not affected by ITF availability</p>			

Source: JST

(2) Buathaih New Sanitary Disposal Facility

The Buathaih landfill under construction is the first environmentally approved landfill in Baghdad City, and has facilities to meet the requirements of a sanitary landfill site. Buathaih landfill site is designed as 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 Buathaih 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.



Source: JST

Fig. 4-9 Facilities under Construction in Buathaih Disposal Facility

4.5.5 Baghdad Mayoralty Municipal Solid Waste Material Flow

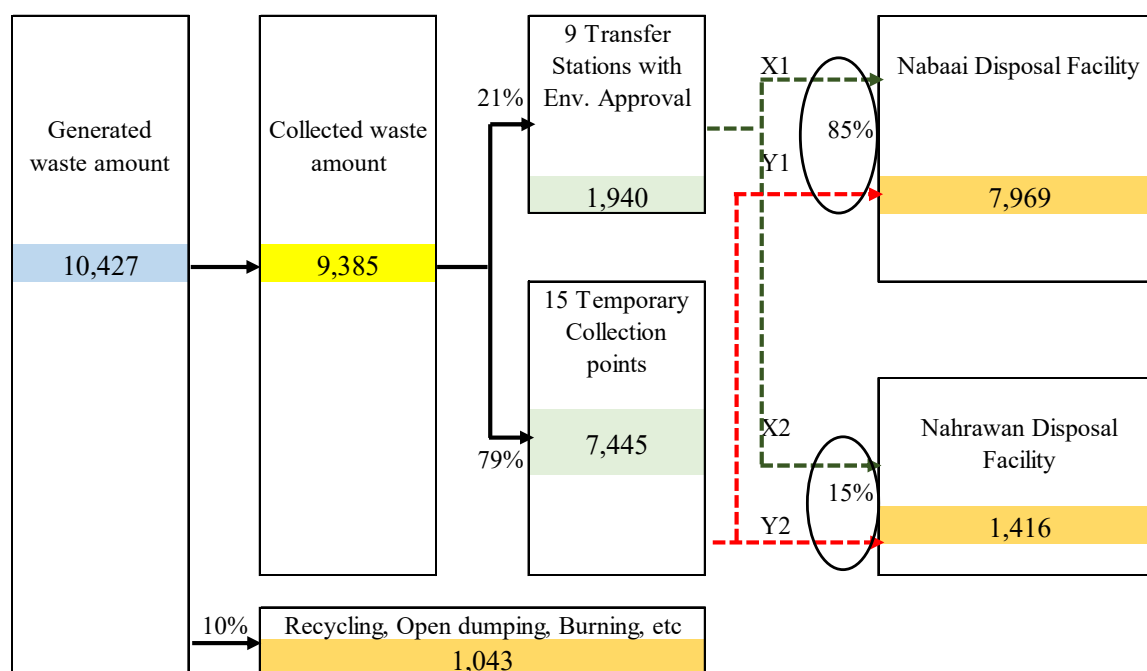
The information collected to prepare the MSW waste flow for Baghdad Mayoralty (BM), together with the information gathering method is shown in Table 4-9.

Table 4-9 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 4-9. Weighbridges are available at the formal transfer stations and records are maintained. But there are no weighbridges at the informal transfer stations and disposal facilities. 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. 4-10.



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 21% 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. 4-10 MSW Flow for Baghdad Mayoralty in 2020

4.6 Private Companies Involved in Waste Management

In Baghdad Mayoralty, several private companies are engaged in waste management as shown in Table 4-10. All MSW collection in Baghdad Mayoralty 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.

Table 4-10 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 Issues on SWM for Baghdad Mayoralty

JST summarize solid waste management issues in Table 4-11 from three viewpoints, 1) Policy and Plan, 2) Institutional system and 3) Operation.

Table 4-11 Issues on SWM for Baghdad Mayoralty

Sector	Issues
1. Policy and Plan	
① Master Plan	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. The latest population census was carried out in 1987. There is only population projection from 1988.
2. Institutional system	
① Data management	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. It is necessary to survey the waste generation amount of waste at the source and grasp the waste unit generation rate. 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	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	No
④ Training system	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	It is necessary to improve waste collection rate by educational activities for drivers/site workers and appropriate management.
② Transfer station	With regard to informal transfer stations, each municipality operates its informal transfer

Sector	Issues
	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.
③ Intermediate treatment and recycling	It is necessary to proceed without delays in implementing the construction of WtE facilities and the two recycling-related facilities currently being promoted. 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 Mayorality shall also promote to develop incentives and technical standards for private companies in cooperation with the Federal government.
④ Final disposal facility	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 tons/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. 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. Both Nabaai DF and Nahrawan DF are located in other municipalities outside of Baghdad Mayorality. 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	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

Chapter 5 Solid Waste Management in Basrah City

5.1 General Conditions

The current population of Basrah City was estimated to be 1,474,072 for the year 2019. According to European Asylum Support Office (EASO), Basrah's oil exports constituted around 98% of Iraq's federal revenues in 2019, 'with a monthly average of around 6.5bn USD'. 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.³

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

5.2 Institutional and Legal Framework

5.2.1 Organization for SWM

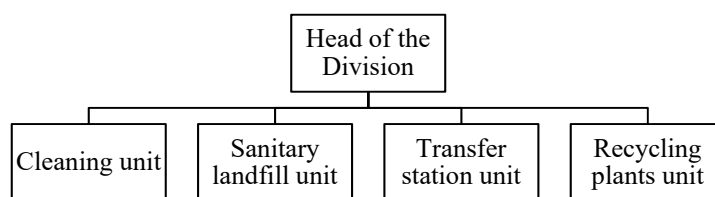
SWM in Basrah City is managed by the Solid Waste and Environment Directorate (hereinafter referred to as "SWED") in Basrah City. The city according to the latest reorganization by the federal government currently falls under the Basrah Governorate administratively. While on a technical level it is linked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

Table 5-2 SWM Organization of Basrah City

Stakeholder	Organization	Responsibility
MCHMPW	General Directorate of Municipalities	<ul style="list-style-type: none"> • 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		<ul style="list-style-type: none"> • Financing and implementation
Basrah City	Solid Waste and Environment Division	<ul style="list-style-type: none"> ▪ Database ▪ Collection of wastes ▪ Operation of facilities

Source: Answer of JST Questionnaire

³ European Asylum Support Office (EASO) - Iraq Key socio-economic indicators For Baghdad, Basra and Erbil - September 2020



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 5-3, which is about half of the city budget of 82.4 billion IQD.

Table 5-3 Basrah City's Total Budget and SWM Budget

Item	Unit: billion IQD		
	2019	2020	2021
Total Budget	77.2	80.1	82.4
SWM Budget	50.0	50.0 (actual expenditure: 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 5-4, 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 – 165 USD/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.

What a Waste 2.0 (World Bank, 2018)

Disposal Type	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.

Table 5-4 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

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. The masterplan aims to ensure regular collection of solid waste, to maximize waste recycling and reuse, to ensure sanitary disposal of unusable waste and to promote sustainable livelihoods and income from waste management. The main actions of the master plan and their progress are shown in Table 5-5.

Table 5-5 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	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	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: 1 site	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

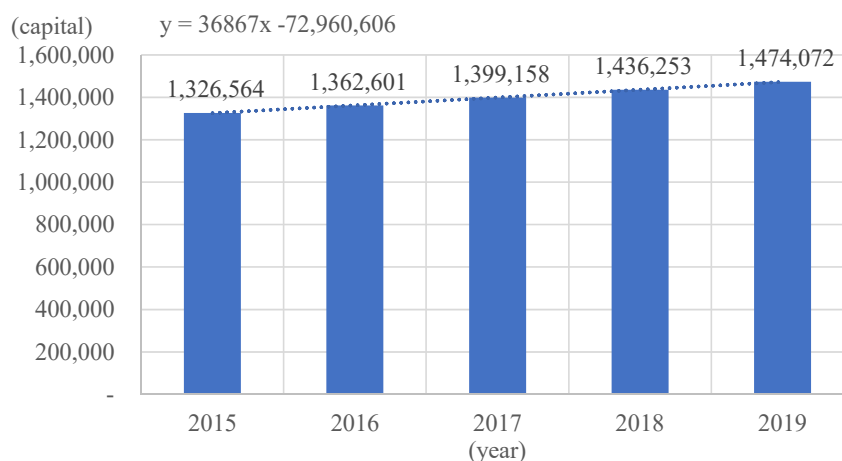
Notes: Activities of Long term are not included due to ones in future

Source: Answer of JST Questionnaire

5.5 Municipal SWM Operation

5.5.1 Waste Generation and Composition

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 shown in Fig. 5-2.



Source: JST estimate using Population Estimation of Iraq 2015 – 2018, (2018)

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

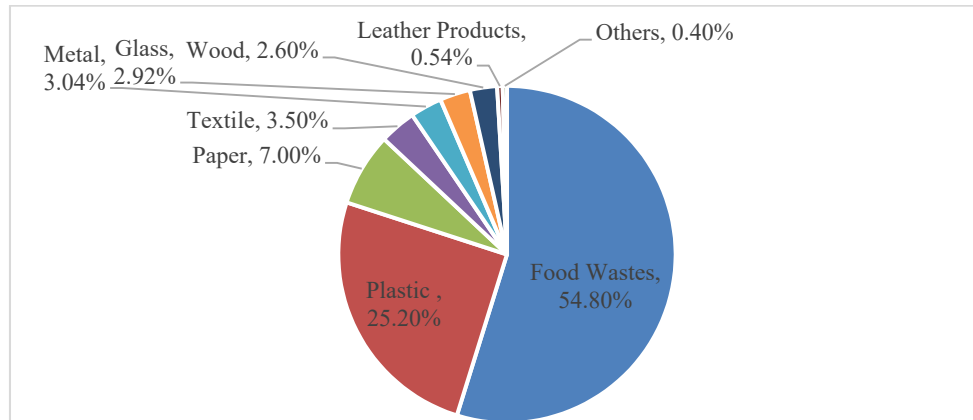
The total generated municipal waste amount provided by Basrah City was 1,676 ton/day in 2020. By dividing the generation amount over the population, the Unit generation rate in 2020 was calculated to be 1.11 kg/capita/day. The Unit generation rate was assumed to increase by 1% annually. The estimation of the MSW generation amounts is shown in Table 5-6.

Table 5-6 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
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.

Fig. 5-3 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. 5-3 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 5-7. Basrah City is divided into seven zones 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 are 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 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 5-7 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)



Source: JST

Fig. 5-4 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 5-8. 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 5-8 Outline of the New Transfer Stations in Basrah City

Station Name	Capacity	Area	Location	Status (Formal/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)

5.5.3 Intermediate Treatment

At present there are no activities for intermediate treatment implemented by Basrah City.

5.5.4 Final Disposal

There is one disposal facility used for MSW management by Basrah City. This disposal facility, Rafaaia landfill, 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. The Basrah City disposal facility is in the neighboring municipality, 45 to 50 kilometers from the city center. The waste disposed at Rafaaia 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.

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.



Source: JST

Fig. 5-5 Location and Layout of Rafaaia Landfill

The facilities available at the landfill are identified in Table 5-9. 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. There are HDPE liner sheet and leachate collection pipes on the bottom of the cell.

Table 5-9 Facilities and Equipment at Rafeaiya 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
11. Leachate treatment	No	23. Gas collection system	No
12. Geomembrane liner	Yes		

Source: Answer of the JST questionnaire

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. 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. .

Basrah City is constructing the 3rd Cell for expanding the disposal area in Rafeaiya landfill site, however the progress is delayed due to lack of the budget. JST study the remaining capacity of Rafeaiya landfill including existing cells and the 3rd cell under construction. Under some assumptions, as shown in Table 5-10, the cumulative waste disposal amount when operating the Rafeaiya 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 m³, 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/m³.

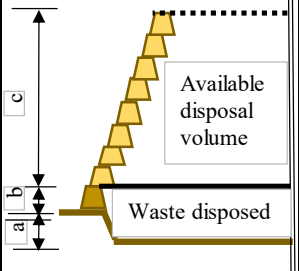
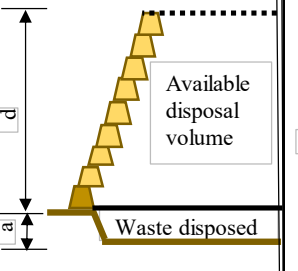
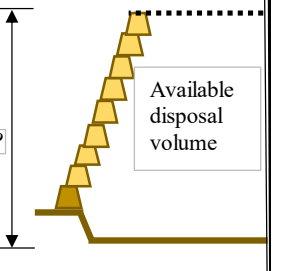
Table 5-10 Waste Disposal Volume Required Up to 2030

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 Rafaiiya disposal facility are shown in Table 5-11. 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. 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. For the disposal facility to secure 7,229,489 m³ 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.

Table 5-11 Remaining Disposal Area in Rafaiiya 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

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 5-12.

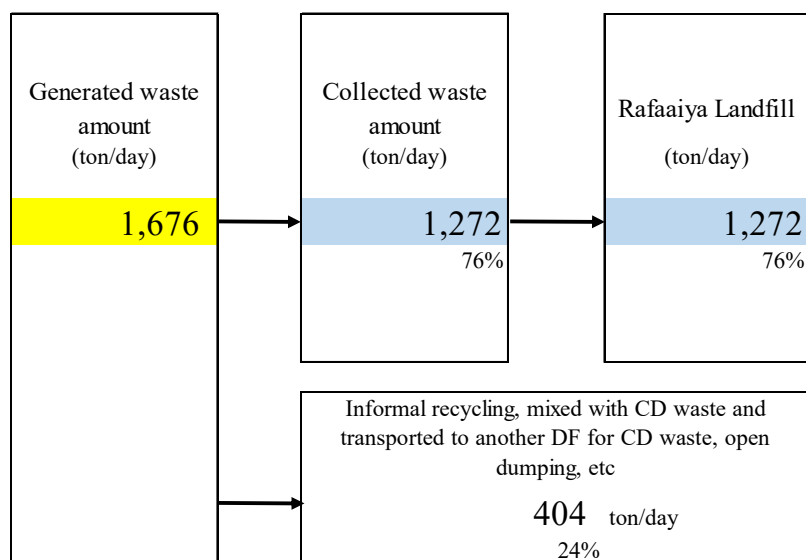
Table 5-12 Basrah City Waste Data for Year 2020

Data Items	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 (tons/day)	1,272 ton/day	Weighbridge at disposal facility

Of the four data items 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/cap/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 ($1.25 \times 1,510,330/1,000$) is more than the amount of 1,676 tons/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 (Data 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. 5-6 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: JST

Fig. 5-6 Basrah City Solid Waste Material Flow in 2020

5.6 Private Companies Involved in Waste Management

In Basrah City, several private companies are engaged in waste management as shown in Table 5-13. 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.

Table 5-13 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 Issues on SWM for Basrah City

JST summarized solid waste management issues in Table 5-14 from three viewpoints, 1) Policy and Plan, 2) Institutional system and 3) Operation.

Table 5-14 Issues on SWM for Basrah City

Sector	Issues
1. Policy and Plan	
① Master Plan	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. The latest population census was carried out in 1987. There is only population projection from 1988.
2. Institutional system	
① Data management	It is necessary to survey the generation amount of waste at the source and grasp the unit generation rate (kilogram per person per day). 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	No issues.
③ Management of private sector service providers	The new tender for the two areas is delayed because of the budget disbursement from the governorate,
④ Training system	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	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	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 rate of about 50%, avoiding further delays.
③ Intermediate treatment and recycling	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	The remaining capacity of the Rafeaiya 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

Sector	Issues
	<p>located, as well as neighboring municipalities, they may consider the regional disposal facility again.</p> <p>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 Rafeaiya 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.</p>
⑤ Environmental education and public awareness	<p>In cooperation with the Takamul 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.</p>

Source: JST

Chapter 6 Solid Waste Management in Erbil City

6.1 General Conditions

CSO issued reports with estimates of populations showing a population of 1,323,903 for Erbil City for the year 2019. 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 International Organization for Migration (hereinafter referred to as 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.

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

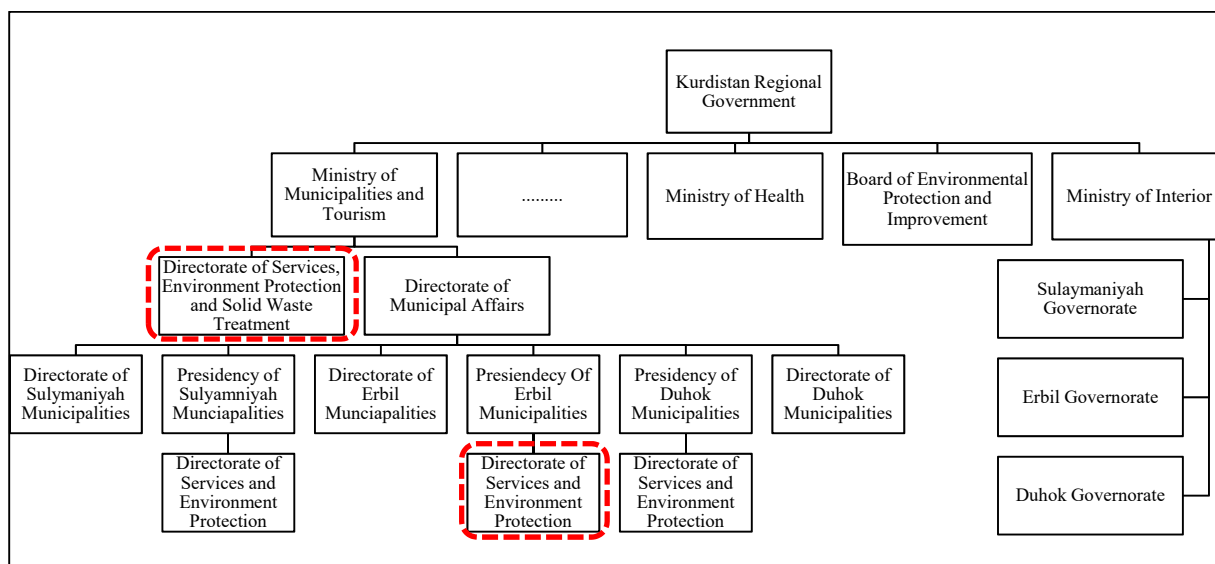
Source: Population Estimation of Iraq 2015 – 2019, (2019), CSO

6.2 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.



Source: MOMT

Fig. 6-1 KRG Organization Structure related to SWM

SWM organization and responsibility are shown in Table 6-2. DSEPSWT is reporting directly to the

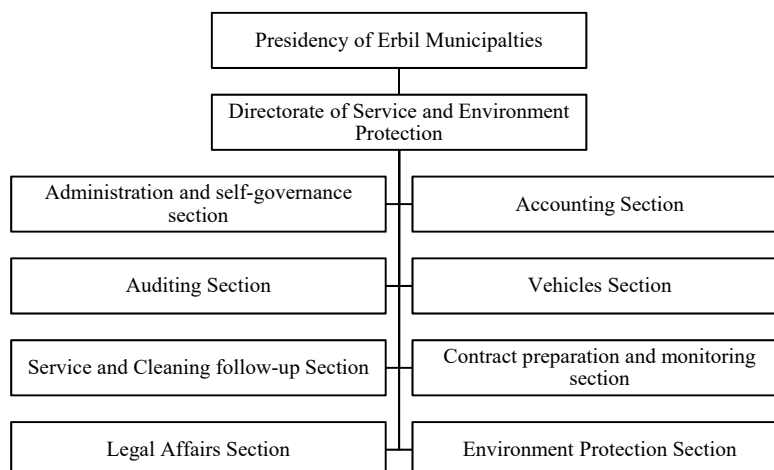
Minister of MOMT office. The directorate is responsible to manage the SWM in Kurdistan region. The directorate currently employs only 5 staff members and is suffering from shortage of staff to be able to conduct the tasks allocated to it.

Directorate of Services and Environment Protection was established under the Ministerial order No. 7423 dated 5/4/2012 with the organization structure as shown in Fig. 6-2. 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. The Directorate currently has 178 employees distributed.

Table 6-2 SWM Organization of Erbil City

Stakeholder	Organization	Responsibility
MOMT	Directorate of Services, Environment Protection and Solid Waste Treatment (DSEPSWT)	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> ▪ Financing and implementation ▪ Database ▪ Collection of wastes ▪ Operation of facilities

Source: Answer of the JST questionnaire



Source: Answer of the JST questionnaire (Erbil City)

Fig. 6-2 DSEP Organization Structure

6.2.2 Bylaw and Guidelines Related to SWM

There is no specific bylaw for SWM in Kurdistan Region. MOMT executes solid waste management in accordance with the laws and regulations of the federal government and KRG.

6.3 Financial Information

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. As of 2021, the total cost of SWM is 2.37 billion IQD per month, as shown in Table 6-3. This monthly cost may not include staff salaries and other administrative costs. 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 6-3 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 tons/day (Refer to 6.5.2)

*3: USD 1 = IQD 1,460

6.4 Policy and Plan Related to SWM

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

6.4.2 Draft KRG Solid Waste Management Policy (2017)

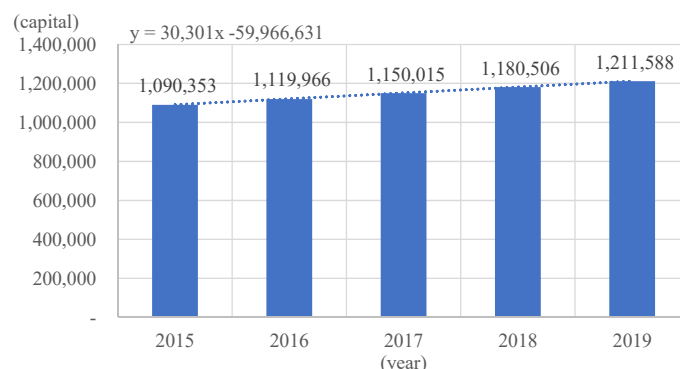
The Draft KRG Solid Waste Management Policy was prepared in August 2017 and aimed at creating a roadmap for the improvement of Solid Management in Kurdistan Region for the following 10 years. This policy also comes in response to the challenges associated with the increasing influx of internally displaced 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. This draft policy was not approved or set to use up to this date.

6.5 Municipal SWM Operation

6.5.1 Waste Generation and Composition

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 and the regression line is shown in Fig. 6-3.



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

Fig. 6-3 Regression Line for Population Forecast in Erbil City

Internally Displaced Persons (hereinafter referred to as 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 IDPs⁴ were in camps and 124,614 (20,769 households) IDPs⁵ 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 6-4.

Table 6-4 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
2029	1,514,098	156,359	1.43	2,391
2030	1,544,399	159,486	1.45	2,463

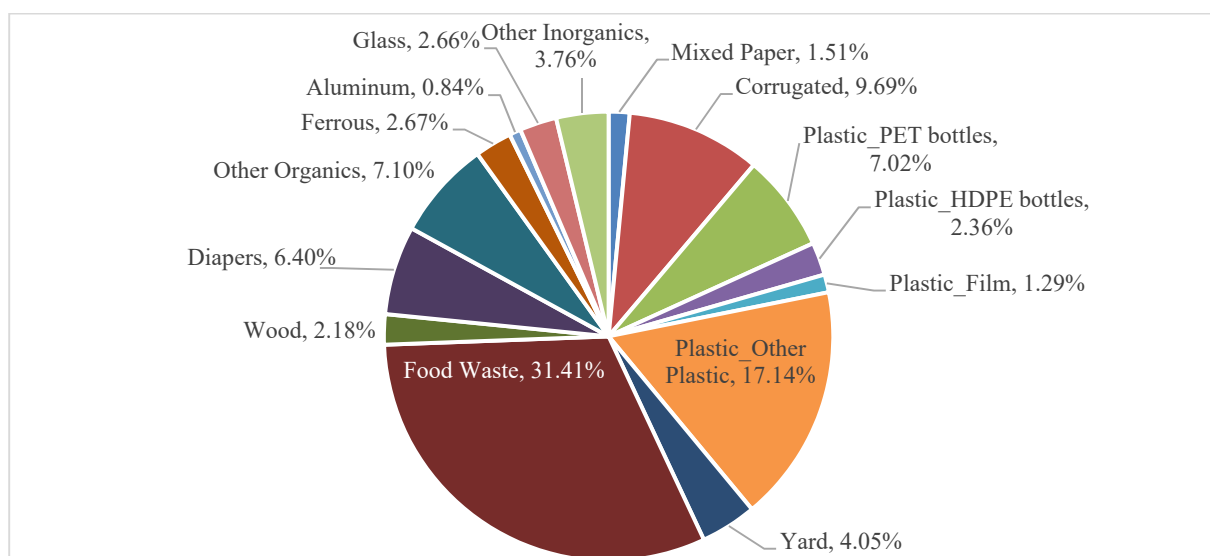
Source: JST estimated using Environmental Statistics of Iraq - Municipal Service sector, (2019), CSO

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%,

⁴ CCCM CLUSTER, 2020, Iraq Camp Master List and Population Flow-March 2020

⁵ IOM Iraq, 2020, URBAN DISPLACEMENT IN IRAQ: A PRELIMINARY ANALYSIS

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

6.5.2 Waste Collection and Transportation

(1) Waste Collection

Waste amount collected was 1,760 ton/day in 2020 as shown in Table 6-5. 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 6-6. 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.

There are no transfer stations in Erbil and all waste collected by collection trucks is directly transported to the disposal facility.

Table 6-5 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 6-6 List of Waste Collection Company and Equipment

Zone	Company	Total number of vehicles	Pickup cars	Total number of staff
Zone 1	Hot clean	69	6	154
Zone 2	Kahdar	63	6	212
Zone 3	Baghi Prghol	73	6	192
Zone 4	Dazling future	105	6	295
Zone 5	Zok	70	6	210
Zone 6	Nrkh	101	6	262
Ainkawa	Kahdar	22	1	101
Baherka, Chaweis, Kani Qirzhala	Nrkh	60	6	131
Banislawa, Daratow	Class Shtutgart	73	4	181

Source: Answer of the JST questionnaire



Source: JST

Fig. 6-5 Waste Collection Work

6.5.3 Intermediate Treatment Facilities

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 several options for ITF for the city were discussed between the city and 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.

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. 6-6, and is located within Erbil municipality, about 15 kilometers from the city center. 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. The disposal facility is located on a total area of 37 hectares. 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 reported making any move toward the construction of a new disposal facility.



Source: Answer of the JST questionnaire

Fig. 6-6 Location of Kani Qirzhala DF

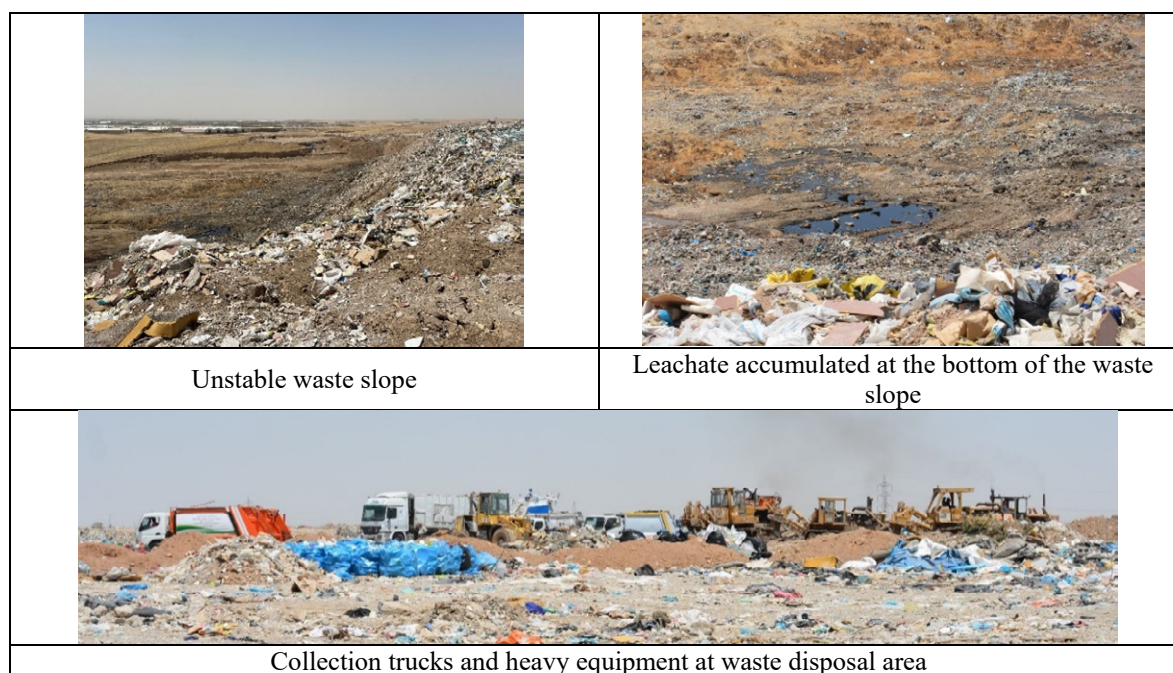
The facilities available at the Kani Qirzhala DF are identified in Table 6-7.

Table 6-7 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
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

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.



Source: Answer of the JST questionnaire

Fig. 6-7 Photographs of Disposal Operations

Remaining capacity of Kani Qirzhala DF is studied as follows. 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. A rough estimate on relation between disposal height and remaining capacity is shown in Table 6-8.

Table 6-8 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 m³. On the other hand, the disposal volume required for the waste disposed of at the site in the last 17 years until 2020, the soil cover applied to that waste and considering compaction is roughly estimated at 8,775,643 m³. Considering the space taken by the waste disposal in the last 17 years of 8,775,643 m³, then from 2021 the remaining disposal volume is estimated to be 3,834,974 m³. Based on this estimate the disposal facility will last up to about 2025, even though the disposal height is set 50 m. Table 6-9 shows the disposal volume required by the end of that year to be 4,411,445 m³. As a result of the estimation, Kani Qirzhala DF will be expired in 2025 even though the disposal height would be set 50m.

Table 6-9 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

6.5.5 Erbil City SWM Material Flow

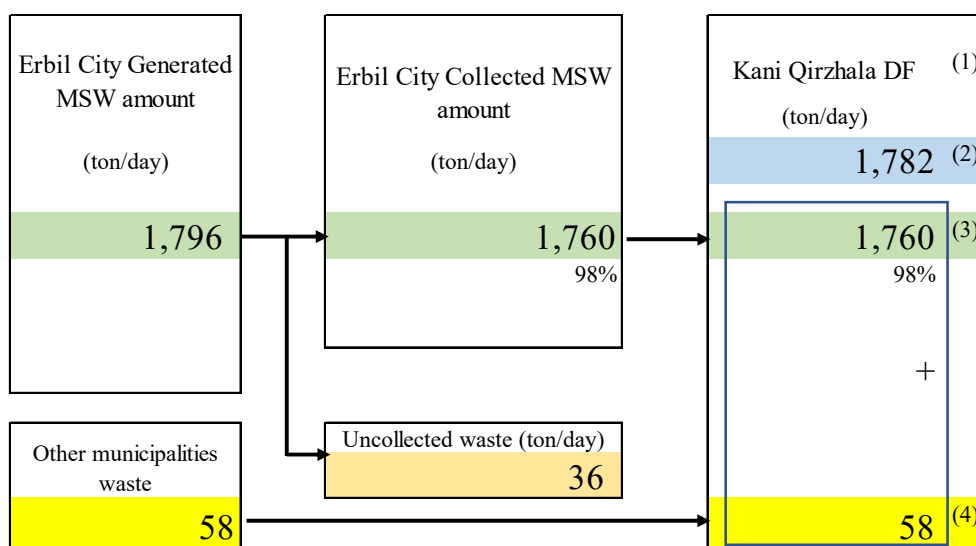
The information collected to prepare the MSW waste flow for Erbil City, together with the information gathering method is shown in Table 6-10. The table also includes information for the two nahia and one center outside Erbil City that dispose their wastes at Kani Qirzhala LF.

Table 6-10 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/d in 2017, extended by 1% annual increase to 2020
4) Generated waste amount	1,796 ton/day	$(1,241,389 + 130,834) \times 1.31$
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	$(0.98 \times 1,796) + (115,271 \times 0.50) + \alpha(1)$

Source: Answer of the JST questionnaire

Fig. 6-8 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. 6-8 Erbil City Municipal Solid Waste Material Flow in 2020

6.6 Private Companies Involved in Waste Management

In Erbil City, several private companies are involved in waste management as shown in Table 6-11. 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 6-11. 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.

Table 6-11 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 Shtuttgart, White Dolphin, Pap group, Maver
Recycling	Erbil Steel Factory, Med Steel Company
Hazardous Waste Treatment	Green Environment, HSE

Source: Prepared by JST

6.7 Issues on SWM for Erbil City

JST summarized solid waste management issues in Table 6-12 Issues on SWM for Erbil City from three viewpoints, 1) Policy and Plan, 2) Institutional system and 3) Operation.

Table 6-12 Issues on SWM for Erbil City

Sector	Issues
1. Policy and Plan	
① Master Plan	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. The latest population census was carried out in 1987. There is only population projection from 1988.
2. Institutional system	
① Data management	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. Waste amount survey should be implemented in order to grasp the waste unit generation rate. 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	Waste management fee is not collected from residents and is also not collected from private companies.
③ Private sector management	In 2021, only 60% of the contract amount has been paid to the private company because of budgetary problem.
④ Training system	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	None
② Transfer station	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	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	Development of a sanitary landfill final disposal site to replace the Kani Qirzhala 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. 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	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

Chapter 7 Support to SWM in Iraq by Donners

USAID UNICEF and USAID are currently involved in the SWM activities in Iraq and outline of their projects are summarized as follow.

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 Muthanna 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. The programme aims to reduce methane emissions and to incentivize the use of compost over chemical fertilizers through a pilot project in Karbala Governorate

Source: Answer of the JST questionnaire

Table -7-2 List of UNICEF's Solid Waste Management Project in Iraq

Project Activity	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.

Source: Answer of the JST questionnaire

Table -7-3 List of USAID's Solid Waste Management Project in Iraq

Project Name	Iraq Governance and Performance Accountability (IGPA/TAKAMUL) Project	
Project Duration	Year 2017-2023	
Project Site	All regions and provinces of Iraq with a special focus on Anbar, Basrah, Babel, Erbil, and Ninewa	
Budget	172 million USD	
Outline	<p>The Project shall implement the following activities in priority service sectors including water supply, solid waste management, and electricity</p> <ul style="list-style-type: none"> • Economic Reform and Public Financial Management • Monitoring and Oversight • Community Outreach & Support to Emerging Leaders 	
Activity of SWM component	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.	

Source: Answer of the JST questionnaire

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. 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 setting 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> ➤ 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)

(3) The lesson 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 ton of waste daily and has an output capacity of 3 MW. According to Municipal 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

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 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 Feed-in Tariff (hereinafter referred to as 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.

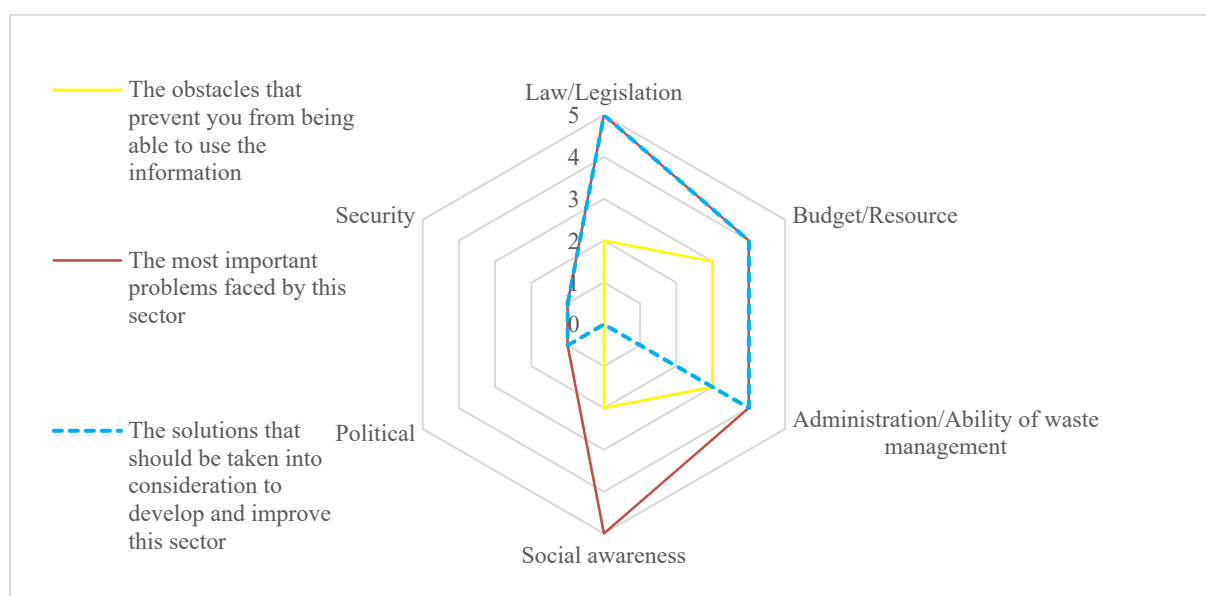
Japan's Ministry of Economy, Trade and Industry and the Ministry of the Environment are focusing on exporting environment-related infrastructure in Asia. Due to the favorable Asian markets such as China in recent years, Japanese companies are not aggressive in their high-risk businesses in the Middle 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

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 you 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 the 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 solution despite a lot of answers as being the important problem, it may be suggested that problems on 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

8.4 Issues and Proposed Support Policies

8.4.1 Federal Government

Table 8-3 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 8-3 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	There are no standards for intermediate treatment facilities.	A: To support the establishment of technical standards and promotion systems. Add items to		

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
	treatment and disposal			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 in suburban areas, is a problem.	None	C: It is difficult for the Federal Government to support this issue because it is a municipality 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 Mayorality

Table 8-4 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 8-4 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)*
Cap	1. Formulation of policies and plans			
	Master plan	Ten years have passed since	None	A: To conduct an interim

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
		its 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	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.
	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.
	4. Development of waste management facilities			
Financial support	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

Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
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 8-5 shows the issues and the need for support for waste management related to Basrah City. Proposed support policies.

Table 8-5 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)*
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	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	It is necessary to develop a plan for	Being	C: It is required to coordinate with	

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
	awareness	public awareness and coordinate with USAID activities.	implemented by USAID	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 private sector participation	There is no specific plan for the development of intermediate treatment facilities. It is still 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 8-6 shows the issues and the need for support for waste management related to Erbil City. Proposed support policies.

Table 8-6 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	B: To support the development of operation and		

	Item	Issue	Status of other donors	Needs for support and their content (A, B or C)*
		of operation and management and develop facility operation and monitoring systems.		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.
	4. Development of waste management facilities			
Financial support	Collection and transportation	Already mentioned in the "Capacity development" section above	None	C
	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 Mayorality 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 Mayorality 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 Mayorality which require improvement. Consequently, the priority project for Baghdad Mayorality 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 8-7. 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 8-7 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 8-8. 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 Mayorality has proceeded with developing WtE facility and therefore the Mayorality 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 Mayorality 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 8-8 Prioritized Future Project (Federal Government: SWM Strategy and Intuitional Development Project)

Scheme	Technical Cooperation Project
C/P organization	MCHMPW and Baghdad Mayorality
Period	3 years
Expected outcomes	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. National Waste Management Master Plan will be revised. <ol style="list-style-type: none"> (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 <ol style="list-style-type: none"> (1) To setup a committee for the guidelines that will be established (Baghdad Mayorality will be a member of the committee) (2) To implement case survey in Japan and other foreign countries (Desktop survey, Site visit survey)

	<ul style="list-style-type: none"> (3) To formulate the draft guideline (4) To install laboratory equipment for solid waste testing and analysis <p>3. Guidelines for developing sanitary landfill facility and safe closure of dumping site will be formulated.</p> <ul style="list-style-type: none"> (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 <p>4. System for developing solid waste management facility will be proposed.</p> <ul style="list-style-type: none"> (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 8-9. 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 8-9 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 8-10 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	<ul style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. SWM masterplan in Baghdad Mayoralty will be revised <ol style="list-style-type: none"> (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 <ol style="list-style-type: none"> (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 <ol style="list-style-type: none"> (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 8-11 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	<ol style="list-style-type: none"> 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 8-12. Support policy by JICA to Basrah city are categorized as two groups, 1) Masterplan and 2) Improving existing landfill facility.

Table 8-12 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)	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.

Group	Items with very high need	Assumed activity
	Final disposal (financial support)	
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 8-13 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	<ol style="list-style-type: none"> 1. SWM masterplan in Basrah governorate will be revised 2. Landfill facility utilized by Basrah city will be improved
Activities	<ol style="list-style-type: none"> 1. SWM masterplan in Basrah governorate will be revised <ol style="list-style-type: none"> (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 <ol style="list-style-type: none"> (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 8-14. Support policy by JICA to Erbil city are categorized as two groups, 1) Masterplan and 2) Improving existing disposal facility.

Table 8-14 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	Final disposal (capacity development / existing disposal)	Work plan and environmental management plan will be formulated for expanding the life span of the

Group	Items with very high need	Assumed activity
facility	facility)	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 8-15 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 8-16. 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 8-16 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