Directorate General of Human Settlements, Ministry of Public Works

DKI Jakarta

PD PAL JAYA

THE PROJECT FOR CAPACITY DEVELOPMENT OF WASTEWATER SECTOR THROUGH REVIEWING THE WASTEWATER MANAGEMENT MASTER PLAN IN DKI JAKARTA IN THE REPUBLIC OF INDONESIA

FINAL REPORT

(SUMMARY REPORT)

MARCH 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

YACHIYO ENGINEERING CO., LTD.
JAPAN ENVIRONMENTAL SANITATION CENTER
WATER AGENCY INC.

GED
JR
12-058

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Foreign Exchange Rate

USD 1.00 = JPY 79.87、USD 1.00 = IDR 8,570

JPY 1.00 = IDR 107.38、IDR 1.00 = JPY 0.00931

(Average of end of March 2011 to August)

Photo (1/4)

Only one wastewater treatment plant currently operated in Jakarta (Setiabudi WWTP).

The 1st JCC meeting held in December 2010.

Influent channel into the existing Setiabudi WWTP.

One of flood control gates in the Jakarta city.

On-site sludge is discharged into receiving tank at the existing sludge treatment plant.

Condition of flood in Jakarta city after heavy rain.

Photo (2/4)

Residential areas along one of the rivers in Jakarta.

Observatory survey of the factory of septic tank.

Drainage is contaminated by sewage and solid wastes in Jakarta.

Gray water flowing into drainage from septic tank.

Condition of solid wastes accumulated in the Pluit pond.

Dumping areas of solid wastes are found along rivers.

Photo (3/4)

Inside of the existing manhole.

Field survey for the existing pipe line.

Existing Duri Kosambi sludge treatment plant.

Site survey of candidate sites for new WWTP.

Site survey of candidate sites for new WWTP.

The 2nd JCC meeting held in July 2011.

Photo (4/4)

Condition of the individual treatment plant.

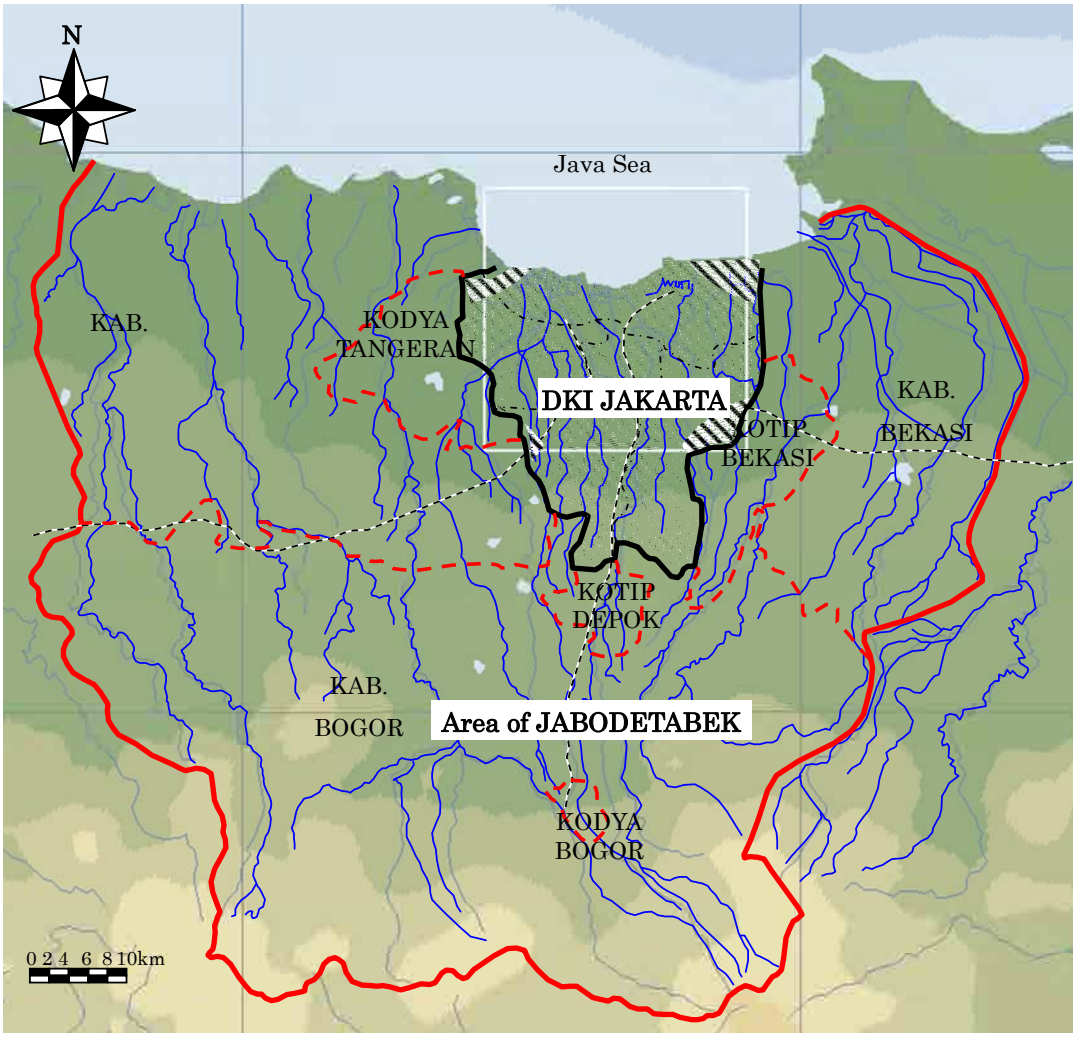
Condition of septic tank in the slum area.

Survey for septic tank of one of the residents in slum area.

Meeting for Draft Final Report explanation held in February 2012.

Seminar for the outcomes of the Project held in March 2012.

Seminar for the outcomes of the Project held in March 2012. One of C/P members is making a presentation.



Location Map of Study Area

List of Report

Main Report (English)
Main Report (Japanese)
Main Report (Indonesia)

Summary Report (English)
Summary Report (Japanese)
Summary Report (Indonesia)

Supporting Report (English)

PART-A (Not applicable: no figures and tables are included.)
PART-B DATA AND INFORMATION
PART-C FUNDAMENTAL PLANNING AND DESIGN CONSIDERATIONS
PART-D FORMULATION OF MASTER PLAN
PART-E ECONOMIC AND FINANCIAL EVALUATION
PART-F EVALUATION BY ENVIRONMENTAL SOCIAL CONSIDERATIONS
PART-G INSTITUTIONAL CONSIDERATIONS
PART-H ENVIRONMENTAL EDUCATION AND PUBLIC CAMPAIGN ACTIVITIES FOR WASTEWATER SECTOR
PART-I CAPACITY BUILDING FOR COUNTERPART ORGANIZATIONS
PART-J (Not applicable: no figures and tables are included.)
PART-K (Not applicable: no figures and tables are included.)

Japan International Cooperation Agency

Directorate General of Human Settlements, Ministry of Public Works
DKI Jakarta
PD PAL JAYA

The Project for Capacity Development of Wastewater Sector Through Reviewing the Wastewater Management Master Plan In DKI Jakarta

THE NEW MASTER PLAN

March 2012

Yachiyo Engineering Co., Ltd.
Japan Environmental Sanitation Center
Water Agency Inc.

The New Master Plan

Contents

The New Master Plan (M/P) for Improvement of Wastewater Management in DKI Jakarta

Chapter 1 Purpose, Period and Vision for the New M/P

1.1 Purpose for Formulating the New M/P

The purposes for formulating the New M/P for improvement of wastewater management in DKI Jakarta are as follows:

- Development of sewerage system could not proceed as planned and the coverage remains as low as less than 2%, although Cipta Karya of Ministry of Public Works formulated a master plan featuring drainage, sewerage and sanitation development in DKI Jakarta for the target year of 2010 through "the Study on Urban Drainage and Wastewater Disposal Project in the City of Jakarta" under JICA development study (hereinafter referred to as the "Old M/P").
- More than 90% of the domestic wastewater is currently being discharged into public bodies (rivers and sea) or underground through septic tanks without treatment. This causes the deterioration of water quality of surface water and groundwater as well.
- Due to the poor water quality of the surface water, water supply sources have to be obtained from the remote areas outside of DKI Jakarta and it leads to the high water tariff and excessive extraction of groundwater which is considered as the main cause of a large scale land settlement in the region. Moreover, the poor water quality also causes the water-borne disease in the region.
- Sewerage facilities such as wastewater treatment plants require relatively large area to construct treatment facilities. However, it is getting more difficult to find such a large land in DKI Jakarta due to the rapid economic growth in the near future. It is important to secure the lands for the sewerage facilities based on the New M/P.

1.2 Period

The New M/P proposes development plans for improvement of wastewater management in DKI Jakarta for the following development years and prioritized projects as the short-term development plan.

(Year) 2012 2020 2030 2050

Short-term Development Plan	Medium-term Development Plan	Long-term Development Plan
Prioritized Projects are proposed.	**Facility plans are proposed.**	**Facility plans are proposed.**

1.3 Vision

Vision for the New M/P is set as follows:

[Vision]

"Create sustainable water cycling society in DKI Jakarta"

Improve the current river water quality up to the level that river water can be used as water sources for water supply system in DKI Jakarta by the year 2050.

Chapter 2 Current Situation and Improvement Targets

2.1 Current Situation of Sewerage and Sanitation in DKI Jakarta

Figure S2-1 shows the current situation of treating & discharging wastewater in DKI Jakarta. Also, Figure S2-2 and 3 explain the current situation of mass balance for BOD and SS basis in the region respectively.

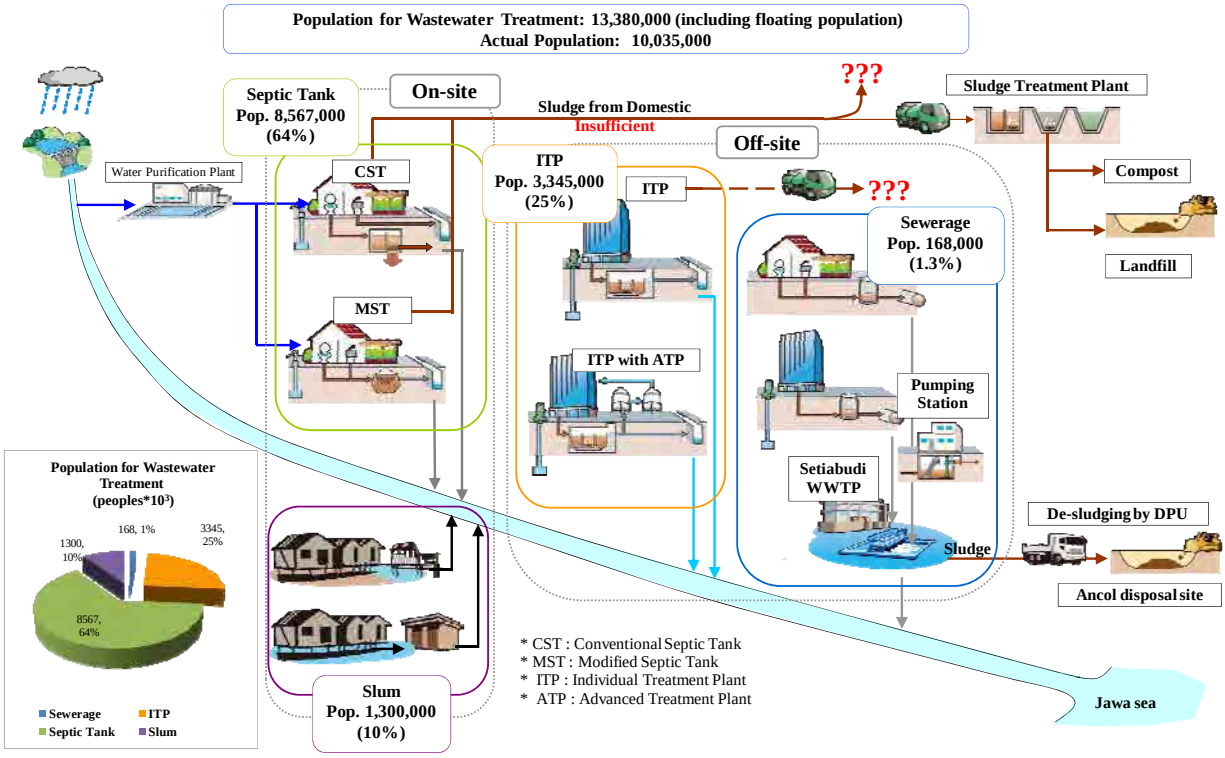
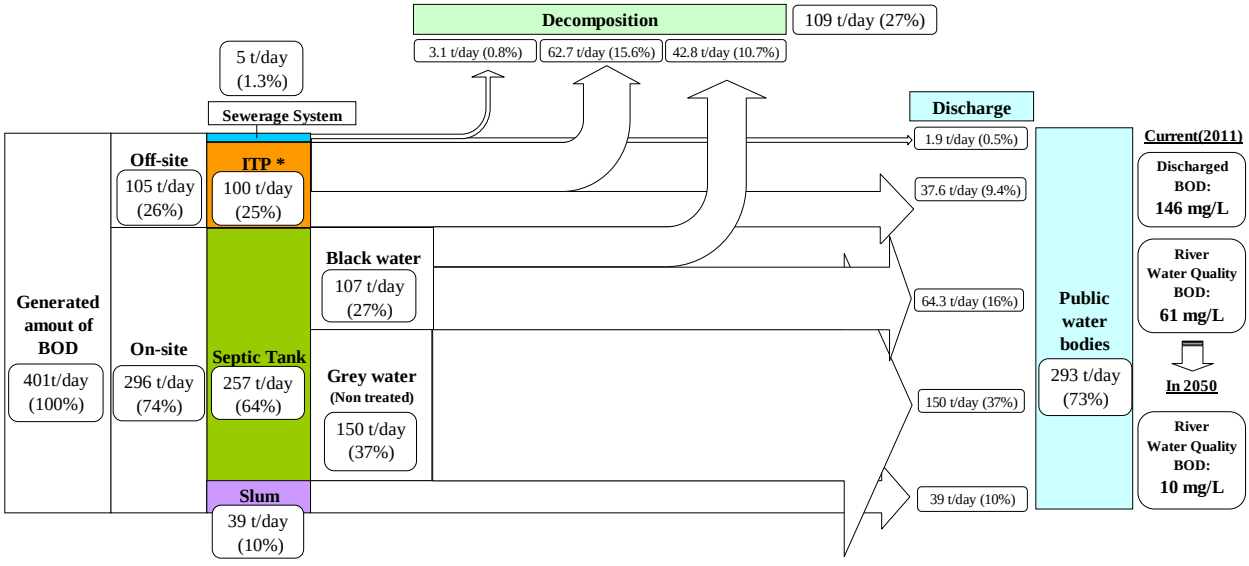


Figure S2-1 Current Situation for Wastewater Discharge in DKI Jakarta



* ITP : Individual Treatment Plant

Figure S2-2 Current Situation of Mass Balance for BOD Basis

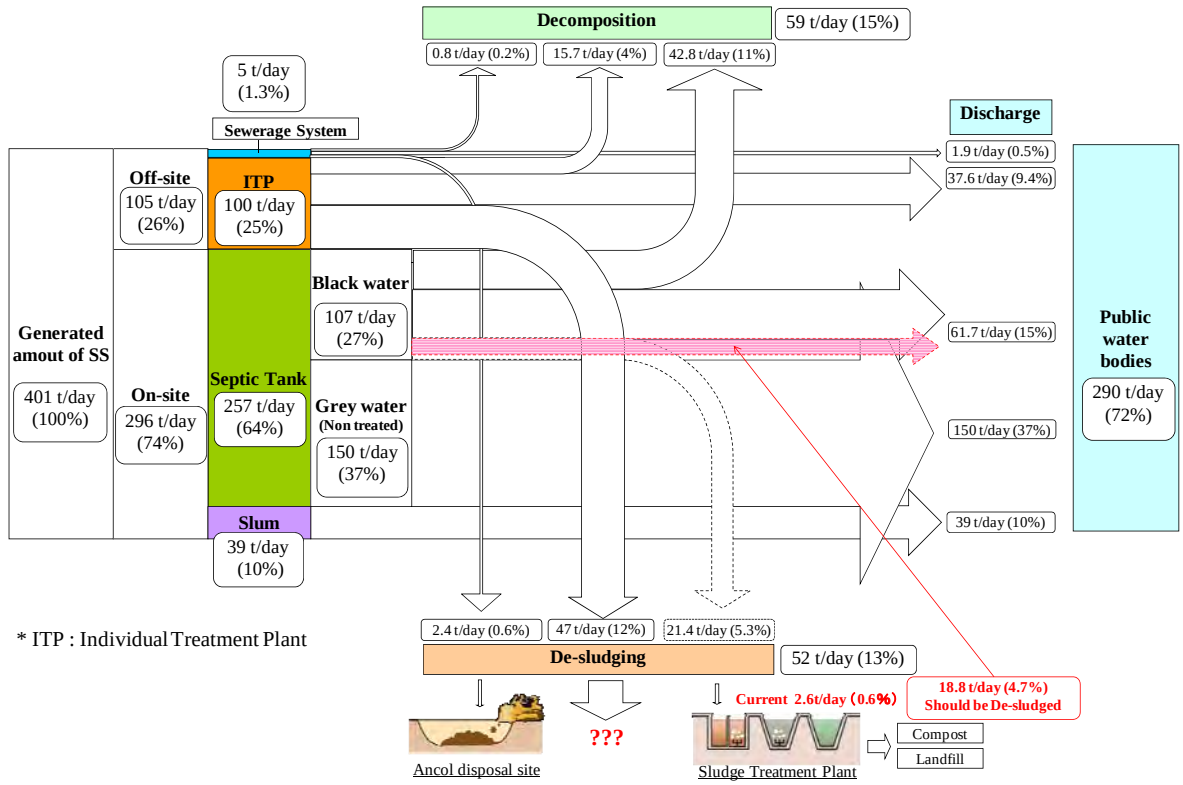


Figure S2-3 Current Situation of Mass Balance for SS Basis

More than 70% of the generated amount of BOD is being discharged to public water bodies (including groundwater). Meanwhile, more than 70% of the generated amount of SS is also discharged to public water bodies. It is clear that this situation is deteriorating river water quality in DKI Jakarta as well as worsening groundwater quality.

2.2 Improvement Targets

In order to fulfill the vision mentioned above, the following targets are proposed in the New M/P:

Table S2-1 Improvement Targets for Wastewater Management in DKI Jakarta

Item		Unit	Short-term Plan			Medium-term Plan	Long-term Plan
			Y2012	Y2014	Y2020	Y2030	Y2050
Design Population		1,000PE	12,665	12,665	12,665	12,665	12,665
Administration Population		1,000PE	10,035	10,361	11,284	12,665	12,665
Off-site	Facility Coverage Ratio	%	2	7	20	40	80
	Service Coverage Ratio	%	2	4	15	35	80
	Served Population	*1,000PE*	*168*	*387*	*1,685*	*4,478*	*10,166*
On-site	On-site Treatment Ratio	%	85	96	85	65	20
	Served Population for On-site	*1,000PE*	*8,567*	*9,974*	*9,599*	*8,188*	*2,500*
	Regular Desludging Coverage ratio	*%*	*0*	*20*	*50*	*75*	*100*
	Change CST to MST (MST/(CST+MST))	*%*	*2*	*16*	*25*	*50*	*100*
Slum areas	Open Defecation Ratio	%	13	0	0	0	0
	Open Defecation Population	*1,000PE*	*1,300*	*0*	*0*	*0*	*0*
River Water Quality (BOD)		mg/L	61	54	33	24	10

Chapter 3 Formulation of the New M/P to Achieve the Targets

3.1 Demarcation between Off-site and On-site Areas

The demarcation between off-site and on-site areas is shown below:

System	Area to be Applied
Off-site System	Applied to all the DKI Jakarta area
On-site System	Applied to the areas where off-site system development is technically difficult

3.2 Development Stages

The proposed projects in the New M/P will be implemented in the following three (3) stages:

Development Plan	Period	Remark
Short-term development plan	2012 to 2020	Implemented as the priority projects
Medium-term development plan	2021 to 2030	Population reaches to it maximum
Long-term development plan	2031 to 2050	Population will be kept to the same level

3.3 Sewerage Zones and Prioritized Project Areas for Each Target Development Year

Sewerage zones for each target development year have been determined as shown below:

Priority	Zone No.	Target Development Year
1	**1**	Short-Term Plan: Year 2012 to 2020
2	**6**	
3 to 6	**4, 5, 8 & 10**	Mid-Term Plan: Year 2021 to 2030
7 to 14	**2, 3, 7, 9, 11, 12, 13 & 14**	Long-Term Plan: Year 2031 to 2050

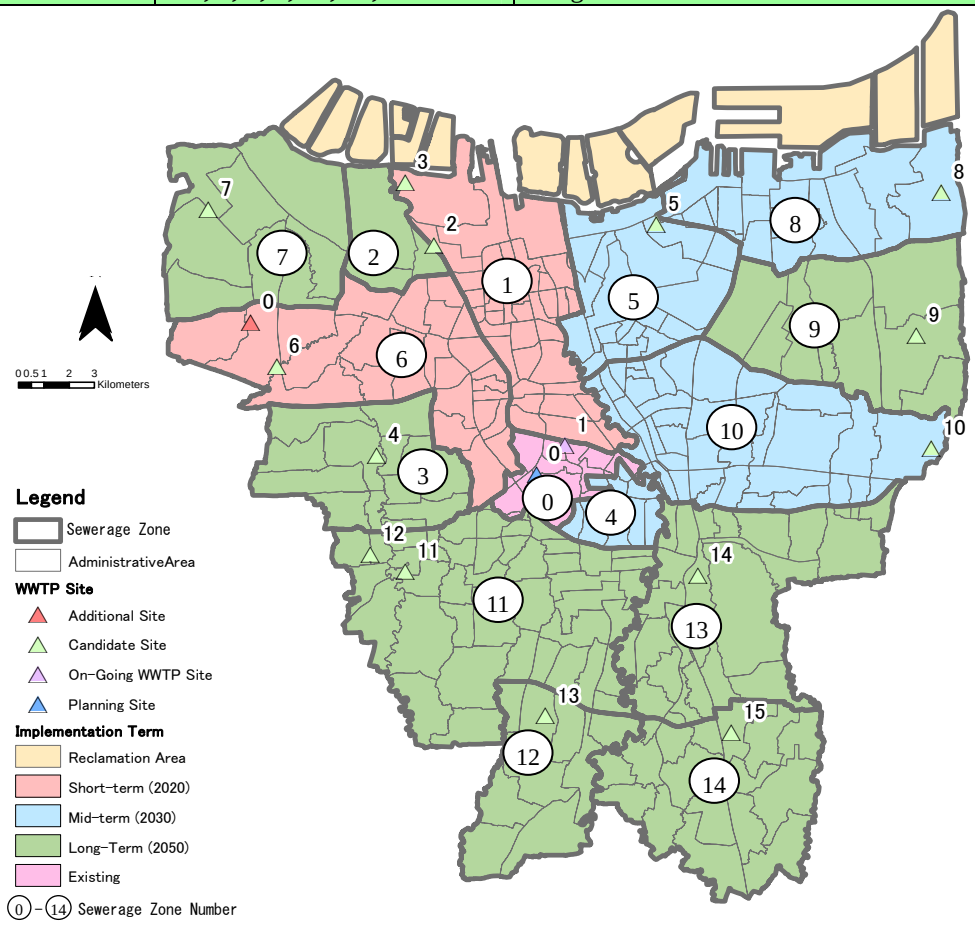


Figure S3-1 Sewerage Zones for Each Target Development Year[1]

[1] The zoning and each target development year are subject to change after the detailed examination in feasibility study (F/S).

3.4 Summary of Off-site and On-site System Development Plans

The summary of the New M/P is as shown in Table S3-1 below:

The projects for the Short-Term development plan (sewerage Zone No.1 and No.6 and sludge treatment facilities to support the introduction of regular desludging) are considered as the prioritized project. The facility plans were prepared for these prioritized projects.

Table S3-1 Summary of the New M/P

No.	Item	Unit	Short-Term (2020)	Mid-Term (2030)	Long-Term (2050)	New M/P (2050)
1	Sewerage Zone		No.1 & No.6	No.4, 5, 8 & 10	No.2, 3, 7, 9, 11, 12, 13 & 14	14 Zones
2	Project area	ha	10,775	15,301	37,328	63,404
3	Design population	PE	2,702,454	3,735,294	5,905,620	12,343,368
4	Coverage ratio (for each zone)	%	80	80	80	80
5	Coverage ratio (for whole DKI)					
	(1) Facility coverage ratio	%	20	40	80	80
	(2) Service coverage ratio	%	15	35	80	80
6	Design wastewater flow		(Unit wastewater × Design Pop. × Coverage Rate = 80%)			
	(1) Unit wastewater	LCD	Daily average: 200LCD, Daily maximum: 267LCD			
	(2) Daily average wastewater flow	m^3/day	433,000	598,000	946,000	1,977,000
	(3) Daily maximum wastewater flow	m^3/day	577,000	798,000	1,261,000	2,636,000
7	Secondary & tertiary sewer					
	(1) Diameter	mm	φ200～φ300	φ200～φ300	φ200～φ300	
	(2) Length of pipeline	km	1,486	2,043	4,741	8,271
8	Main sewer					
	(1) Diameter	mm	φ350～φ800	φ350～φ800	φ350～φ800	
	(2) Length of pipeline	km	241	471	1,203	1,915
9	Trunk sewer					
	(1) Diameter	mm	φ900～φ2,200	φ900～φ2,400	φ900～φ2,400	
	(2) Length of pipeline	km	39.5	36.4	82.0	157.9
10	Relay pumping station					
	(1) Place	unit	1	3	9	13
	(2) Lifting capacity	m^3/min	172	27～83	10～194	
11	WWTP					
	(1) Place	unit	2	3	8	13
	(2) Capacity (daily maximum wastewater)	m^3/day	264,000～313,000	62,000～331,000	32,000～337,000	2,636,000
12	Sludge Treatment Facilities (On-site sludge)					
	(1) Improvement of Existing STP	No.	1			1
	- Capacity	m^3/day	450	-450 (Integrated to WWTP)		0
	(2) New Construction of STP	No.	1			1
	- Capacity	m^3/day	600			600
	(3) STP at WWTP (capacity for on-site sludge)	m^3/day	1,720	1,920		3,640

Note:
1. Sewerage Zone No.0 (the existing sewerage zone) and the reclamation area are not included in the above table.
2. Figures in the above table are subject to change after the detailed examination in F/S.

3.5 Improvement Plan for Off-site and On-site Systems

(1) Off-site System

The design daily average wastewater flow and the design daily maximum wastewater flow of proposed WWTPs are shown in Table S3-2.

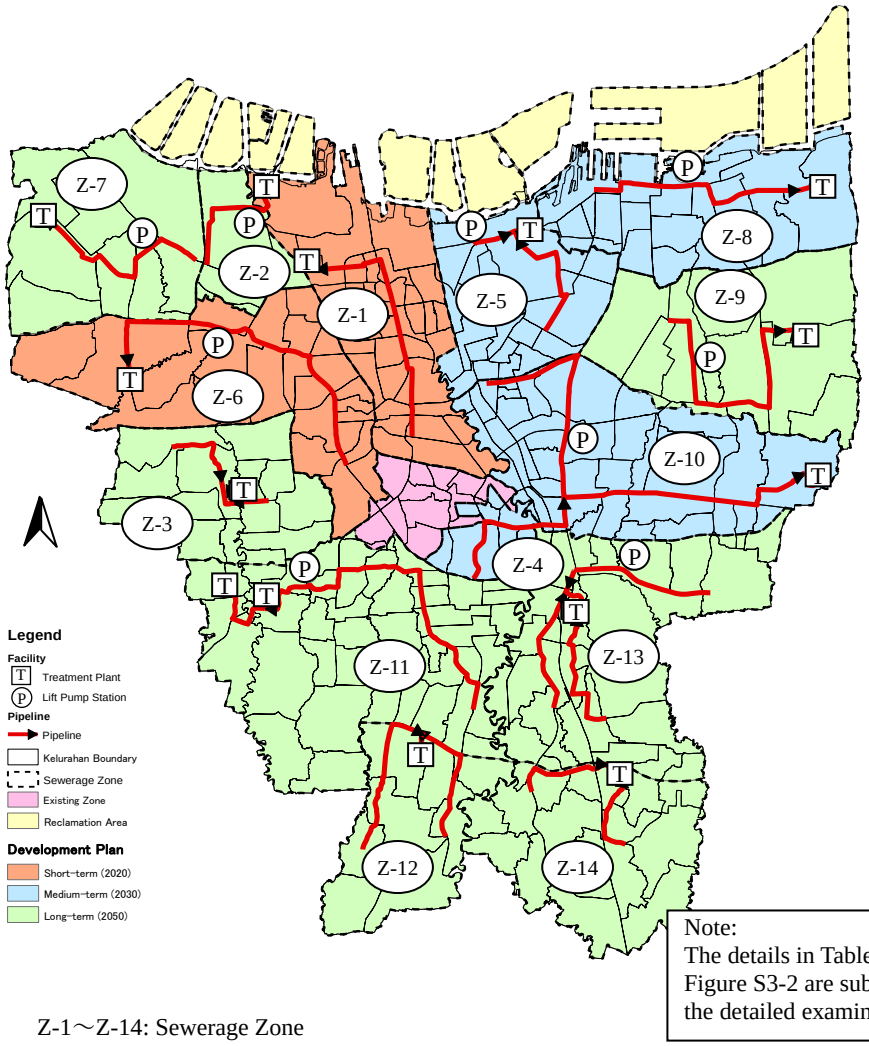
Table S3-2 Design Wastewater Flow for WWTPs in the New M/P

Development Plan	Sewerage Zone	Daily Average (m^3/day)	Daily Maximum (m^3/day)
Short-term	1	198,000	264,000
	6	235,000	313,000
Medium-term	4, 5, 8 & 10	47,000～248,000	62,000～331,000
Long-term	2, 3, 7, 9, 11, 12, 13 & 14	24,000～253,000	32,000～337,000
Total		1,977,000	2,636,000

Main sewer facilities in each sewerage zone per development plan are shown in Table S3-3 and the general layout of main sewerage facilities are shown in Figure S3-2.

Table S3-3 Main Sewer Facilities in Each Sewerage Zone per Development Plan

Sewerage Zone	Area (ha)	Lateral Pipe (no.)	Sewer Pipeline (m)					Relay Pump Station (no.)
			Secondary/ Tertiary Sewer	Main Sewer	Trunk Sewer (Jacking)	Trunk Sewer (Shield)	Total	
[Short-Term Development plan: 2012～2020]								
1 & 6	10,775	232,908	1,485,951	240,878	16,795	22,694	1,766,318	1
[Medium-Term Development plan: 2021～2030]								
4, 5, 8 & 10	15,301	326,877	2,043,273	470,962	20,942	15,442	2,550.619	3
[Long-Term Development plan: 2031～2050]								
2, 3, 7, 9, 11, 12, 13 & 14	37,328	1,324,671	4,741,416	1,203,205	63,917	18,078	6,026,616	9
Total	63,404	1,324,671	8,270,641	1,915,044	101,654	56,214	10,343,553	13



Note:
The details in Table S3-4 & S3-5 and Figure S3-2 are subject to change after the detailed examination in the F/S.

Z-1～Z-14: Sewerage Zone

Figure S3-2 Layout Plan for Main Sewerage Facilities in Each Sewerage Zone

(2) On-site System

The New M/P proposes to connect as much households as possible to the sewers by 2050, thereby reducing the harm of septic tanks. In the meantime, it proposes to minimize the harm of septic tanks until houses are connected with sewers by following measures as shown in Table S3-4.

Table S3-4 Outline of Improvement Plan for On-site System

Issues to be Solved	Measure
On-site desludging is implemented on an on-call basis only. Sludge accumulates in the tank and the effective treatment capacity decreases. This leads to deterioration of the treatment function and the leaking of sludge out of the system, which then causes environmental pollution of rivers and underground water sources.	Introduce the regular desludging system in DKI Jakarta.
Conventional septic tank treats black water (wastewater from toilet) only. Grey water (domestic wastewater from kitchen, etc., other places than toilet) is discharged without treatment and is polluting public water bodies.	Replace with modified septic tanks that treat both black water and gray water.
Individual Treatment Plant (ITP) of commercial buildings and office buildings are not appropriately operated and desludging is rare. Some ITPs do not meet the effluent standard set by DKI Jakarta (2005).	Operate ITP appropriately and perform desludging based on stronger ITP management.
Weak institutional arrangement	Improve the institutional arrangement.

[Estimated generated sludge volume is as follows: (unit: m^3/day)

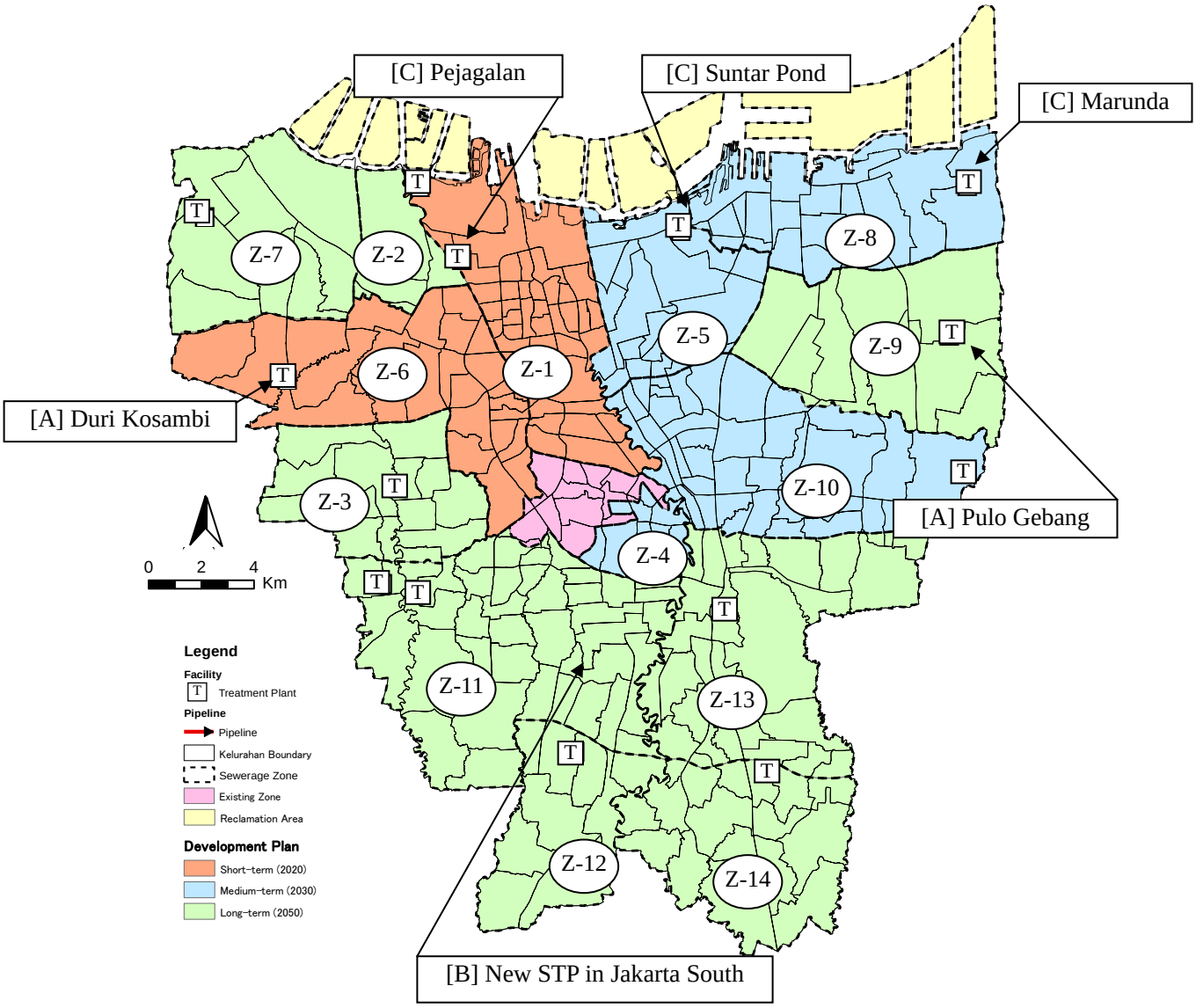
Year	2012	2014	2015	2020	2025	2030	2035	2040	2045	2050
CST	257	307	354	544	495	403	298	183	77	0
MST	0	620	679	960	1,366	1,638	1,723	1,660	1,433	1,000
ITP	0	457	530	866	1,418	1,847	1,731	1,385	808	0
Sludge(total)	257	1,385	1,564	2,370	3,279	3,887	3,752	3,229	2,317	1,000
Capacity	600	450	1,050	1,050	600	600	600	600	600	600
Co-treatment	0	934	514	1,320	2,679	3,287	3,152	2,329	1,717	400

The facility improvement plan to support the Improvement Plan for on-site system is shown in Table S3-5 and the location of each method of Improvement is shown in Figure S3-3.

Table S3-5 Outline of Facility Improvement Plan for Sludge Treatment[2]

Method for Improvement	Outline of Improvement Plan
[A] Existing sludge treatment plants (STPs)	[Short-term plan] • Integrating Duri Kosambi STP with newly constructed WWTP: Up to 950 m^3/day • Rehabilitation and expansion of Pulo Gebang STP: Up to 450m^3/day [Medium-term plan] • Integrating Pulo Gebang STP with newly constructed WWTP: Up to 940m^3/day
[B] Constructing a new sludge treatment plant (STP) in the southern area of DKI	• Capacity of new STP: 600 m^3/day
[C] Co-treatment of septic sludge at WWTPs	• Off-site WWTPs to be constructed under the short- and medium-term plans receive and treat septic sludge (sludge from on-site facilities). [Receiving WWTP] • (Zone No.1)-Pejagalan WWTP: Up to 790 m^3/day • (Zone No.5)-Suntar Pond WWTP: Up to 410 m^3/day • (Zone No.8)-Marunda WWTP: Up to 570 m^3/day

[2] The estimated volume of sludge collected from on-site system and the facility improvement plan are subject to change after the detailed examination in F/S.



Z-1～Z-14: Sewerage Zone

Figure S3-3 Layout Plan for Facilities related to Improvement of Sludge Treatment

Chapter 4 Prioritized Projects for Short-Term Development Plan

4.1 Outline of the Prioritized Projects

(1) Off-site System

Outline of the prioritized project proposed in Zone No.1 and No.6 is as shown in Table S4-1 below:

Table S4-1 Outline of Prioritized Projects for Off-site System in Zone No.1 and No.6

No.	Item	Unit	Zone No.1	Zone No.6
1. General				
1-1	Project area	ha	4,901	5,874
1-2	Design population	PE	1,236,736	1,465,718
1-3	Coverage ratio	%	80	80
1-4	Served population	PE	989,389	1,172,574
1-5	Unit wastewater flow	LCD	Daily average: 200, Daily maximum: 267	
1-6	Design wastewater flow		Unit wastewater flow × Served population	
	- Daily average	m^3/day	198,000	235,000
	- Daily maximum	m^3/day	264,000	313,000
2. Sewerage System				
2-1	Sewers			
(1)	Secondary & tertiary sewer			
	- Diameter	mm	φ200～φ300	φ200～φ300
	- Length of pipeline	km	657	829
(2)	Main sewer			
	- Diameter	mm	φ350～φ800	φ350～φ800
	- Length of pipeline	km	86	155
(3)	Trunk sewer			
	- Diameter	mm	φ900～φ2,200	φ900～φ2,400
	- Length of pipeline	km	15.5	24.0
2-2	Relay pumping station			
	(1) Place	unit	0	1
	(2) Lifting capacity	m^3/min	--	172
2-3	WWTP			
	(1) Place	unit	1	1
	(2) Capacity (daily maximum wastewater)	m^3/day	264,000	313,000

Note: Figures in the above table are subject to change after the detailed examination in F/S.

(2) On-site System

The contents for on-site system improvement to be conducted during the short-term development plan are as follows:

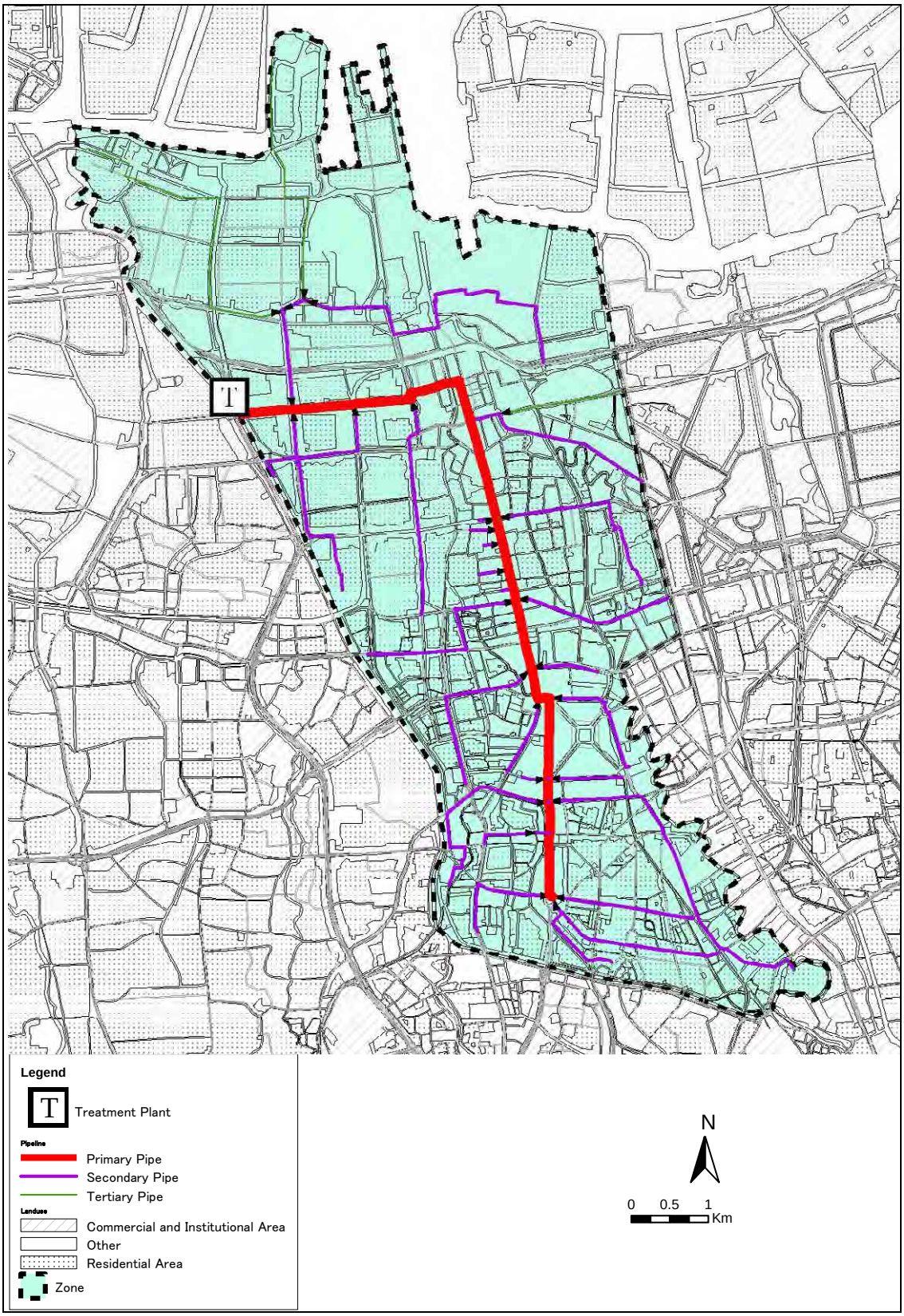
Table S4-2 Outline of On-site System Improvement as the Prioritized Project

No.	Item	Unit	Quantity
Sludge Treatment Plant (STP) – Rehabilitation & New Construction			
(1)	Integration to new WWTP	No.	1
	- Treated at new WWTP	m^3/day	930
	Improvement	No.	1
	- Capacity	m^3/day	450
(2)	New Construction	No.	1
	- Capacity	m^3/day	600
(3)	Treated at new WWTP	m^3/day	790

4.2 Facility Plan for Off-site System

(1) Sewerage Facilities in Sewerage Zone No.1

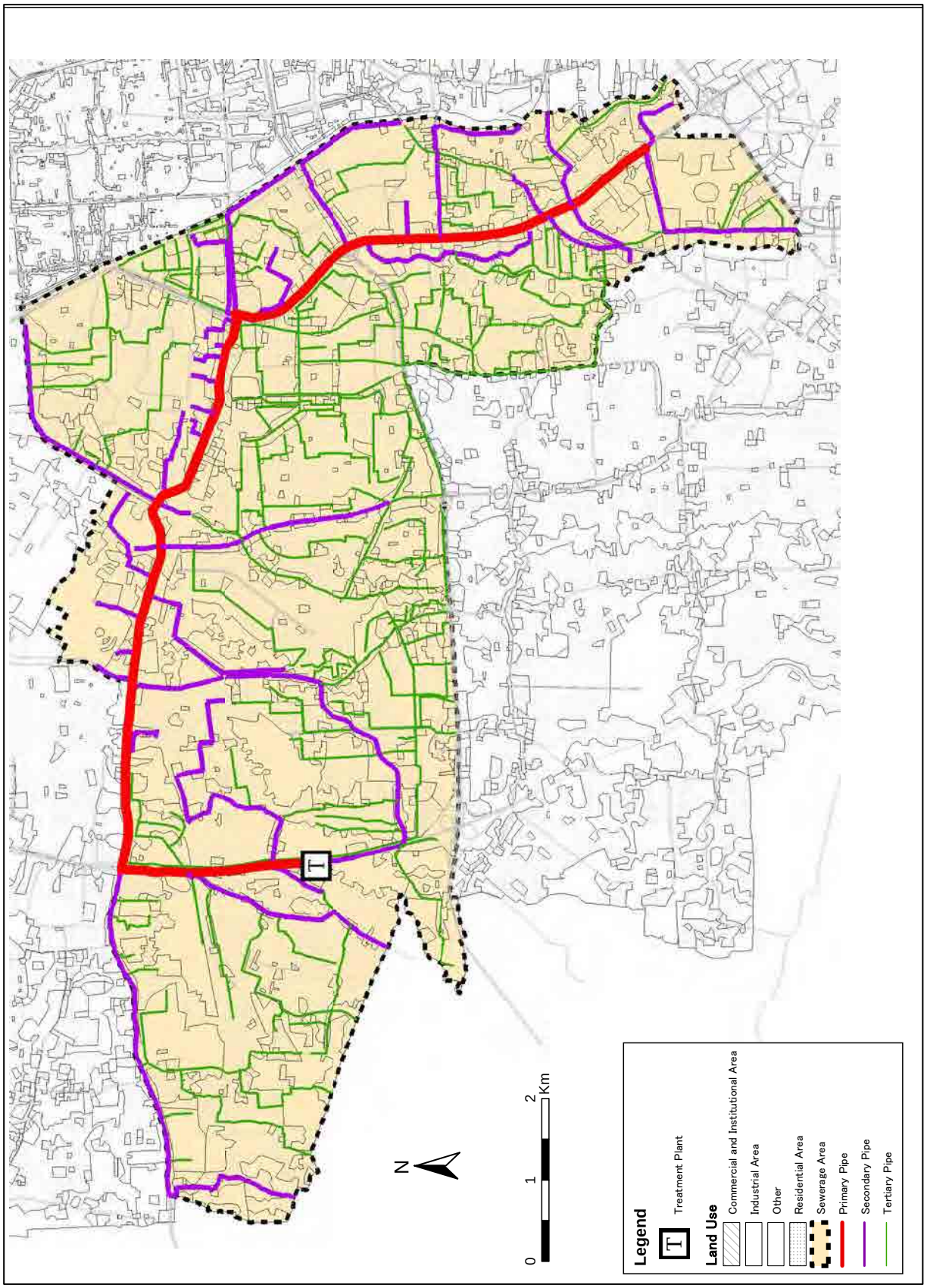
[Sewer Pipeline Route and Location of WWTP]



Note: Pipeline routes and the zone boundary are subject to change after detailed examination in F/S.

(2) Sewerage Facilities in Sewerage Zone No.6

[Sewer Pipeline Route and Location of WWTP]



Note: Pipeline routes and the zone boundary are subject to change after detailed examination in F/S.

4.3 Facility Plan for On-site System

The new STP will be located in the southern Jakarta area.

(1) Necessary size of the land: 1.5ha (0.4ha for buildings and 1.1ha for parking and green area)

(2) Criteria for selecting the land is as follows:

1) To support the efficient regular desludging operation, new STP should be located in the convenient place for the transportation of the sludge collected from any part of southern Jakarta area.

*Sludge collected from central, northern, western, eastern Jakarta will be treated at the newly built WWTPs in the short-medium term plans.

2) No flood, no land slide, close to the water body, open land with good sun shine, good geological structure and soil condition.

3) Land acquisition is easy. No environmental problem (beauty and odor aspect).

4.4 Institutional Framework

DKI's institutional framework for wastewater management should be reviewed and restructured based on the following principles.

(1) It is necessary to establish an institutional framework capable of overseeing the current and future water environment of DKI Jakarta overall, and of managing and supervising both wastewater and sludge treatment in an integrated manner.

(2) It is necessary to manage both off-site system and on-site system in an integrated manner so that the wastewater management budget is spent in the most efficient way by coordinating and modifying wastewater management planning as the system evolves.

(3) The anticipated framework must have authority and functions concerning budgets, preparation of legislation, planning, construction, operation, and preparation of regulations and guidelines that fit existing government institutions.

A1. Cost Estimation for Implementing the Projects proposed in the New M/P

A1.1 Total Cost for the Projects

Table A1-1 shows the result of the cost estimation for implementing the whole projects proposed in the New M/P including construction cost for the short-term, medium-term and long-term development plans. The project cost has been estimated in local currency and foreign currency. Direct construction cost has been estimated for the following items:

[Off-site (sewerage system)]

- ✓ House connection
- ✓ Collection sewer line (secondary & tertiary sewer, sewer main and trunk sewer)
- ✓ Lift pump station
- ✓ Wastewater treatment plant
- ✓ Facility replacement

[On-site]

- ✓ Integrating Duri Kosambi STP with newly constructed WWTP
- ✓ Rehabilitation and expansion of Pulo Gebang STP
- ✓ Integrating Pulo Gebang STP with newly constructed WWTP
- ✓ Construction of a new STP in South Jakarta
- ✓ On-site sludge treatment facilities added to newly constructed WWTPs
- ✓ Facility replacement

As indirect costs, the following items have been considered:

- ✓ Indirect construction cost
- ✓ Engineering cost
- ✓ Physical contingency
- ✓ Land use cost (However, he land use cost is not accounted with assuming the sites of facilities are owned by public.)

The cost for capacity development of the Indonesian side organizations is considered to be included in the engineering cost.

Table A1-1 Total Construction Cost for Off-site and On-site System Development

Unit: Million IDR

development contents			Construction cost			Remarks
			Initial construction cost	Facilities replacement cost (2013-2050)	Total	
A. Short-term plan						
(1)	Zone No.1	Development of sewerage system	5,192,315	1,079,250	6,271,565	
		On-site sludge treatment facilities	131,904	68,590	200,494	Co-treatment of On-site sludge
		Sub-total	5,324,219	1,147,840	6,472,059	
(2)	Zone No.6	Development of sewerage system	7,110,408	1,357,898	8,468,307	
		Integration Duri Kosambi STP with newly constructed WWTP	155,279	80,745	236,025	Co-treatment of On-site sludge
		Sub-total	7,265,688	1,438,644	8,704,331	
(3)	Rehabilitation and expansion of Pulo Gebang STP		24,390	0	24,390	
(4)	Construction of a new STP in south area		42,100	20,275	62,375	
		Total of Short-term plan	12,656,397	2,606,758	15,263,155	
B. Medium-term plan						
(1)	Zone No.4	Development of sewerage network	636,325	0	636,325	
(2)	Zone No.5	Development of sewerage system	3,586,678	570,552	4,157,230	
		On-site sludge treatment facilities	68,457	28,752	97,208	Co-treatment of On-site sludge
		Sub-total	3,655,134	599,304	4,254,438	
(3)	Zone No.8	Development of sewerage system	4,856,836	794,711	5,651,547	
		On-site sludge treatment facilities	95,171	39,972	135,143	Co-treatment of On-site sludge
		Sub-total	4,952,008	834,683	5,786,691	
(4)	Zone No.10	Development of sewerage system	7,639,771	1,322,893	8,962,664	
		Integration Pulo Gebang STP with newly constructed WWTP	156,949	65,919	222,868	
		Sub-total	7,796,720	1,388,812	9,185,531	
		Total of Medium-term plan	17,040,187	2,822,798	19,862,985	
C. long-term plan						
(1)	Zone No.2	Development of sewerage system	1,158,206	0	1,158,206	
(2)	Zone No.3	Development of sewerage system	3,701,406	24,508	3,725,914	
(3)	Zone No.7	Development of sewerage system	3,967,381	23,963	3,991,345	
(4)	Zone No.9	Development of sewerage system	4,333,679	18,550	4,352,229	
(5)	Zone No.11	Development of sewerage system	8,643,992	56,387	8,700,380	
(6)	Zone No.12	Development of sewerage system	3,253,732	0	3,253,732	
(7)	Zone No.13	Development of sewerage system	5,624,321	0	5,624,321	
(8)	Zone No.14	Development of sewerage system	3,674,569	21,449	3,696,018	
		Total of Long-term plan	34,357,286	144,858	34,502,144	
		Grand total	64,053,869	5,574,415	69,628,284	

A1.2 Capital Investment Considerations

From 2013 when construction is expected to start for short, medium and long-term sewerage development projects and on-site sludge treatment plants development projects, the approximate total construction cost that must be capital-invested and financed by 2050, which is the long-term development year, is as given in Table A1-2 and Table A1-3.

Table A1-2 Total Capital Investment Cost required for Short, Medium and Long-term Sewerage Development Projects

<Initial Construction Cost>

Unit : Million IDR

Items			Cost		
			Local currency	Foreign currency	Total
A. Construction Cost			41,185,186	10,631,889	51,817,074
	a. Direct Construction Cost		36,447,067	9,408,751	45,855,818
	(1)House Connection Cost		4,694,090	0	4,694,090
	(2)Collection Sewer Line	Tertiary and Secondary	10,144,598	0	10,144,598
		Main	9,990,725	0	9,990,725
		Trunk	1,273,268	1,273,268	2,546,535
		Conveyance	603,690	2,414,758	3,018,448
		Sub-total	22,012,280	3,688,026	25,700,306
	(3)Lift Pump Station	Civil/Architect Works	233,930	0	233,930
		Mecanical Facility	37,429	149,714	187,143
		Electrical Facility	23,391	23,391	46,781
		Sub-total	294,749	173,105	467,854
	(4)Wastewater Treatmment Plant	Civil/Architect Works	7,496,784	0	7,496,784
		Mecanical Facility	1,199,485	4,797,942	5,997,427
		Electrical Facility	749,678	749,678	1,499,357
		Sub-total	9,445,948	5,547,620	14,993,568
	b. Indirect Construction Cost	13% of Direct Construction Cost	4,738,119	1,223,138	5,961,256
B. Engineering Cost		7% of Direct Construction Cost	2,551,295	658,613	3,209,907
C. Physical Contingency		5% of the sum of Direct Construction Cost and Indirect Construction Cost	2,059,259	531,594	2,590,854
D. Land Use Cost			0	0	0
Total			**45,795,740**	**11,822,096**	**57,617,835**
E. Value Added Tax		10%	4,579,574	1,182,210	5,761,784
Grand Total			**50,375,314**	**13,004,305**	**63,379,619**

<Facility Re placement (2013-2050)>

Unit : Million IDR

Items			Cost		
			Local currency	Foreign currency	Total
A. Construction Cost			1,192,197	3,116,512	4,308,710
	a. Facilities Replacement Cost (Direct Construction Cost) (from 2013 to 2050)	Mecanical Facility	567,645	2,270,578	2,838,223
		Electrical Facility	487,397	487,397	974,795
		Sub-total	1,055,042	2,757,976	3,813,018
	b. Indirect Construction Cost	13% of Direct Construction Cost	137,155	358,537	495,692
B. Engineering Cost		7% of Direct Construction Cost	73,853	193,058	266,911
C. Physical Contingency		5% of the sum of Direct Construction Cost and Indirect Construction Cost	59,610	155,826	215,435
Total			**1,325,660**	**3,465,396**	**4,791,057**
D. Value Added Tax		10%	132,566	346,540	479,106
Grand Total			**1,458,226**	**3,811,936**	**5,270,162**

Table A1-3 Total Capital Investment Cost Required for Short, Medium and Long-term On-site Sludge Treatment Plants Development Projects

<Initial Construction Cost>

Unit : Million IDR

Items			Cost		
			Local currency	Foreign currency	Total
A. Construction Cost			343,172	208,073	551,245
	a. Direct Construction Cost		303,692	184,135	487,827
	(1) Civil and Building works		242,393	0	242,393
	(2) Mechanical facilities		16,812	184,135	200,948
	(3) Electrical facilities		44,486	0	44,486
	b. Indirect Construction Cost	13% of Direct Construction Cost	39,480	23,938	63,418
B. Engineering Cost		7% of Direct Construction Cost	21,258	12,889	34,148
C. Physical Contingency		5% of the sum of Direct Construction Cost and Indirect Construction Cost	17,159	10,404	27,562
D. Land Use Cost			0	0	0
Total			**381,589**	**231,366**	**612,955**
F. Value Added Tax		10%	38,159	23,137	61,295
Grand Total			**419,748**	**254,503**	**674,250**

<Facility Re placement (2013-2050)>

Unit : Million IDR

Items			Cost		
			Local currency	Foreign currency	Total
A. Construction Cost			71,018	177,728	248,747
	a. Facilities Replacement Cost (from 2013 to 2050)	Mecanical Facility	14,360	157,282	171,642
		Electrical Facility	48,488	0	48,488
		Sub-total	62,848	157,282	220,130
	b. Indirect Construction Cost	13% of Direct Construction Cost	8,170	20,447	28,617
B. Engineering Cost		7% of Direct Construction Cost	4,399	11,010	15,409
C. Physical Contingency		5% of the sum of Direct Construction Cost and Indirect Construction Cost	3,551	8,886	12,437
Total			**78,969**	**197,624**	**276,593**
D. Value Added Tax		10%	7,897	19,762	27,659
Grand Total			**86,865**	**217,387**	**304,252**

A2. Economic and Financial Evaluation

A2.1 Economic Evaluation

Whether the projects of the M/P are optimal distribution of resources from the standpoint of the national economy or not is verified by calculation of Net Present Value (NPV), Benefit/Cost Ratio (B/C Ratio) and Economic Internal Rate of Return (EIRR).

The targets of economic analysis are sewerage (off-site) plans and on-site plans of short-term plan (2012 - 2020) and medium-term plan (2021 - 2030).

Concretely, as for off-site, projects of zones No.1 & No.6 (short-term) and No.4, No.5, No.8 & No.10 (medium-term) are set as target of the analysis. As for on-site, development of new on-site sludge treatment plant in South area, rehabilitation and expansion of existing STP, and integration with newly constructed WWTPs, and co-treatment for on-site sludge at off-site WWTPs are set as the targets.

As a result of economic analysis, NPV, B/C and EIRR were as given in Table A2-1.

Table A2-1 Results of Economic Analysis

Cost/benefit ratio (B/C ratio)	1.07
*Net Present Value (NPV)	1,234,803 Million IDR
Economic Internal Rate of Return (EIRR)	13.9 %

*Discount rate of project = 12%

From the above table, B/C ratio exceeds 1.0 and NPV exceeds zero. Also, since EIRR was 13.9%, which excess 12% established as capital opportunity cost that indicates limited profitability related to capital for public construction, the project is considered economically feasible.

(1) Financial Evaluation

Financial analysis was conducted to evaluate whether or not the project established by the New M/P is financially feasible. The results of financial analysis are evaluated by calculating Net Present Value (NPV), Benefit/Cost Ratio (B/C Ratio) and Financial Internal Rate of Return (FIRR).

Sewerage projects (off-site) are targets of financial analysis.

Zones No.1 and No.6, which are priority projects of the New M/P, are targets of financial analysis. The analysis is conducted to evaluate whether the projects are financially feasible for repayment of 35% of the construction cost, assuming 35% of the construction cost is procured by loan, and the rest 65% is no need to be repaid because it depends on subsidies. Table A2-2 shows the results of financial analysis.

Table A2-2 Results of Financial Analysis (Summary)

Evaluation Items	Unit	Zone No.1		Zone No.6		Zone No.1 and Zone No.6		Evaluation Criteria
		Case1	Case2	Case1	Case2	Case1	Case2	
B/C Ratio	-	0.71	1.83	0.40	1.03	0.54	1.38	B/C Ratio>1
	Evaluation	N.F.F.	F.F.	N.F.F.	F.F.	N.F.F.	F.F.	
NPV	Mill. IDR	-1,397,280	4,028,732	-3,677,844	175,741	-5,075,124	4,204,473	NPV>0
	Evaluation	N.F.F.	F.F.	N.F.F.	F.F.	N.F.F.	F.F.	
FIRR	%	No solution	9.66%	No solution	1.57%	No solution	5.79%	FIRR>r
	Evaluation	N.F.F.	F.F.	N.F.F.	F.F.	N.F.F.	F.F.	r=1.15%
Financial Evaluation		**N.F.F.**	**F.F.**	**N.F.F.**	**F.F.**	**N.F.F.**	**F.F.**	

Note: F.F. = Financially Feasible, N.F.F. = Not Financially Feasible

The results of financial analysis show that all projects of zone No.1 and zone No.6 require gradual increase of sewerage tariff, and that sewerage system project profitability can be secured by raising the tariff by 30% every 3 years from 2016, and eventually raising up approximately to 3 times level of the current level in stages through the 4 times revisions by 2025 (case 2).

In addition, the results of analysis for both Zone No.1 and Zone No.6 as a single business were as given in the table. The results show that FIRR can be secured 5.79% if sewerage charge is increased.

The Project for Capacity Development of Wastewater Sector
Through
Reviewing the Wastewater Management Master Plan in DKI Jakarta

FINAL REPORT
SUMMARY REPORT

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Abbreviations

ADB	Asia Development Bank
AMDAL	Environmental Impact Assessment (*Analisis Mengenai Dampak Lingkungan*)
ANDAL	Environmental Impact Analysis Report (*Analisis Dampak Lingkungan*)
APBD	Regional Income and Expenditure Budget (*Anggaran Pendapatan dan Belanja Daerah*)
APBN	Indonesian National Income and Expenditure Budget (*Anggaran Pendapatan dan Belanja Negara*)
ASP	Activated Sludge Process
ASRT	Aerobic Solids Retention Time
ATP	Affordability To Pay
BAPPEDA	Regional Planning and Development Board (*Badan Perencanaan Pembangunan Daerah*)
BAPPENAS	National Planning and Development Board (*Badan Perencanaan Pembangunan Nasional*)
BBWS CC	Central Hall of River Management of Ciliwung – Cisadane (*Balai Besar Wilayah Sungai Ciliwung – Cisadane*)
BOD	Biochemical Oxygen Demand
BPLHD	Regional Environment Management Board (*Badan Pengelolaan Lingkungan Hidup*)
BPS	Central Bureau of Statistic (*Badan Pusat Statistik*)
B/C	Benefit/Cost
CA	Capacity Assessment
CAD	Computer Aided Design
CBS	Community-Based Sanitation approach
CD	Capacity Development
CFU	Colony Forming Unit
COD	Chemical Oxygen Demand
C/P	Counterpart
CSS	City Sanitation Strategy
DB	Data Base
DESD	Directorate of Environmental Sanitation Development
DF/R	Draft Final Report
DGHS	Directorate General of Human Settlements, Ministry of Public Works (*Direktorat Jenderal Cipta Karya*)
DGSP	Directorate General of Spatial Planning, Ministry of Public Works
DHS	Down-flow Hanging Sponge
DK	Cleansing Agency (*Dinas Kebersihan*)
DKI	Special State Capital of Jakarta (*Daerah Khusus Ibukota Jakarta*)
DPU	Public Works Agency
DP2B	Building Supervision and Control Agency (*Dinas Penertiban dan Pengawasan Bangunan*)
DTR	Spatial Planning Agency (*Dinas Tata Ruang*)
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
FPU	Final Polishing Pond
F/R	Final Report
F/S	Feasibility Study
GDP	Gross Domestic Product
GIS	Geographical Information System
HWL	High Water Level
HRT	Hydraulic Retention Time
IC/R	Inception Report
IEE	Initial Environmental Examination
IMB	Building Construction Permit
ISSDP	Indonesia Sanitation Sector Development Program
ITP	Individual Treatment Plant
IT/R	Interim Report

IWK	Indah Water Konsortium Sdn Bhd
JBIC	Japan Bank for International Cooperation
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
JSSP	Jakarta Sewerage and Sanitation Project
JWDP	Jakarta Wastewater Development Plan
KA-ANDAL	Executive Summary of the Project (Terms of Reference of ANDAL) (*Kerangka Acuan Analisis Dampak Lingkungan Hidip*)
KMB	Feasibility of Building Utilization Permit (*Kelayakan Menggunakan Bangunan*)
LWL	Low Water Level
MBBR	Moving Bed Bio-film Reactor
MBR	Membrane Biological Reactor
MCK	Communal Place for Bathing, Washing and Toilet (*Mandi, Cuci, Kakus*)
MLSS	Mixed Liquor Suspended Solids
M/M	Minutes of Meetings
M/P	Master Plan
MPW	Ministry of Public Works
MRT	Mass Rapid Transit
NPV	Net Present Value
OJT	On-the-job Training
O&M	Operation and Maintenance
PDAM	Local Water Supply Enterprise (*Perusahaan Daerah Air Minum*)
PDM	Project Design Matrix
PD PAL JAYA	Regional Company of Wastewater Management of DKI Jakarta (*Perusahaan Daerah Pengelolaan Air Limbah Jakarta Raya*)
PI	Performance Indicator
PJ	Project
PO	Plan of Operation
PPMK	Community of Kelurahan Empowerment Program
PPP	Public-Private-Partnership
PPSP	Acceleration of Urban Sanitation Development Program (*Program Percepatan Pembangunan Sanitasi Permukiman*)
RBC	Rotating Biological Contactor
R/D	Record of Discussions
RDTR	Detailed Spatial Plan
RKL	Environmental Management Planning Document (*Rencana Pengelolaan Lingkungan*)
RPL	Environmental Monitoring Planning Document (*Rencana Pemantauan Lingkungan*)
RT	Smallest Community Group (*Rukun Tetangga*)
RTRW	Provincial Spatial Plan
RTRWN	National Spatial Plan
RTRW Kabupaten	Regency Spatial Plan
RTRW Kota	Municipal Spatial Plan
RW	Community Group (*Rukun Warga*)
SANIMAS	Community Based On-site System (*Sanitasi untuk Masyarakat*)
SER	Shadow Exchange Rate
SBR	Sequencing Batch Reactor
SIDA	Swedish Agency for International Development
SIPPT	Permit of Land Use and Designation
SLF	Certificate for Sustainability of Functions
SOP	Standard Operating Procedure
SP3L	Principle Approval Letter of Land Acquisition (*Surat Persetujuan Pembebasan & Penguasaan Lahan)*
SPPL	Statement Letter of Environmental Management (*Surat Pernyataan Pengelolaan Lingkungan*)
SRT	Solid Retention Time
SSA	Sewerage Services Act in Malaysia

SV	Sludge Volume
TTPS	National Sanitation Technical Team (*Tim Teknis Pembangunan Sanitasi*)
UASB	Up-flow Anaerobic Sludge Blanket
UKL	Environmental Management Plan (*Upaya Pengelolaan Lingkungan*)
UPL	Environmental Monitoring Plan (*Upaya Pemantauan Lingkungan*)
USDP	Urban Sanitation Development Program
UV/VIS	Ultra-Violet/Visible Sepctrophotometry
WOPs	Water Operators Partnership
WSIA	Water Services Industry Act
WSP	Water and Sanitation Program
WTP	Willingness To Pay
WWTP	Wastewater Treatment Plant

Units

℃	Degree Celsius
ha	Hectare
IDR	Indonesian Rupiah
km	Kilometer
L	Liter
L/min	Liter per minute
L/sec	Liter per second
m	Meter
mg/L	Milligram per liter
min	Minute
mm	Millimeter
m^2	Square meter
m^3	Cubic meter
m^3/d	Cubic meter per day
m^3/sec	Cubic meter per second
No(s).	Number(s)
NTU	Nephelometric Turbidity Units
ohm m	Ohm meter
%	Percent
USD	U.S. (United States) Dollar

ANNEX

PART-A INTRODUCTION

PART-A INTRODUCTION

A1 Objectives of the Project

A1.1 Introduction of the Project

The Project has two (2) outputs. JICA short term expert team (hereinafter referred to as "JICA Expert Team") deals with Output-2 (formulation of the New M/P). Output 1 will be produced by the JICA long-term expert (Team Leader/Sewerage Policy Adviser).

The overall goal, project purpose, output and objectively verifiable indicators to evaluate the achievement are shown in Table SMR-A1-1 "the Project Design Matrix (PDM) of the Project". The activities of Phase-1 (Plan of Operation: RO) and the progress to achieve the above are shown in Table SMR-A1-2.

Table SMR-A1-1 Project Design Matrix (PDM) of the Project

Narrative Summary	Objectively Verifiable Indicator
[Overall Goal] 1. Proper policy, system and plan in wastewater sector are established. 2. DKI Jakarta has enough capacity to improve wastewater sector conditions.	 1-1 Domestic Wastewater Law is enacted. 1-2 Regulations and standards related to Domestic Wastewater Law are enacted. 2-1 Finance is prepared. 2-2 Revised wastewater management master plan is implemented.
[Project Purpose] Capacity of Ministry of Public Works and DKI Jakarta in formulation of wastewater sector policies and wastewater management plans is enhanced.	 1-1 Draft Domestic Wastewater Law is submitted to the parliament. 1-2 Draft Regulations and standards related to Domestic Wastewater Law are submitted to MPW. 2. An action plan of the implementation of the revised Wastewater Management Master Plan in DKI Jakarta is developed (with information on timeframe, target, organization/section in charge, sources of the budget for each work item).
[Output] 1. Domestic Wastewater Law and its regulations are prepared. 2. The wastewater management master plan in DKI Jakarta is revised.	 1-1 Draft Domestic Wastewater Law is developed. 1-2 Regulations and standards related to Domestic Wastewater Law are developed. 2-1 Revised wastewater management master plan is approved in DKI Jakarta.

Note: Domestic Wastewater Law is now changed to Sanitation Law
Source: Excerpt from Record of Discussions signed on 17th June 2010

A1.2 Necessity for Development of Wastewater Law and the related Regulations as Output-1

One of the reasons for lagging behind in the sewerage development is a nonexistence of wastewater law. DGHS has already prepared a draft of Domestic Wastewater Law according to the Strategic Plan for the Ministry of Public Works 2010-2014 and is now conducting activities to finalize the draft by the assistance of JICA long-term expert under Output-1 of the Project.

The schedule of formulating wastewater law and the related regulations in Output-1 of the Project is as follows:

Table SMR-A1-2 Schedule of Formulating Sanitation Law and the Related Regulations as Output-1

Item for Development	Implementation Schedule
◆ Selection of the related regulations ◆ Preparation of water quality standard for wastewater discharge to sewerage ◆ Development of guidelines for master plan preparation ◆ Preparation of off-site facility standard	November 2011 to June 2012

A1.3 Process to Achieve Output-2

According to the Indonesian side, the reason for the Old M/P in 1991 having not been implemented is that it had not been approved by DKI Jakarta. Therefore, it is indispensable that the New M/P should be approved by DKI Jakarta. The process for getting approval of DKI Jakarta is expected as follows:

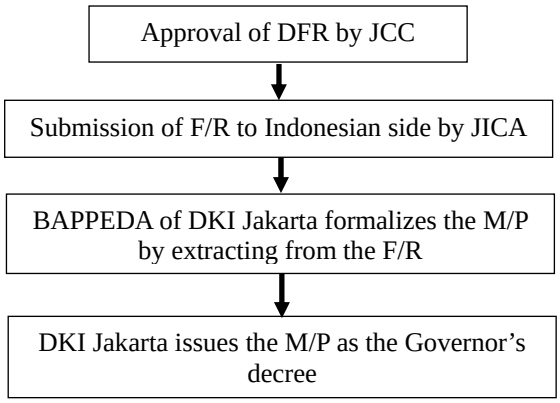


Figure SMR-A1-1 Expected Approval Process by DKI for the New Master Plan

JICA expert team has formulated the New M/P in close consultations with the working group of DKI Jakarta consisting of the representative of the related divisions and departments of DKI Jakarta including BAPPEDA. The New M/P includes a number of proposals requiring decision making by the top management level of DKI Jakarta for realization such as securing the sites of WWTP, reorganization of wastewater and sludge management, establishment of regular desludging system of septic sludge, etc. Therefore, it is expected that DKI Jakarta should promote implementation of these proposals based on the New M/P.

A2 Project Area

The Project Area shall be DKI Jakarta administration area shown in Figure SMR-A2-1.

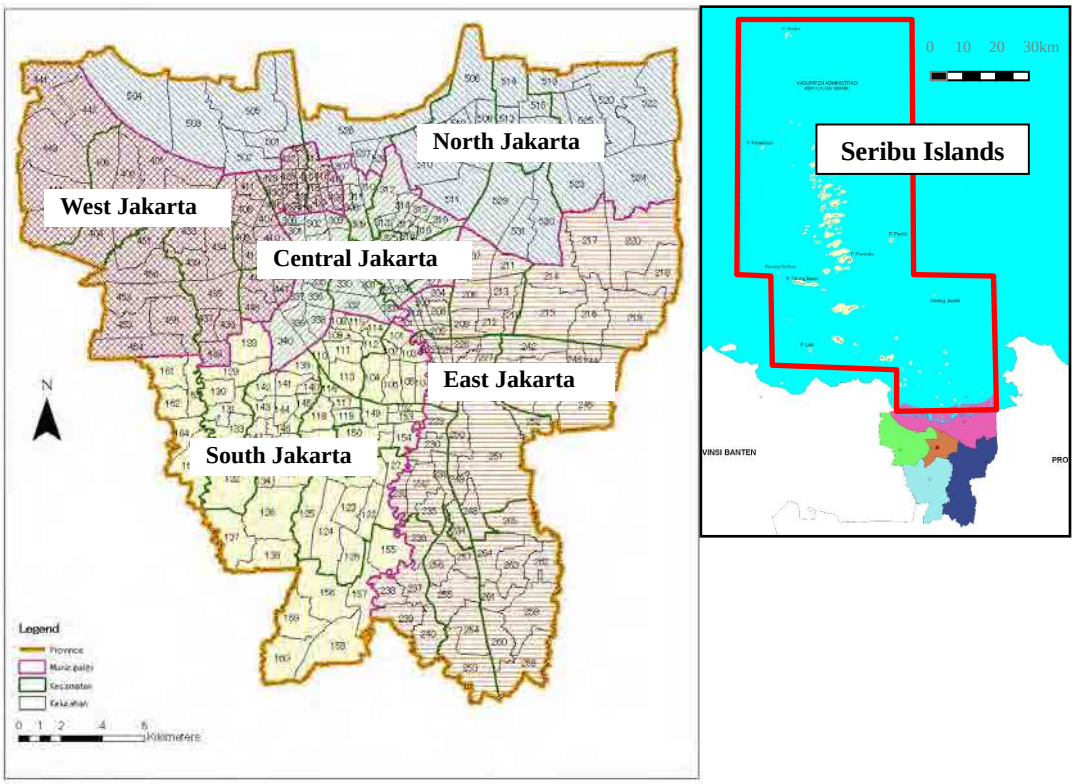


Figure SMR-A2-1 Administrative Boundaries of DKI Jakarta

DKI Jakarta comprises of five (5) municipalities (Wilayah), 1 regency (Kabupaten), 44 districts (Kecamatan) and 267 sub-districts (Kelurahan) as shown in Table SMR-A2-1. The population and the density in 2010 are also shown in this table

Table SMR-A2-1 Population and Density of DKI Jakarta (2010)

No.	Municipalities	District	Sub-district	Population (PE)	Area (ha)	Density (person/ha)
1	North Jakarta	6	31	1,554,003	13,903	112
2	West Jakarta	8	56	2,345,524	12.525	187
3	Central Jakarta	8	44	952.635	4.714	202
4	South Jakarta	10	65	2,280,406	14.573	156
5	East Jakarta	10	65	2,585,628	18.990	136
	5 Municipalities Total	**42**	**261**	**9,718,196**	**64,705**	**150**
6	Seribu Islands	2	6	20,684	870	24
DKI Total		44	267	9,738,880	65.575	149

Also, there exist 2,657 RWs (Rukun Warga) and 29,769 RTs (Rukun Tetangga) which mean a neighboring community.

A3 Target Year and Staged Development Plans for the Project

The target year of the New M/P for the Project is the year 2030. The New M/P for sewerage and sanitation development shall be formulated for three (3) stages as follows:

Table SMR-A3-1 Development Stages for the New M/P

Development Plan	Period	Remark
Short-term development plan	2012 to 2020	Implemented as the priority projects
Medium-term development plan	2021 to 2030	Population reaches to it maximum
Long-term development plan	2031 to 2050	Population will be kept to the same level

Meanwhile, an action plan for the prioritized projects in the New M/P shall be prepared only for the Short-term Development Plan.

PART-B DATA AND INFORMATION

PART-B DATA AND INFORMATION

B1 Current Situation of Wastewater Treatment in DKI Jakarta

Types of methods for treating or discharging wastewater in DKI Jakarta are categorized into the following four (4) types:

1. Sewerage system (off-site)
2. Individual treatment plant (off-site)
3. Septic tank - conventional or modified types (on-site)
4. Open defecation

Proportion of population and wastewater volume for the above types are shown in Table SMR-B1-1.

Table SMR-B1-1 Population and Wastewater Volume for Types of Treating & Discharging Wastewater

No.	Type	Population incl. Floating Pop. (PE)	Unit Wastewater (LCD)	Wastewater (Daily Average) (m^3/day)
1	Sewerage System (off-site)	168,000	150	252,000
2	Individual Treatment Plant (off-site)	3,345,000	150	5,017,500
3	Septic Tank (on-site)	8,567,000	150	12,850,500
4	Open Defecation	1,300,000	150	1,950,000
	Total	13,380,000		20,070,000

Figure SMR-B1-1 shows the current situation for treating or discharging wastewater in DKI Jakarta.

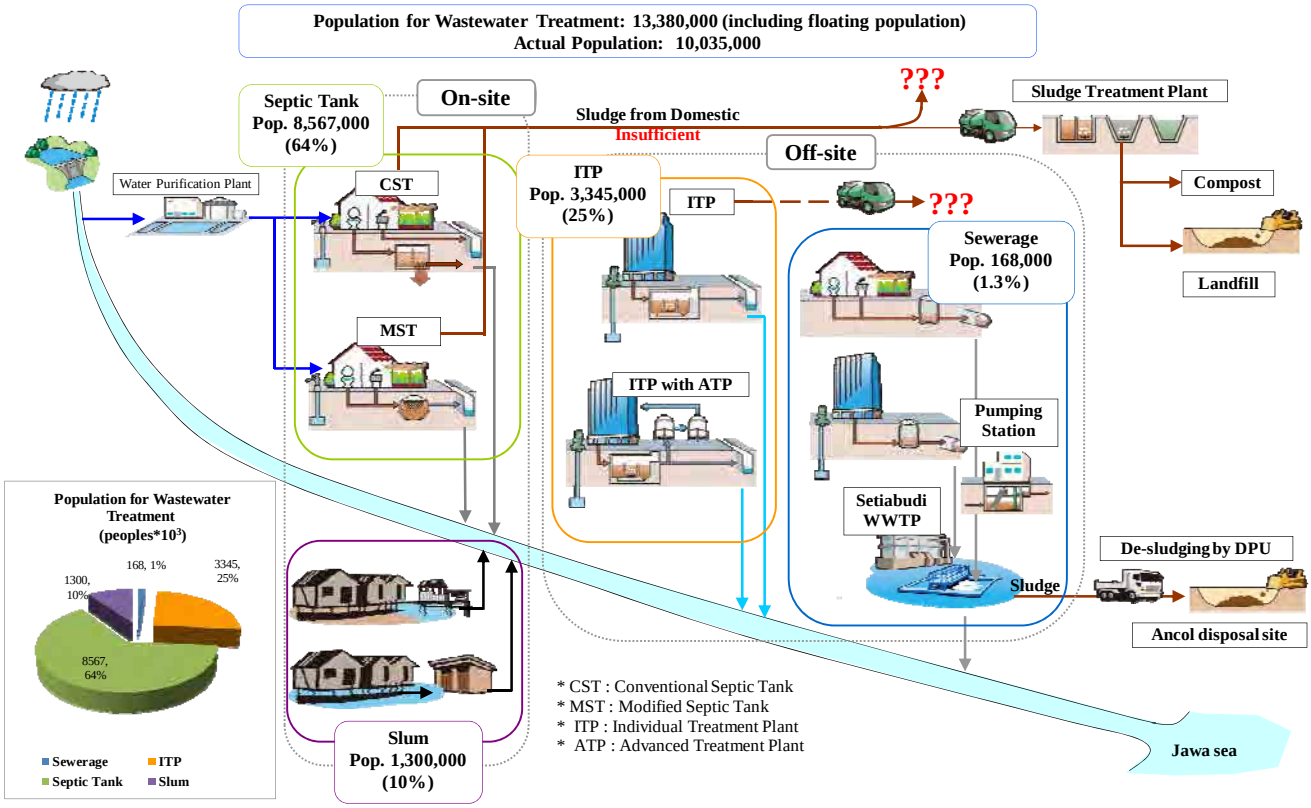


Figure SMR-B1-1 Current Situation for Treating & Discharging Wastewater in DKI Jakarta

B2 Current Situation and Issues in Sewerage and Sanitation Sectors in Indonesia

B2.1 Total System of Management and Supervision for Sewerage and Sanitation Sectors in Indonesia

Management and supervision for storm water & wastewater and sanitation are under responsibility of the following agencies in Indonesia. However, the responsiblity of each agency is unclear. Therefore, organizational and institutional re-arrangement/reform is necessary including unification.

Table SMR-B2-1 Total System of Management and Supervision for Sewerage and Sanitation Sectors in Indonesia

Management and Supervision		Stormwater	Wastewater	
			Off-site	On-site
Ministry of Public Works	DKI Jakarta	○ (main rivers)	○	○
	Others	○	○	○
DKI Jakarta	BPLHD		○	○
	DPU	○(branches, canals)		
	PD PAL JAYA		○	○
	DK			○

Note: BPLHD: Regional Environment Management Board, DPU: Public Works Agency of DKI Jakarta, PD PAL JAYA: Public corporation, DK: Cleansing Agency of DKI Jakarta

B2.2 Policies and Strategies

In Indonesia, both off-site system and on-site system are managed by the Cipta Karya (Directorate General of Human Settlement : DGHS) at the Ministry of Public Works. Therefore, the policies and strategies for off-site and on-site systems are not separated. Indonesia has “sanitation” policies and strategies which cover both off-site and on-site systems.

B2.2.1 BAPPENAS (National Planning & Development Board)

(1) Indonesia Sanitation Sector Development Program (ISSDP) 2006-2010

At the central government level, the National Water Supply and Sanitation Working Group were organized by eight relevant ministries and agencies as a cross-ministerial organization. BAPPENAS became the leading agency. At the local level, urban sanitation strategies were formulated for six cities (Payakumbuh, Jambi, Banjarmasin, Denpasar, Blitar and Surakarta) using the participatory approach in the first phase of the ISSDP (which ended in September 2008). Using the methodology established in this process, the “Acceleration of Urban Sanitation Development Program (PPSP) 2010-2014” was prepared and it was adopted at the national conference on urban sanitation strategies in April, 2009.

(2) Urban Sanitation Development Program (PPSP) 2010- 2014 (Concerning Wastewater)

1) Objectives

- Open defecation will be eradicated by 2014 (Open Defecation Free).
- 80% of urban household have access to solid waste management
- Flooding in 22,500ha in 100 strategic urban areas will be reduced.

2) Main Approaches

(a) Through the development of sewage systems in 16 cities (the construction of new systems in five cities and the expansion of the systems in 11 cities), the population covered by sewage systems in urban areas will be increased to 5% and the population who have access to sewage systems will be increased to five million.
(b) SANIMAS (community-based sanitation systems) will be constructed in 226 cities nationwide.
(c) The quantity of sludge at on-site systems will be reduced the total volume of the sludge inside the septic tanks by 20%.
(d) 3R practice will be nationally implemented.

(e) Final disposal sites will be improved as sanitatary landfills to serve 240 cities.
(f) Flooding in 22,500ha in 100 strategic urban areas will be reduced.

3) Planning

(a) Urban sanitation strategies will be formulated in all 330 cities.
(b) Urban sanitation strategies will be implemented in 160 cities.

4) Investment Amount

5.5 billion USD (of which 500 million USD will come from the central government's Special Allocation Fund)

B2.2.2 Ministry of Public Works (MPW)

At the Indonesian central government level, the National Water Supply and Sanitation Working Group (led by BAPPENAS) was organized by eight ministries and agencies and sanitation policies are properly coordinated. Therefore, it is thought that BAPPENAS and the MPW are united behind the same policies.

B2.2.3 DKI Jakarta Government

The most urgent tasks for the DKI Jakarta government would be to establish an organization which will control the unified wastewater management policies, secure the budget by establishing a "special policy expenditure budget" for wastewater management costs and create a system through which PD PAL JAYA can access the budget for wastewater management. It will be necessary for these measures to be incorporated into the JICA master plan and a DKI Jakarta Governor Regulation will have to be issued for the measures, in order for these measures to be established as DKI Jakarta policies.

B2.2.4 PD PAL JAYA

PD PAL JAYA is an organization established to maintain the sewerage systems constructed in a limited area of Jakarta City under the JSSP assisted by the World Bank. The company's operations include the maintenance of on-site sanitation facilities because the JSSP included some on-site sanitation facilities. Therefore, the company has personnel who have received specialized education and overseas training on sewerage and on-site systems. For this reason, it is expected that the company has a reasonable level of policy-making capabilities, but it is not being given the opportunity to utilize these capabilities because it does not have the status of a policy-making organization within the DKI Jakarta government.

B2.3 Regulations for Water Pollution

The laws and regulations for water pollution are listed below:

- Regulation No. 82 year 2001 on Water Quality Management and Water Pollution Control: National Water Quality Standards based on Intended Use of River Water
- Governor's Decree No. 582-1995): Environmental water quality standards for rivers in DKI Jakarta
- Governor's Decree No. 122-2005: Water quality standards for liquid waste from Individual, household and communal wastewater treatment system
- Decree of Ministry of Environment No. 51, Year 1995: Industrial wastewater quality standards
- Regulation of Ministry of Health No. 416-1990: Groundwater quality standard for drinking water use
- Regulation of Ministry of Health No. 416-1990: Groundwater quality standard for household water use
- Decree of the Governor of DKI Jakarta No.1040 / 1997: Wastewater quality standards for connection to sewer pipe for domestic and non-domestic

B3 Current Situation and Issues of Off-Site System

B3.1 Wastewater Treatment Plant

Surface aerators were installed in Setiabudi Pond, which was a flood-control reservoir, in 1991 to

aerate wastewater. Therefore, the Setiabudi wastewater plant is also used as a flood-control reservoir.

The Setiabudi wastewater treatment plant is divided into the two sections, West pond and East pond. The total area is 43,500 m^2, the effective capacity is 133,980 m^3, and the effective depth is 3 m in the West pond and 3.2 m in the East pond. However, the actual effective depth is thought to be less than those values because the sediment and sludge are accumulated on the bottom.

The designed treatment capability is 28,000m^3/day. The average treatment volume of year 2009 is 18,031.68 m^3/day according to PD PAL JAYA, and the West pond receives about 75% of wastewater and the East pond receives about 25% of it.

Four surface aerators are installed in the West pond and three surface aerators in the East pond. The treated wastewater aerated in the respective ponds is discharged into the Banjir Canal near the ponds by the effluent pumps when the water level in the ponds becomes high. Table SMR-B3-1 shows the outline of the Setiabudi wastewater treatment plant and Figure SMR-B3-1 shows the top view of it.

Table SMR-B3-1 Outline of Setiabudi WWTP

Physical Condition		West Pond	East Pond	Total
Surface area		26,100 m^2	17,400 m^2	43,500 m^2
Water level	in high condition	4.5 m	4.7 m	-
	in low condition	1.5 m	1.5 m	-
Pond depth (effective)		3.00 m	3.20 m	-
Elevation at the bottom of pond		-0.5 m	-0.5 m	-
Pond capacity(effective volume)		78,300 m^3	55,680 m^3	133,980 m^3
Treatment process		Aerated Lagoon	Aerated Lagoon	-
Treatment capacity *[1]		18,116 m^3/day	10,167 m^3/day	28,283 m^3/day
Present quantity of influent *[2]		13,523.76 m^3/day	4,507.92 m^3/day	18,031.68 m^3/day
Retention time *[3]	Based on treatment capacity	4.3 day	5.5 day	4.7 day
	Based on present quantity	8.1 day	17 day	10.3 day
Inlet	Wastewater	3	2	5
	Drainage	6	2	8
Screen (Mechanical Screen)		2 (0)	2 (2)	4 (2)
Aerator unit		4	3	7
Effluent Pump		5 x 1.10 m^3/s	3 x 1.10 m^3/s	-

Note: 1. Based on JSSP
2. Hearing from PD PAL JAYA
3. Calculated by pond capacity, 1 and 2.

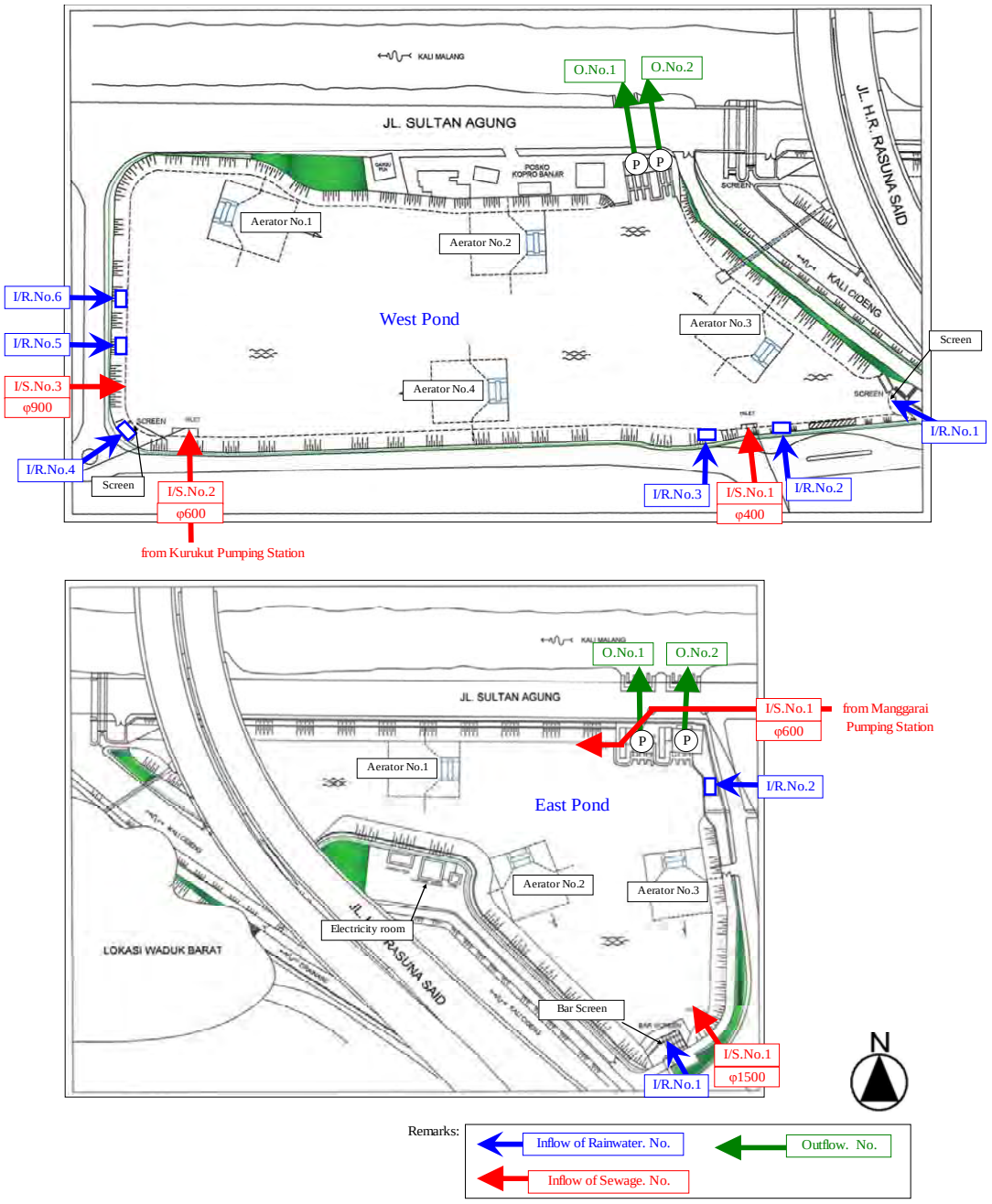


Figure SMR-B3-1 Top View of Setiabudi Wastewater Treatment Plant

The flood-control reservoir is under the jurisdiction of the DPU in the Special Region of Jakarta and so priority is given to the flood control in a rainy season. In addition, mutual coordination is not made between DPU and PD PAL JAYA for the control of the Setiabudi pond including the dredging process of deposited sand. (See Section B1.3.4 for details.)

PD PAL JAYA controls only the surface aerators and part of screens and does not have a measurement device for influent wastewater flow. It is difficult for this plant to understand the basic mass balance in wastewater treatment.

In addition, judging from the exterior appearance of the ponds, there is no suspended activated sludge, which is usually found in an aerobic lagoon, and anaerobic gas is generated from part of accumulated anaerobic sludge. The surface aerators stir the surface water and supplies oxygen only partly. Furthermore, the effluent water in the Setiabudi pond seems to be diluted by the influent rainwater especially in a rainy season and so it seems this plant does not have a normal wastewater treatment and control function. In addition, a large amount of solid waste is flowed into the ponds and additional

labor is required to remove it before performing the usual wastewater treatment.

B3.1.1 Pumping Station

Currently there are two wastewater pumping stations, the Krukut pumping station and the Manggarai pumping station.

Figure SMR-B3-3 shows the outline of the respective pumping stations. The Manggarai pumping station has small manhole pumps. The Krukut pumping station is a large-scale pumping station, but has not performed screening from the very beginning. One of the three main pumps installed there is out of order and not used.

Table SMR-B3-2 Outline of Wastewater Pumping Stations

Items	Krukut Pumping Station	Manggarai Pumping Station
Final destination	West Setiabudi Pond	East Setiabudi Pond
performance of pump	365 L/s×16.7m×90kW×3unit (=21.9 m^3/min= 31,536 m^3/day)	38.9L/s×11.7m×7.5kW×2units (2.33 m^3/min=3,361m^3/day)
type of pump	Vertical spiral pump	Aquatic pump
technique of operate	Manually-operated	Automatically-operated (by water level)

B3.1.2 Sewer Network

In the existing sewer network, the treatment district is divided into two districts for the West Setiabudi pond and the East Setiabudi pond. Figure SMR-B3-2 shows the outline of the sewer network. ”Sewer D” and “alan Rasuna Said, Jalan Denpasar4” (red circled parts) shown in this figure are under construction at present.

The total length of the sewer line is about 76 km, the number of manholes is 1,300 and that of the inspection chambers is about 3,500. Table SMR-B3-3 shows the sewer length and other data. Washing is mainly performed for control of the sewer to prevent clogging of it and foul odor. S/R PART-B : B4 shows the existing sewerage pipe system for each catchment area.

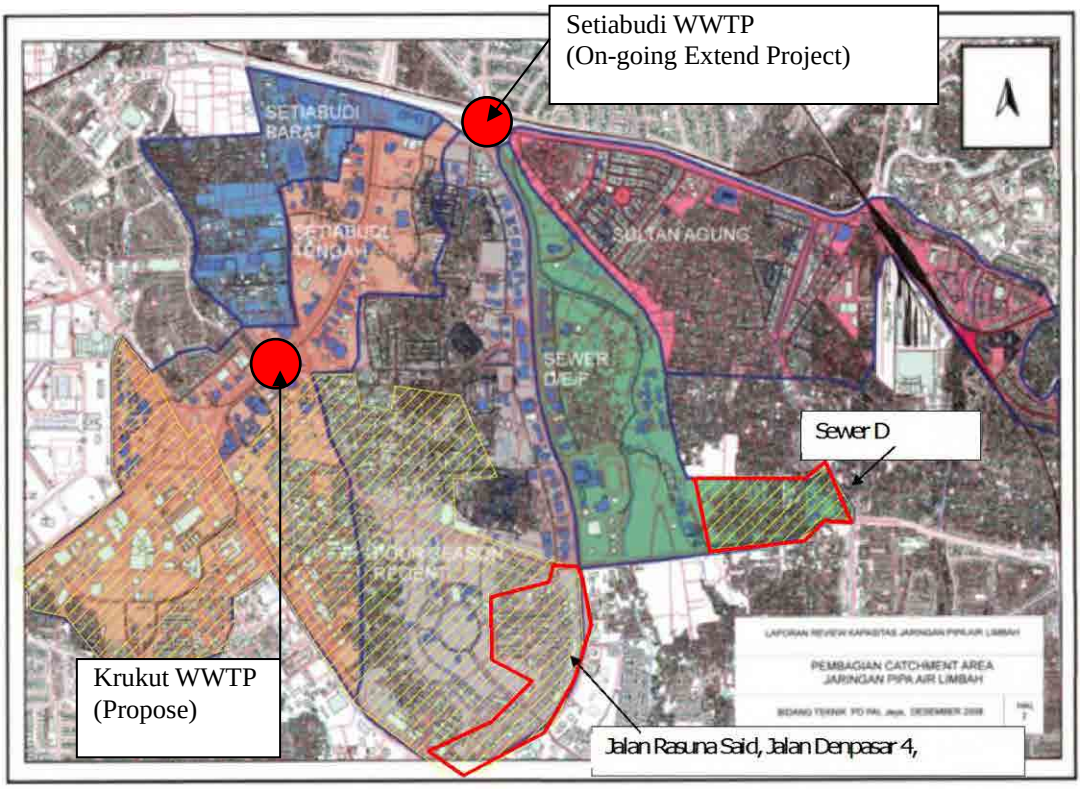


Figure SMR-B3-2 Existing Sewerage Zone (Zone No.0)

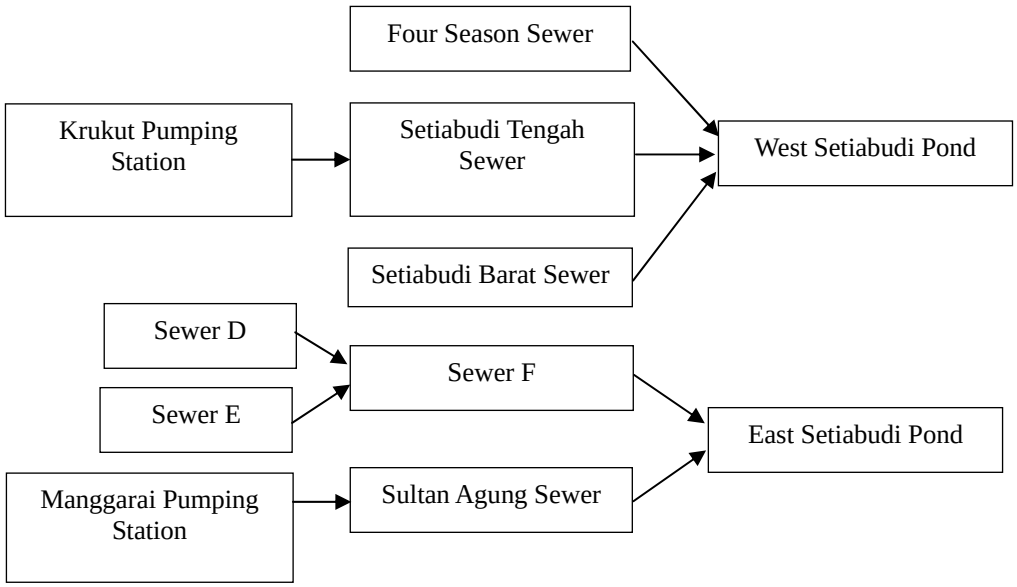


Figure SMR-B3-3 Outline of Sewer Network

Table SMR-B3-3 Sewer Length and Numbers of Manholes and Inspection Chambers

Pond	No	Catchment Area	Pipe (m)	MH (unit)	Service Pipe (m)	IC (unit)
East Setiabudi Pond	1	Sultan Agung	19,830	480	9,022	1,432
	2	Sewer D,E & F	4,648	77	882	40
West Setiabudi Pond	3	Four Season Regent	16,319	487	8,843	1,713
	4	Setiabudi Tengah	10,995	245	3,078	292
	5	Setiabudi Barat	2,184	48	668	10
total			53,977	1,337	22,493	3,487

Note: MH=Manhole, IC=Inspection chamber

B4 Current Situation of On-site System

B4.1 Current Situation of the On-Site Sanitation Facilities Constructed by the JSSP

B4.1.1 Current Status

The Jakarta Sewerage and Sanitation Project (JSSP) was approved by the World Bank on February 8, 1983. The project was launched after the loan became effective in June 1983, four months after the signing. The loan amount was 22.4 million USD. The main purpose of the project was to improve the means for protecting public health through improving the urban environment.

The long-term goal of the project was to develop an appropriate organization responsible for sewerage and sanitation services. The goal of establishing a financially independent organization in Jakarta was achieved.

However, the main purpose was not achieved due to several problems and restrictions.

In the sanitation project, 80 MCK facilities (256 toilet seats) were installed while the installation of 30 MCK facilities (240 toilet seats) was approved. However, only 778 leaching pits were constructed while the installation of 3,000 leaching pits was approved.

B4.1.2 Lessons Learned

Nearly 30 years have passed since the JSSP was implemented. Since then, people from other cities and provinces have continued to migrate to Jakarta City. In particular, this led to an increase in the number of low-income people, the expansion of low-income settlements and increased population density. Their living spaces are getting smaller and it is becoming difficult to secure spaces for installing sanitation facilities, spaces for constructing pipes and drains and spaces for building roads wide

enough for sludge collecting trucks to pass.

Ground subsidence caused by pumping up groundwater resulted in 40% of the total area of Jakarta City being at sea level or below. This led to the increased occurrence of floods. Drainage for gray water and water contaminants from sanitation facilities overflow when flooding occurs and this causes insanitary conditions.

It is also expected that the ground subsidence results in higher groundwater levels relative to the ground and increases the possibility of groundwater contamination from septic tanks which work through the infiltration of waste into the ground and from heavily contaminated rivers.

B4.2 Current Situation of On-Site Sanitation Facilities by Other than JSSP

B4.2.1 Toilets in Individual Houses

(1) Types of Toilets

The typical type of toilet in individual houses is situated in a room which contains a water storage tank, a toilet bowl and a bathing space. A pail is typically used to flush the toilet bowl, but flush toilets are installed in high-end housing. The toilet bowls are Turkish toilets or stool toilets, and the latter are more often found in houses. Water is traditionally used to clean oneself after passing stools, using a manually-operated nozzle or a pail. Toilet paper is not provided in many cases, but when it is used, it is disposed of separately. Therefore, black water does not contain toilet paper.

(2) Properties of Effluents

1) Properties of Black Water

Black water contains excrement and water used to flush the toilet bowls. According to the Old M/P 1991 report, the amount of black water was 23 L/person/day. The custom of flushing a toilet bowl using a pail has not changed since the report was published, therefore it is assumed that this figure is close to the current situation. If flush toilets are introduced in the future, an increase in the amount of water used is expected when compared to using pails. The Old M/P 1991 reports that the BOD (biochemical oxygen demand) emission per unit was 10.5 g/person/day. It is assumed that this figure is also close to the current situation.

- The quantity of black water 23 L/person/day (Old M/P 1991)
- BOD load in black water 10.5 g/person/day (Old M/P 1991)
- BOD concentration in black water 457 mg/L

2) Properties of Domestic Wastewater

The properties of domestic wastewater (including black water and gray water from kitchens and bathrooms) emitted from general housing are summarized as follows, based on existing literature, etc.

- Quantity of domestic wastewater 120 L/person/day (No. 122/2005)
- BOD load in domestic wastewater 23.2 g/person/day (Old M/P 1991)
- BOD concentration in domestic wastewater 193 mg/L

(3) On-Site Wastewater Treatment Systems

On-site wastewater treatment systems for black water emitted from a house include pit latrines and septic tanks. Modified septic tanks are also used to treat both black water and gray water from kitchens and bathrooms (combined-type).

1) Structures of Septic Tanks

(a) Conventional Septic Tanks

The structural standards for conventional sealed septic tanks are stipulated in the SNI 03-2398-2002 Standard National Indonesia. It stipulates that a septic tank designed for five users shall have an effective capacity of 3.5 m^3. However, it is unknown to what extent the standards are followed when

they are installed.

(b) Modified Septic Tanks

The design standards and structural standards for combined-type modified septic tanks for housing are stipulated in the ordinance of DKI Jakarta, Domestic Wastewater Quality Standards NO.122/2005. The tank capacity is stipulated as shown in Main Report Part-B : B5 Table B5-1. Similarly to conventional septic tanks, it is unknown to what extent the standards are implemented in reality.

Modified septic tanks include those constructed on-site and those manufactured in factories. Factory products are easy to install and are compact. They are made of FRP (fiber reinforced plastic) and have a vertical cylindrical shape. The household wastewater which flows into the outer tank then flows down to the bottom. It then flows upwards from the bottom and is treated by upflow filtration through the anaerobic filter placed in the center. The capacity of the anaerobic filter is 9-15% of the total tank capacity. The outer cylinder tank has a separation function using a sedimentation process and a sludge storage function. The inner cylinder tank (the anaerobic filter) has an anaerobic treatment function.

2) Standards for the Quality of Septic Tank Treated Water

There are no standards for the quality of the water treated by conventional septic tanks. On the other hand, the water quality standards for modified septic tanks (combined-type) are stipulated in the DKI Jakarta ordinance, Domestic Wastewater Quality Standards NO.122/2005. The standard is BOD 75 mg/L for treated water.

(4) Challenges and Measures for the Treatment of Black Water in Houses

Although direct infiltration septic tanks have hygiene problems, since they are installed in old houses, it is expected that they will be replaced by a sewage system and modified septic tanks when the houses are reconstructed in the future.

The BOD of the water treated by conventional sealed septic tanks (infiltrated water) was high (BOD 200 mg/L) according to the study results from two sites. Therefore, it is possible that conventional sealed septic tanks are a contamination source for groundwater and river water. The principal improvement measure should be to switch from septic tanks with limited capacity to combined-type treatment systems such as the modified septic tanks. However, due to the limited size of housing plots, another option would be to connect individual wastewater outlets with pipes and install a small-scale concentrated treatment system.

In order to maintain the stable functioning of septic tanks, it is necessary to conduct desludging appropriately. However, the regular desludging has not been institutionalized. The amount of sludge generated and decomposed depends on conditions of installation and usage of the septic tanks. Therefore, there is not enough data to clearly determine how frequently desludging needs to be conducted. It is surmised that desludging should be conducted every 3-5 years under normal use conditions, therefore desludging at this frequency needs to be institutionalized.

It was difficult to study the actual treatment performance of modified septic tanks in the survey, because they were being used in overloaded conditions. We are planning to continue studying them.

It was difficult to study the actual treatment performance of modified septic tanks in the survey, because they were being used in overloaded conditions. Under the conditions of such overloading and less space of the tank comparing to those of conventional septic tanks, desludging from modified septic tanks should be conducted every 1-2 years.

B4.2.2 Public Toilets

According to the list of public toilets provided by the Cleansing Department, there are currently 1,263 public toilets in DKI Jakarta. These are toilets for residents who do not have toilets in their home rather than toilets for the general public. They have been constructed by the Cleansing Department, other departments, private capital and individuals since the 1970s. These public toilets include types which directly discharge effluent into public water such as rivers, toilets which discharge effluent into public water via attached septic tanks, and toilets which allow effluent to infiltrate into the ground. The data on the number of public toilets in each city is shown in the attached material. The following

outlines the 1,263 public toilets installed in DKI Jakarta.

The types of public toilets include: 581 MCK (toilet, washing and shower) facilities (46%); 534 KU (toilet only) facilities (42%); and 148 MC (shower only) facilities (12%). Many public toilets were installed a long time ago. In West Jakarta and South Jakarta, very few toilets have been installed since 2000. A variety of sources provide funds for the installation of public toilets including the DK, communities, individuals, NGOs, central government programs and foreign donors programs. Those who conduct maintenance of public toilets include communities, individuals, RTs and RWs. The highest number of public toilets is maintained by specific individuals (about 50%). Regarding the current use situation, about 20% of public toilets are broken.

B4.2.3 Sludge Treatment Plants

Sludge accumulated in household septic tanks in DKI Jakarta is collected by each municipality and private businesses. It is then transported and treated at two sludge treatment plants situated in the east and west of DKI Jakarta. The following shows the results of an outline survey on the sludge treatment plants. The sludge treatment plants do not treat surplus sludge from commercial facilities.

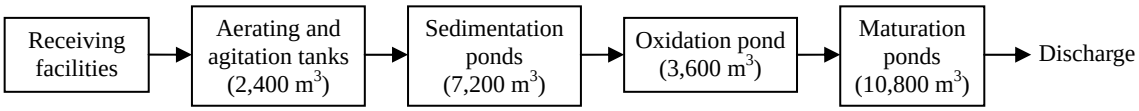
(1) Sludge Treatment Plants

1) Outline of the Facilities

The following outlines the sludge treatment plant (east) and the sludge treatment plant (west).

(a) Sludge Treatment Plant (East): Pulogebang IPAL

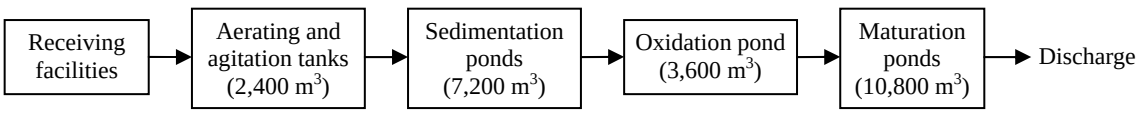
- Treatment capacity: 300 m^3/day
- Collection areas: the whole of East Jakarta, 50% each of West Jakarta, South Jakarta, North Jakarta and Central Jakarta
- Destination for discharge: East Canal Flood
- Operating and managing body: the Cleansing Agency of DKI Jakarta
- Treatment method: lagoon system
- System flow: As shown below



- Quality of treated water: pH 6-9, BOD 75 mg/L, COD_{Cr} 100 mg/L, SS 100mg/L
- Year of completion: 1984

(b) Sludge Treatment Plant (West): Durikosambi IPAL

- Treatment capacity: 300 m^3/day
- Collection areas: the whole of West Jakarta, 50% each of East Jakarta, South Jakarta, North Jakarta and Central Jakarta
- Destination for discharge: the Angke River
- Operating and managing body: the Cleansing Agency of DKI Jakarta
- Treatment method: lagoon system
- System flow: As shown below



- Quality of treated water: pH 6-9, BOD 75 mg/L, COD_{Cr} 100 mg/L, SS 100mg/L
- Year of completion: 1994

B5 Existing and Future Projects

The Flood Management Master Plan in DKI Jakarta will be developed in "The Project for Jakarta Comprehensive Flood Management (from 2011 to 2013)".

The drainage pump station is planned at three locations. This plan was proposed in "The Institutional Revitalization Project for Flood Management in JABODETABEK ".

From now on, the progress and data of these plans are planned to be collected.

The plan for the inner water drainage should be consistent with the above Flood Management Master Plan. JICA Expert Team will share the data and information with the team of the Project for Jakarta Comprehensive Flood Management, and prepare the facility and management plan for the inner water drainage.

Considering the existing capacity of Pluit Pump Station as $45m^3/s$, the total capacity will be more than $150m^3/s$. If these stations are constructed, the drainage capacity in the downstream area from Manggarai Gate would be increased, and the flood control safety will be improved.

The above plans are for the downstream areas, however, DGHS has another plan for the comprehensive drainage improvement (refer to as “Drainage M/P”) (small drainage (micro): 1/5 return year, small rivers (sub-macro): 1/25 return year) after implementing the topographic survey for drainages in DKI Jakarta and setting the drainage areas for each drainage. This plan will be commencement in August 2011 and completed in the end of March 2012. At the stage of the feasibility study (F/S) for the sewerage development, when it is found that rainwater in the project area for F/S can not be discharged by the surface dainage only after the examination of the Drainage M/P, study for development of drainage pipelines will be considered

Flood control plan being prepared by JICA Technical Cooperation Project “The Project for Capacity Development of Jakarta Comprehensive Flood Management” should be considered for the New M/P, such as the facility plan for internal water drainage and its impact.

B6 Current Situation of Water Supply System

B6.1 Current Situation of Water Supply Services

As shown in Table SMR-B6-1, the current situation for water supply service in DKI Jakarta is about 5.61million of served population and service ratio is still as small as 62.3% to the administrative population.

Table SMR-B6-1 Served Population for Water Supply in Jakarta

Item	Unit	Figures
Administrative Population	Person	8,998,755
Served population	Person	5,607,338
Service Ratio	%	62.3

Source: PAM JAYA

Water supply service operation for DKI Jakarta has been conducted by Jakarta Water Supply Agency (PAM JAYA) as one of DKI agencies until 1997. However, in 1998, DKI made a concession contract of 25 years with two private water service providers (PT. AETRA for eastern area and PT.PAM LYONNAISE JAYA for western area).

- Main contents of the contract between DKI and service providers are as follows:
  (1) Improvement of house connection ratio by the customers
  (2) Expansion & rehabilitation of water treatment plant
  (3) Construction of water distribution pipelines
- Water tariff and bulk water charge shall be reviewed every 5 years.

For PAM JAYA, through the privatization in 1998, 2,800 out of 3,000 staff were shifted to the private water supply service providers. At present, it is supervising the observance of the contract contents and regulations on water production and water quality.

In 2001, Jakarta Water Supply Regulatory Body was established as a regulatory body which is monitoring water supply and water quality based on the regulations.

B6.2 Capacity of Water Supply Facilities

(1) Capacity of the Existing WaterTreatment Plant (WTP)

There are 6 existing WTPs in DKI. The total capacity is 17,875L/s (or 1,544,400m^3/day).

(2) Future Plan for Expansion & Rehabilitation of Water Supply Facilities

PAM JAYA is planning to develop 7 new water sources in total, 2 in the east side and 5 in the west side. Size of new water sources is 1,907,000m^3/day in the east and 959,000m^3/day in the west.

B6.3 Water Distribution

Daily and annual treated water volume and the water distributed in DKI Jakarta are as shown in Table SMR-B6-2.

Table SMR-B6-2 Treated and Distributed Water in DKI Jakarta

Item	Unit	Figure
Treated Water	m^3/day	1,544,400
	m^3/year	563,706,000
Distributed Water	m^3/day	1,450,385
	m^3/year	529,390,502

Source: PAM JAYA

B6.4 Per Capita Water Consumption

Per Capita Water Consumption shall be determined by the distributed water from PAM system and that from wells obtained from PAM JAYA.

Water consumption of ordinary household customers and water consumption of non-household customers (commercial, industrial, etc.). As seen in the table, it was found that daily per capita water consumption (Liter Capita per Day: LCD) is almost the same amount of 200LCD in either case of PAM system or wells as water sources.

Table SMR-B6-3 Unit Water Consumption for PAM System Users and Well Users

No.	Item	Served Population (person)	Supplied Water (m^3)	Unit Water Consumption (LCD)
1	Water consumption by domestic users of wells	5,204,387	338,611,212	179
2	Water consumption by domestic users of PAM system	3,298,470	156,220,000	130
3	Water consumption by non-domestic users of wells		22,205,353	12
4	Water consumption by non-domestic users of PAM system		99,687,224	83
5	Water consumption for wells			191
6	Water consumption for PAM			213
	Total / Average	8,502,857	616,723,789	199
	Averaged domestic consumption			154
	Averaged non-domestic consumption			45

Source: Prepared by JICA Expert Team through the data from PAM JAYA

PART-C FUNDAMENTAL PLANNING AND DESIGN CONSIDERATIONS

PART-C FUNDAMENTAL PLANNING AND DESIGN CONSIDERATIONS

C1 Planning Considerations

C1.1 Demarcation of Off-Site Area and On-Site Area

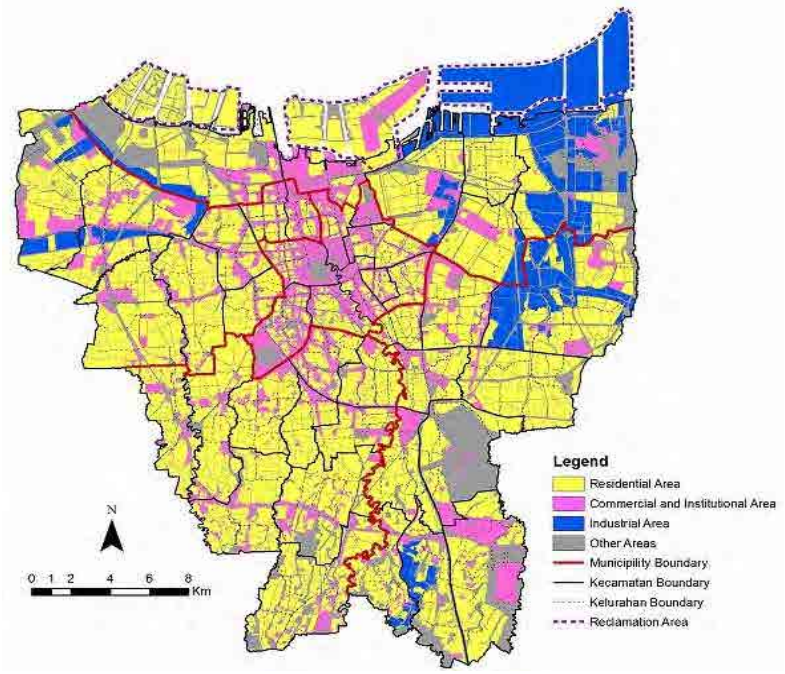
As a result of the field survey, it was found that the slum areas, where on-site sanitation is a priority, exist all over DKI Jakarta. Therefore, it is not possible in the present scope of the thie master plan to point out the exact places of on-site and off-site areas. Therefore, the demarcation of off-site and on-site areas was implemented on the basis of the following policy.

Table SMR-C1-1 Policy for Demarcation of Off-Site and On-Site Areas

Area	Conditions for Demarcation
Off-site (sewerage)	Sewerage zones with high population density shall be developed with high priority in principle. Also the areas, where the lands for WWTP are secured and the sewerage system developmenet can be conducted, shall be prioritized.
On-site (sanitation facility)	On-site sanitation areas shall be considered as following items; ✓ The areas other than the off-site areas which are the transitional on-site areas until off-site system has been developed. ✓ The areas other than the off-site areas which are the permanent on-site areas where off-site system development is technically difficult. The ratio is estimated around 20%.

C1.2 Future Land Use Plan (RTRW2030)

Land use in the Old M/P was classified into residential area, commercial/institutional area, industrial area and others. The same classification as the Old M/P is utilized to formulate the New M/P. The land use classification in the municipal spatial plans of the RTRW 2030 is aggregated into those 4 categories as residential, commercial & institutional, industrial and other areas.



Source: Redrawing prepared by JICA Expert Team on the basis of the RTRW 2030

Figure SMR-C1-1 Land Use Plan in 2030 of the Mainland of DKI Jakarta

Direction of future land use in the reclamation area along the north coast of DKI Jakarta is indicated in

the RTRW 2030 as shown in Figure SMR-C1-1. The reclamation area is roughly divided into east part, central part and west part. The land use of those parts is in line with the mainland, that is, the east part for industrial land use, the central part for mixed land use with residential and commercial/institutional, and the west part for residential land use.

In regard to the future land use of the mainland of DKI Jakarta, industrial areas are concentrated in the northeast, and the commercial/institutional areas are aggregated along with dissolving of ribbon developments along the arterial roads. The following table shows the comparison of land use between the land use in 2007 and the future land use in 2030.

C1.3 Future Population Projection and its Distribution in the Project Area

The current and future populations for each city of DKI Jakarta applied in RTRW 2030 (from 2010 to 2030) are as shown in Table SMR-C1-2. According to RTRW 2030, it is projected that the population of DKI Jakarta should reach at its saturated population by the year 2030.

Table SMR-C1-2 Projected Population of DKI Jakarta (Person)

Year / City	2010	2015	2020	2025	2030
North Jakarta	1,554,003	1,853,854	1,993,032	2,205,298	2,360,286
West Jakarta	2,345,524	2,520,770	2,807,023	2,989,373	3,211,959
Central Jakarta	952,635	1,032,834	1,041,686	1,129,759	1,163,800
South Jakarta	2,280,406	2,352,822	2,598,275	2,736,680	2,869,321
East Jakarta	2,585,628	2,768,408	2,844,145	2,932,867	3,059,916
Total for 5 cities	9,718,196	10,528,688	11,284,161	11,993,977	12,665,282
DKI Jakarta Area (ha)	64,292	65,613	66,933	68,253	69,573
Pop. Density (person/ha)	151	160	169	176	182

Source: Urban Spatial Planning Department of DKI Jakarta

The population density for each city is as shown in Table SMR-C1-3. It is predicted that DKI Jakarta should become overcrowded city with the density of 196 person/ha by 2030 which is much more than that of Tokyo (140 person/ha in 2010).

Table SMR-C1-3 Population Density of DKI Jakarta

Year / City	2010	2020	2030
North Jakarta	111	120	123
West Jakarta	187	224	257
Central Jakarta	199	218	243
South Jakarta	158	179	198
East Jakarta	140	153	198
Average for 5 cities	151	169	182

Source: Urban Spatial Planning of DKI Jakarta

C1.4 Sewerage Coverage Ratio

Sewerage coverage ratio is expressed by sewage treatment population ratio and defined as follows:

Sewerage Treatment Population Ratio (%) = Treated Population / Administrative Population × 100

"Treated Population" means the population who is able to discharge domestic wastewater. In the New M/P, it is called as "sewerage facility coverage ratio" and is separately defined as sewerage service coverage ratio.

Hereinafter, sewerage facility coverage ratio and sewerage service coverage ratio are described in detail.

(1) Sewerage Facility Coverage Ratio

Sewerage facility coverage ratio is defined as follows:

- Wastewater treatment capacity at WWTP to the design wastewater volume

Sewerage facility coverage ratio is obtained by the following equation.

> Sewerage Facility Coverage Ratio (%) = Treatment Capacity of the Constructed WWTP (m^3/day) / Design Wastewater Volume in DKI Jakarta in the concerned year (m^3/day) × 100

(2) Sewerage Service Coverage Ratio

Sewerage service coverage ratio is defined as follow:

- Ratio of sewerage service coverage population to administrative population in the concerned year

Sewerage service coverage population is defined as follows:

- Population under the circumstances where the residents can receive a sewerage service (population who are able to discharge wastewater to sewers in the concerned sewerage zone)

Sewerage service coverage ratio is obtained by the following equation:

> Sewerage Service Coverage Ratio (%) = Sewerage service coverage population (PE) / Administrative population in DKI Jakarta in the concerd year (PE) × 100

C2 Design Considerations

C2.1 Sewage Collection System

(1) Selection of Sewage Collection System

Sewerage (rainwater + wastewater) collection has 2 systems; separated system and combined system. Both systems have advantages and disadvantages, however, the separate system will be adopted in the New M/P. The reasons are as follows;

- Existing drainages can be utilized because they are constructed along the road with the density as 100 to 150m/ha in DKI Jakarta
- Spatial Plan 2030 requires to treat rainwater and wastewater separately (refer to C1.2)

On the other hand, the following issues are pointed out for the separated system at the construction stage.

- In some areas, wastewater mixed with rainwater flows into rivers through the small scale drainages and other facility by the rainwater flushing.
- It takes a long period of time to complete the sewer network. Until the completion of sewer network, sanitation situation will not be improved, or even will deteriorated in some areas
- It will be unclear which agency will have a responsibility of water quality at the small scale drainages and other facility because the implementation agency of sewerage only manages wastewater. There is a risk that any agencies do not have the responsibility of wastewater from unconnected areas.

In order to solve these issues step by step and to develop the sewerage system, development of trunk sewers would be prioritized in the short-term plan for off-site system, however, expansion of secondary and tertiary sewers is implemented as soon as possible.

(2) Relation between Sewage Collecion System and Drainage Development in DKI Jakarta

For the on-going projects for drainage development in DKI Jakarta, master plan study for drainage is being carried out by DPU and the capacity development project for comprehensive flood management is being implemented under the JICA technical cooperation. The outline of these study and project is described in Table SMR-C2-1.

Table SMR-C2-1 Outline of Drainage Development in DKI Jakarta

No.	Study/Project	Outline
1	Master Plan for Stormwater Drainage in DKI Jakarta	Plan to discharge all the inner water with 25-year return period by drainage and pump stations will be formulated.
2	The Project for Capacity Development of Jakarta Comprehensive Flood Management in Indonesia	There have been some experiences of flooding and submerging in low- laying areas of DKI Jakarta. In order to solve it, necessity of stormwater pipelines will be examined at the F/S stage.

It is essential that a sewergage development plan should be formulated as a comprehensive water environment improvement plan together with a drainage development plan. However, the outputs from the above-mentioned study and project for drainage development plan will not be able to be incorporated in the New M/P because those outputs will come out at the later stage.

At the stage of the feasibility study (F/S) for the sewerage development, when it is found that rainwater in the project area for F/S can not be discharged by the surface dainage only after the examination of the Drainage M/P, study for development of drainage pipelines will be considered.

C2.2 Wastewater Treatment Process

There must be considerations of the current issues and provision for future upgradation during the process of selecting and designing a technology for WWTP in DKI Jakarta. Therefore, all issues either current or future would be carefully examined during the process of selecting and designing of a technology for WWTP as shown in the following table.

Table SMR-C2-2 Design Considerations for WWTPs in DKI Jakarta

No.	Item	Consideration
1	**Availability of Land**	Open space is seriously lacking in DKI Jakarta. Therefore, it is necessary that technology uses land as minimum as possible and it must also be integrated with the landscape as much as possible.
2	**Quality of Receiving Water Body**	It is extremely poor. For the long term, stringent effluent quality criteria would be required to conserve the water environment. For the short term, standard effluent quality criteria would be considered for selecting & designing the technology. For the future, there would be provision for upgradation in technology.
3	**Treated Effluent Quality**	For the short term, treated effluent quality of standard level would be considered for selecting & designing the technology. For the future, there would be provision for upgradation in technology.
4	**Treated Effluent recycle**	This will save large amount of fresh water, generate revenue to strengthen the financial position of O&M agency and thus reduce pollution in water bodies & reduce depletion of ground water table. There would be provision of renovation & flexibility in technology for upgradation when effluent recycling would be required.
5	**Disposing of Treated Wastewater**	Must be in an environmentally and socially acceptable manner.
6	**Operational Reliability**	Selected technology should be easy to operate and troubleshoot, and provide reliability under a wide range of operational conditions.
7	**Track Record**	Tried, tested and proven processes enjoy the advantage of world-wide knowledge and experience, with much training and information available to operators.
8	**Life-Cycle Cost**	Life-cycle cost will be used as an indicator of best value for the technology. Life-cycle cost takes into account of knowledge of availability of land and cost, construction cost, and all operational inputs, such as manpower, energy, chemicals, and repair costs.

Alternatives of the treatment systems and guidelines for the selection of the treatment system have been presented in Section D6.1.5 (1)-(5).

C2.3 Desludging and Sludge Treatment Process

(1) Extracting Sludge

Tank trucks are used to extract sludge from small-scale wastewater treatment facilities, including septic tanks (collection and transportation). The following shows basic requirements for designing the desludging process.

1) Extracting Sludge from Septic Tanks

Table SMR-C2-3 shows the sludge generation rates on a wastewater treatment unit basis. In this plan, the amount of sludge to be extracted is estimated from the figures shown in the table, but in the actual work, it may be limited by collection and transportation efficiency.

Table SMR-C2-3 Sludge Generation Rate

Item	Sludge generation rate g-SS/person/day	Sludge concentration %	Desludging frequency
Conventional septic tank	2.5	1.5	Once every 3 years
Modified septic tank	6.0	1.5	Once a year
Individual wastewater treatment plant	20.5	1.5	Once every 40 days

2) Sludge Treatment System

As shown in Figure SMR-C2-1, the sludge treatment system is classified roughly into two types: dedicated treatment, and co-treatment at a wastewater treatment plant.

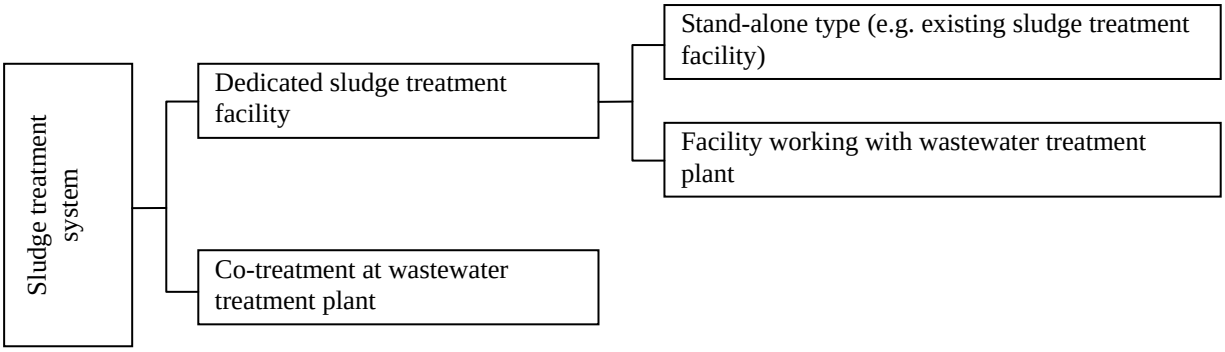


Figure SMR-C2-1 System for Treating Extracted Sludge