5.2.3 Sanitation

5.2.3.1 Waste Management

(1) Present Situation

1) Classification of Waste

In South Sudan, there is no specific law for solid waste management (SWM) to define or classify waste. However, following terms are commonly used for classification.

- Solid waste: Municipal solid waste, industrial waste and medical waste
- Semi-liquid waste: Urine, stool and sludge in septic tank and pit latrine
- Liquid waste: Urine, stool and domestic wastewater, collected and transported through a network of piped sewers

The development plan for SWM in the Study focuses only on “solid waste”, while the development plan for a sanitation system focuses on “semi-liquid waste” and “liquid waste”.

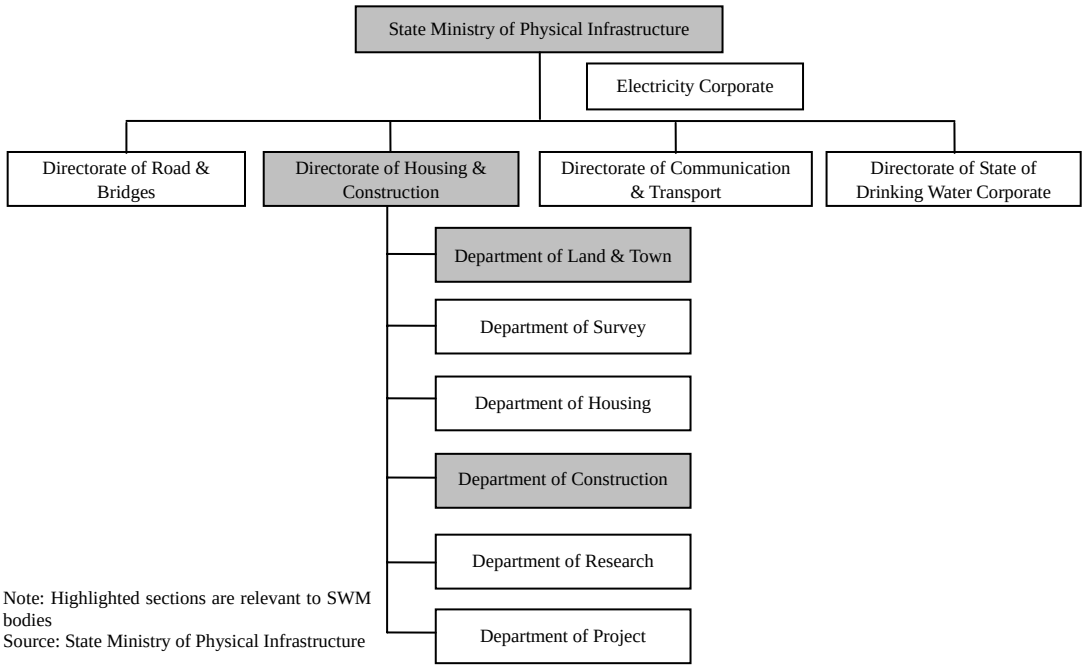
2) Institutional and Legal Structure

There is no specific law for SWM to mention the institutional and legal structure or clearly specify the roles and organizations responsible for the management. There are several organizations responsible for the management in Juba as follows;

- The Ministry of Housing, Lands and Utilities (MHLU) of GOSS
- The State Ministry of Physical Infrastructure (SMPI)
- District (Payam) in Juba

3) Organizations Responsible

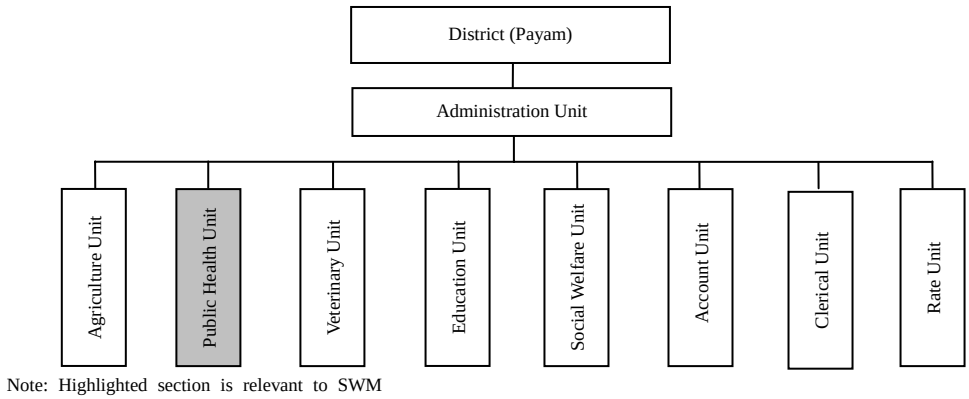
The MHLU is an organization responsible for the design of the master plan, detailed plan and construction of a facility for SWM. The MHLU designed the master plan for SWM and implemented the bidding for construction of a facility for SWM in Juba in 2006. In the meantime, the SMPI is the organization responsible for the detailed plan and the construction of a facility for SWM in Juba as well. Despite having plans for SWM, since 2005 the SMPI has not yet implemented the construction regarding SWM due to budgetary constraints. There is still no obvious demarcation responsibility for the planning and construction of facilities for SWM between GOSS (MHLU) and SMPI. The organization chart of the SMPI is shown in Figure 5.2-31.



Note: Highlighted sections are relevant to SWM bodies
Source: State Ministry of Physical Infrastructure

Figure 5.2-31 Organization Chart of State Ministry of Physical Infrastructure

Each District (Payam) in Juba is responsible for the collection and transportation of solid waste. Each District consists of an administration unit, education unit, social welfare unit and public health unit and so on. The public health unit includes a public health inspector and cleaning workers who collect and haul waste and clean the streets and parks. Each of Juba Town and Kator District has one compactor truck (6.2m^2), while Munuki District has two lorries (3.5 ton) for the collection and transportation of solid waste. Juba Town, Kator, Munuki and another District collectively own the "Juba Town workshop" which maintains not only the above mentioned waste collection vehicles but also other purpose vehicles such as pickup trucks and tippers. The typical organization chart of the District (Payam) is shown in Figure 5.2-32, while the number of each staff members at each district is shown in Table 5.2-54.



Note: Highlighted section is relevant to SWM

Figure 5.2-32 Typical Organization Chart of District (Payam)

Table 5.2-54 Breakdown of Organization of Each District (Payam)

Unit	Position	Juba Town District	Munuki District	Kator District
Administration Unit	(inc. Director: one person)	22	10	27
Public Health Unit				
	• Chief Public Health Inspector	1	-	-
	• Superior Public Health Inspector	-	1	-
	• Public Health Inspector	-	1	1
	• Public Health Officer	3	-	7
	• Sanitary Overseers	4	2	-
	• Assistant Sanitary Overseers	2	4	-
	• Cleaning Worker	100	128	47
	Sub total	110	136	55
Agriculture Unit		5	-	-
Veterinary Unit		3	-	-
Education Unit		NA	NA	?
Social Welfare Unit		10	NA	4
Account Unit		5	5	3
Clerical Unit		2	6	8
Rate Unit		25	20	?
Workshop		14	-	-

Source: Juba Town, Munuki and Kator District (Payam)
Highlighted sections are relevant to SWM bodies

The organization responsible for the operation of the disposal site in Juba has still not been defined. The current dumping area owned by the community of the Munuki District has been instructed by the SMPI as the dumping area for each district. The waste collected by each district is dumped and scattered in the field on the south side of Mt. Jebel Kujur without any regulations.

4) Joint Committee for the Issue of Sanitation

A joint committee for the issue of sanitation is held among related organizations every week or every ten days. The agenda covers mainly sanitary issues such as garbage problems, hygiene in public areas, human waste and so on. The participants are the State Ministry of Health, SMPI, commissioner of Juba County, executive director of each district, town councils of each district, and so on.

5) Municipal Solid Waste

The volumes of generated, collected and dumped waste in Juba are described in this section. The JICA Study refers to the waste generation rate of households obtained from other SWM studies since the waste generation rate in Juba has not been estimated so far. The following table compares the waste generation rates measured in several studies carried out by JICA and ELS for Khartoum in Sudan, Dar Es Salaam in Tanzania and four towns in Uganda.

Table 5.2-55 Comparison of the Waste Generation Rates in Several Studies

unit: g/cap/day

Income Group	JICA		ELS[3] in Uganda (1990)			
	Khartoum Study[1] (1986)	Dar Es Salaam Study[2] (1996)	Tororo	Masaka	Mbarara	Mbale
High Income (>US$160/month)	-	744	500	800	700	400
Middle Income (US$80-US$160)	-	780	600	1,100	1,200	700
Low Income (<US$80)	-	511	1,040	600	800	600
Weighted Average	630	698	-	-	-	-

Note 1) JICA (1986):: "Basic Design Study on Solid Waste Disposal Improvement Project of Metropolitan Area in the Republic of Sudan"
2) JICA (1987): "The Study on Solid Waste Management for Dar Es Salaam City
3) GTZ/World Bank (1990): "Seven Towns Project" Reports, Environmental Resources Limited (ERL)"

This Study assumes the waste generation rate of households in Juba to be 511g/cap/day which is equivalent to the rate of the low income group in Dar Es Salaam. Consequently, the waste generation amount of households in Juba is estimated to be approx.127.8ton/day. The waste generation amount of markets, hospitals and hotels in Juba is estimated according to the amount of collected waste. Approximately two thirds of the waste generation amount of the markets is collected by collection vehicles, while one third of it remains at the markets. The total waste generation amount and the breakdown are shown in Table 5.2-56.

Table 5.2-56 The Waste Generation Amount in Juba in 2006

Source of Waste	District (Payam)	Collected Waste Amount (ton/day)
Household[1]	Juba Town	52.6
	Kator	35.3
	Munuki	39.9
	Sub Total	127.8
Market & Hospital[2]	Juba Town	6.5[3]
	Kator	9.8[4]
	Munuki	21.0[5]
	SubTotal	37.3
Hotel	-	1.0[6]
Total		166.1

Note: 1) 511g/cap/day x population / 1000g /1000kg=127.8 ton/day
2) The waste generated at the hospital does not include medical waste
3) 6.2m2 x 0.35ton/m2 x 2 times/day x 3/2=6.51 ton/day
4) 6.2m2 x 0.35ton/m2 x 3 times/day x 3/2=9.77 ton/day
5) 3.5 ton x 4 times /day x 3/2=21.0 ton/day
6)1.0 ton x 1times /day =1.0 ton/day

Not all generated waste is collected in Juba. Approximately two thirds of waste generated at the markets and the hospitals is collected daily by each district, furthermore, the waste generated at four hotels is collected by the informal sector. In the meantime, the waste generated in households is not collected at all. Most waste generated in households is dumped as self-disposal; dumping in the field, river, stream and drainage or burning at the household.

The amount of waste collected at the markets and hotels is estimated to be 25.9 ton/day, while the amount of uncollected waste at the markets is estimated to be 12.4 ton/day and the self-disposal waste is estimated to be 127.8 ton /day. The breakdown of the waste collection amount in Juba is shown in Table 5.2-57.

Table 5.2-57 The Amount of Waste Collection

Source of Waste	District (Payam)	Collected Waste Amount (ton/day)
Market & Hospital[1)]	Juba Town	4.4[2)]
	Kator	6.5[3)]
	Munuki	14.0[4)]
Hotel	-	1.0[5)]
Total		25.9

Note: 1) The waste generated at the hospital does not include medical waste
2) 6.2m2 x 0.35ton/m2 x 2 times/day=4.34 ton/day
3) 6.2m2 x 0.35ton/m2 x 3 times/day=6.51 ton/day
4) 3.5 ton x 4 times /day =14.0 ton/day
5) 1.0 ton x 1times /day =1.0 ton/day
6) 158 ton/day -25.9 ton/day=.132.1 ton/day

The waste collected at the markets, hospitals and hotels, which amount to 25.9 ton/day, is dumped openly by each district and informal sector in the field (N04.47'.47", E31.29'.21") on the south side of Mt. JEBEL KUJUR without any regulations. The distance from the custom market to the dumping area is approximately 15 km.

6) Industrial Solid Waste

Industrial solid waste such as used tires, wooden waste, scrap metals, construction and demolition waste has not been recognized in Juba. The main industry in Juba is still agriculture and the new construction of buildings began in late 2005. Therefore, the amount of industrial waste still seems to be not substantial in Juba.

7) Medical Waste

Medical waste, which contains syringes, needles, sharps, bloody gauze and so on, is generated at the four large hospitals and is incinerated at each hospital. Some of the medical waste is incinerated improperly with oil barrels in the yards of hospitals. The amount of medical waste generated at the hospitals is estimated to be 140.8 kg /day with the number of beds and generation rate obtained from another JICA Study.

Table 5.2-58 The Amount of Medical Waste Generation

Name of Hospital	Number of Beds	Generation Rate (kg/bed/day)	Amount of Medical Waste (kg /day)
Teaching Hospital	537	Approx. 0.183[1)]	98.3
Al Sabah Hospital	78		14.3
Police Hospital	84		15.4
Military Hospital	70		12.8
Total	769		140.8

Note:1) The Study on Improvement of Solid Waste Management in Secondary Cities in Sri Lanka, JICA, 2003

8) Expected or On-Going Projects

Expected or on-going projects regarding SWM are summarized as follows;

- Construction of final disposal site and improvement of collection of waste

  Execution body: GOSS

  Location: Approx. 5km from west center of town on east side of Jebel Kujur
  (However this site was cancelled by GOSS in consideration of approximation to present town area and location within the planned urbanization area.)

  Status: The bidding for the construction of disposal site completed (July 2006)

  Detail: Shown in Table 5.2-59

Table 5.2-59 Details of Construction of Solid Waste Disposal Site

Description	Unit	Qty
Site preparation		
• Prepare site, remove 200mm topsoil, stump trees	m^2	30,625
• Construct 2m height embankment around the site	m	700
➢ Provide V-shaped storm water trenches of 1m deep		
• Wide bottom around site	m	1,000
• Stockpile all spoil excavations on site	sum	1
• Provide 50 x 20m of hard core surface in frond of office block	m^2	1,000
➢ Provide a 1.8 m galvanized diamond wire fence to specifications with 3m-wide vehicle and a 1m-wide pedestrian gate	m	716
Buildings		
➢ Provide brick office, kitchen, washing room and store to specifications for buildings of size 9 x 3m c/w plumbing.		
• Drainage and electrical installations	sum	1
➢ Provide ventilated approved pit latrine in brick		
• Approved design and specifications	sum	1
➢ Provide water tank of 4,500litre on 4m height steel tank		
• Approved design and specifications	sum	1
Equipment for landfill operation		
• Supply D4 bulldozer c/w service manuals and 1 year service contract	sum	1
• Supply 2,000litter fuel tank with hydraulic measuring gauge	sum	1
Miscellaneous		
• Furniture for store	sum	1
• Tools and equipment	sum	1
• Small diesel fired incinerator	sum	1
Solid waste collection		
➢ Collection bays: 7m wide by 5m depth 100mm concrete slab enclosed on		
• Three sides with 1.8m height block wall	nos.	36
• Municipal waste connection for cleaning purpose	nos.	36
Equipment for waste collection		
• Purpose made trailers for waste collection	nos.	72
• Small type MF 35 tractors	nos.	6
• Servicing contractors for equipment for one year	sum	1
Electrical		
• Main overhead 11KVA line	M	5
• Transformer	sum	1
• Small power supply and lighting	sum	1

Source: GIBB Africa (2005 September): Government of South Sudan City of Juba-Urgent Infrastructure Needs Assessment Draft Report

- Plan of final disposal site

Execution body: State Ministry Physical and Infrastructure

Location: Approximately 7km from Custom Market on north side of JEBEL KUJUR mountain (N04.52'.09", E31.31'.56")

Status: Site selection completed (July 2006)

Detail: None

9) Issues to be Solved in SWM

There are mainly three issues to be solved in SWM in Juba. Firstly, the lack of discharge rules for waste shall be solved. The waste generated in the households is dumped in the field, bush, streams and burned by self-disposal. Such self-disposal behavior results in serious environmental degradation such as water pollution, blocking up of streams or drainage, pests, offensive odors and so on. The discharge rules for waste shall be established by the government as soon as possible.

Secondly, the lack of capability for waste storage and collection carried out by the districts shall be solved. Although each district owns and operates one compactor truck or two lorries daily, one third of the waste generated at the markets cannot be collected and it remains in a heap at the markets. The heap of waste causes offensive odors, pests, vermin and smoke and it seriously effects the environment. The shops at the market often rent a lorry in order to get the heap of waste removed. Not only waste generated at the markets but also waste discharged in households results in shortage of capability of storage and collection of waste in accordance with the customary discharge rules. Once the discharge rules are established by the government, residents will discharge the waste properly in accordance with the government's instruction. It means that the customary discharge rules cause the huge amount of discharged waste; however the current capability of storage and collection of waste is quite poor. The capability of storage and collection of waste shall be enhanced in order to collect the waste generated at the markets and the waste discharged by residents.

Finally, open dumping of collected waste shall be ceased. The waste collected by each district is dumped in the field on the south side of JEBEL KUJUR mountain without any regulations. There is no fence, gate, staff or heavy equipment at the open dumping field. The waste dumped in the field without any control results in serious environmental issues such as smoke, leachate, fire and pests. A sanitary landfill site shall be constructed and operated properly. The sanitary landfill site consists of covering soil operation, leachate collection, leachate treatment, fence and gate.

(2) Future Needs

1) Population forecast

The population of Juba in 2006 is estimated to be approximately 250,000, while the population in 2011 is forecasted to be approximately 394,000 and in 2015 approximately 510,000 according to the JICA Study. The breakdown of population for each district in 2006, in 2011 and in 2015 is shown in Table 5.2-60.

Table 5.2-60 Population Forecast

District (Payam)	2006	2011	2015
Juba Town	Approx. 103,000	129,000	134,000
Kator	Approx. 69,000	97,000	107,000
Munuki	Approx. 78,000	168,000	219,000
Rajaf			50,000
Total	Approx. 250,000	394,000	510,000

2) Waste Amount Forecast

The future waste generation amount, WGx will increase in proportion to the increase in population, thus the future waste discharge amount is calculated by multiplying the generation rate, GRx by the future population, Px. Therefore,

$$WGx = Px \times GRx.$$

The future waste discharge rate is deemed to increase in proportion with economic growth. Accordingly, based on the relationship between the GNP and the increase in waste discharge (obtained in Japan), the future waste discharge increase rate is forecasted as shown below. (The growth rates of the GNP and GDP are assumed to be equivalent.)

Short-term (2006 - 2011): 11.0%/year
Medium-term (2012 - 2015): 9.0%/year

Using the above forecasts, the future waste discharge amount in Juba is estimated as shown in Table 5.2-61.

Table 5.2-61 Forecast on Municipal Solid Waste Generation Amount

Source	District (Payam)	Waste Generation Amount (ton/day)		
		2006	2011	2015
Household	Juba Town	52.6	103.2	162.5
	Kator	35.3	77.4	129.8
	Munuki	39.9	134.2	265.6
	Rajaf	-	-	60.7
	Sub Total	127.8	338.8	618.6
Market	Juba Town	6.5	14.9	27.6
	Kator	9.8	22.4	41.7
	Munuki	21.0	48.0	89.3
	Rajaf	-	-	17.2
	Sub Total	37.3	85.3	175.8
Hotel		1.0	2.3	4.3
Total		166.1	426.4	798.7

3) Forecast of Waste Composition

The composition of MSW is closely related to lifestyle, particularly consumption behavior in the future society. Generally, paper waste may increase since Juba will become a mainly administrative city with a number offices predominantly generating paper waste. Plastic waste may increase as well in accordance with increasing consumption of plastic goods and readily packed foodstuff.

4) Forecast of Industrial Waste Generation

The industrial waste tends to differ greatly by the type of industry. The future generation quantity of industrial waste therefore is subject to uncertainties pertinent mainly to future expansion and restructuring plans of industrial activities, as well as new construction of infrastructure.

GOSS plans rehabilitation of the ministerial buildings, government office and houses. The industrial waste related to the construction of new buildings or rehabilitation will be generated as summarized below:

Office for GOSS	:	28,912m^2
Residential houses for GOSS	:	22,536m^2
State offices	:	13,094m^2
State residential	:	105,755m^2
Juba regional hospital	:	6,300m^2

5) Forecast of Medical Waste Generation

The generation of medical waste which contains syringes, needles, sharps, bloody gauze and so on in large hospitals and health centers is forecast as shown in the Table 5.2-62.

Table 5.2-62 Forecast of Medical Waste Generation

Name of Hospital	2006	2011	2015
Number of Beds	769	2,252	2,830
Generation Rate (kg/bed/day)	0.183[1)]	0.309	0.436
Amount of Medical Waste (kg/day)	140.8	695.9	1233.9

Note: 1) The Study on Improvement of Solid Waste Management in Secondary Cities in Sri Lanka, JICA, 2003

The future medical waste generation rate is deemed to increase in proportion to the economic growth. The growth rates of the GNP, GDP, and GRDP were assumed to be equivalent.

6) Measures to be Taken

The proposed measures to be taken, in order to attain the goals, are summarized below.

① Technical System

- Establishment of a proper waste storage system
- Provision of a sufficient waste collection service
- Promotion of public education
- Improvement of the public area cleaning system
- Establishment of a sanitary landfill, strictly complying with the SW Control Regulation of the government
- Establishment of a proper medical waste disposal system from generation to final disposal
- Establishment of a separate collection system
- Establishment of a government related recycling system
- Establishment of an intermediate treatment system by the construction of compost and sorting plants

② Institutional System

- Improvement and strengthening of management/control capability of public organizations concerned with SWM
- Establishment of laws and regulations for SWM
- Establishment of a financially sustainable system
- Establishment of a proper monitoring and information management system, including an effective, operational database
- Full utilization of available human resources through the establishment of proper human resources development programs
- Establishment of laws and regulations for medical waste

(3) Proposed Projects

The principal goal of the SWM development plan is to create an environment where;

"Eighty two (82) % of population in Juba can access improved SWM by the target year 2015".

The Millennium Development Goals (MDGs) provide the internationally agreed targets against which the needs of the people of South Sudan can be assessed. They also reveal that rapid acceleration of development is needed, particularly in war-affected and disadvantaged regions. The "Synthesis Framework for Sustained Peace, Development and Poverty Eradication" by Joint Assessment Mission (JAM) Sudan in 2015" illustrated the massive scale of the development challenge against the MDGs using available data for South Sudan, while recognizing that local conditions are unique and should shape the national targets that are adopted. JAM mentioned in the report that the challenging target of MDG for environmental issues focuses on 58% of the population in South Sudan having access to improved sanitation

in 2015, while it focuses on 82% in North Sudan. Since Juba became the capital city of GOSS and Central Equatorial State in 2005, the population growth is predicted to be rapid and it will cause serious environmental pollution in the area surrounding Juba. Therefore, the Study adopts “82% of the population”, rather than 58%, as the challenging target of MDG for environmental issue in Juba in 2015.

1) Solid Waste Management Development Project

① Background

There are several issues to be solved in SWM in Juba. Firstly, the lack of discharge rules for waste shall be solved. The waste generated in the households is dumped in the field, bush and stream and burned by self-disposal. Secondly, the lack of capability for waste storage and collection carried out by the districts shall be solved. Once the discharge rules are established by the government, residents will discharge the waste properly in accordance with the government’s instruction. It means that the customary discharge rules currently observed cause the huge amount of discharged waste; however the current capability of storage and collection of waste is quite poor. Finally, open dumping of collected waste shall be ceased. The waste collected by each district is dumped in the field on the south side of Jebel Kujur without any regulations. The waste dumped in the field without any control results in serious environmental issues such as smoke, leachate, fire and pests.

② Objectives

The objectives of the project are shown as follows;

- To establish proper discharge rules.
- To enhance the capability for waste storage and collection.
- To establish medical waste disposal site
- To establish sanitary landfill site (This is an on-going project undertaken by GOSS in 2006.)

③ Location

- Establishment of proper discharge rules: Whole Juba Town and the surrounding areas
- Enhancement of the capability for waste storage and collection: Whole Juba Town and the surrounding areas and current workshop
- Establishment of medical waste disposal site: Same location as sanitary landfill site
- To establish sanitary landfill site: Nouth side of Mt. Jebel Kujur (Figure 5.2-33, Figure 5.2-30 and Figure 5.2-31)

④ Scope of the Project

- Implementation of the environmental education
- Procurement of equipment for the environmental education: 1 set.
- Procurement of waste collection vehicles: Compactor truck ($8m^3$) 20nos.
- Procurement of heavy equipment for the landfill site operation:

  Bulldozer: 1

  Excavator: 1

  Dump truck: 2

  Water tanker: 1
- Rehabilitation of current workshop
- Establishment of Solid Waste Management Institution
- Construction of medical waste disposal site
- Construction of sanitary landfill site: North side of Mt. Jebel Kujur ($144,000m^3$)

⑤ Responsible Agency (expected)

- Project Implementation: Ministry of Housing, Lands and Utilities of GOSS, and State Ministry of Physical and Infrastructure
- Operation: Juba Town, Munuki, Kator and Rajaf Payams
- Maintenance: Juba Town, Munuki, Kator and Rajaf Payams

⑥ Project Cost

- Detailed Design Cost : USD 1.5mil.
- Implementation/Construction Cost* :

  Public Education : USD 0.2mil.

  Collection System Improvement : USD 2.2mil.

  Construction of Landfill : USD 1.0mil.
- Total Cost : USD 4.9mil.

  * Including construction supervision cost

⑦ Beneficiaries

(a) Target Beneficiaries:

The whole population in Juba of 510,000 in year 2015, shops at markets, waste collection workers and hospitals

(b) Effects of the Project:

- Mitigation of environmental pollution such as smoke, offensive odor, pests by improvement of collection system and proper disposal of the medical waste.

⑧ Project Evaluation

(a) Economic Viability

Although no economic analysis is done, it is expected that the Project is economically viable because large amount of benefit is expected to accrue from the reduction of external diseconomy.

(b) Financial Soundness

Total amount of cleaning tax is not enough for SWM; hence subsidy should be provided by the district or state ministry.

(c) Environmental Impacts

- Positive Impacts
  - Decrease of diseases
  - Betterment of urban environment (Environmental impacts caused by illegal dumping will be mitigated by the project.).
- Negative Impacts

  None

⑨ Conditions Required

(a) External Condition

- Civil war will not happen again.

(b) Preconditions

- GOSS and State Ministry promote SWM in Juba and surrounding area.

⑩ Relationship with Other Projects

Construction of disposal site and procurement of collection vehicle by MHLU will be revised.

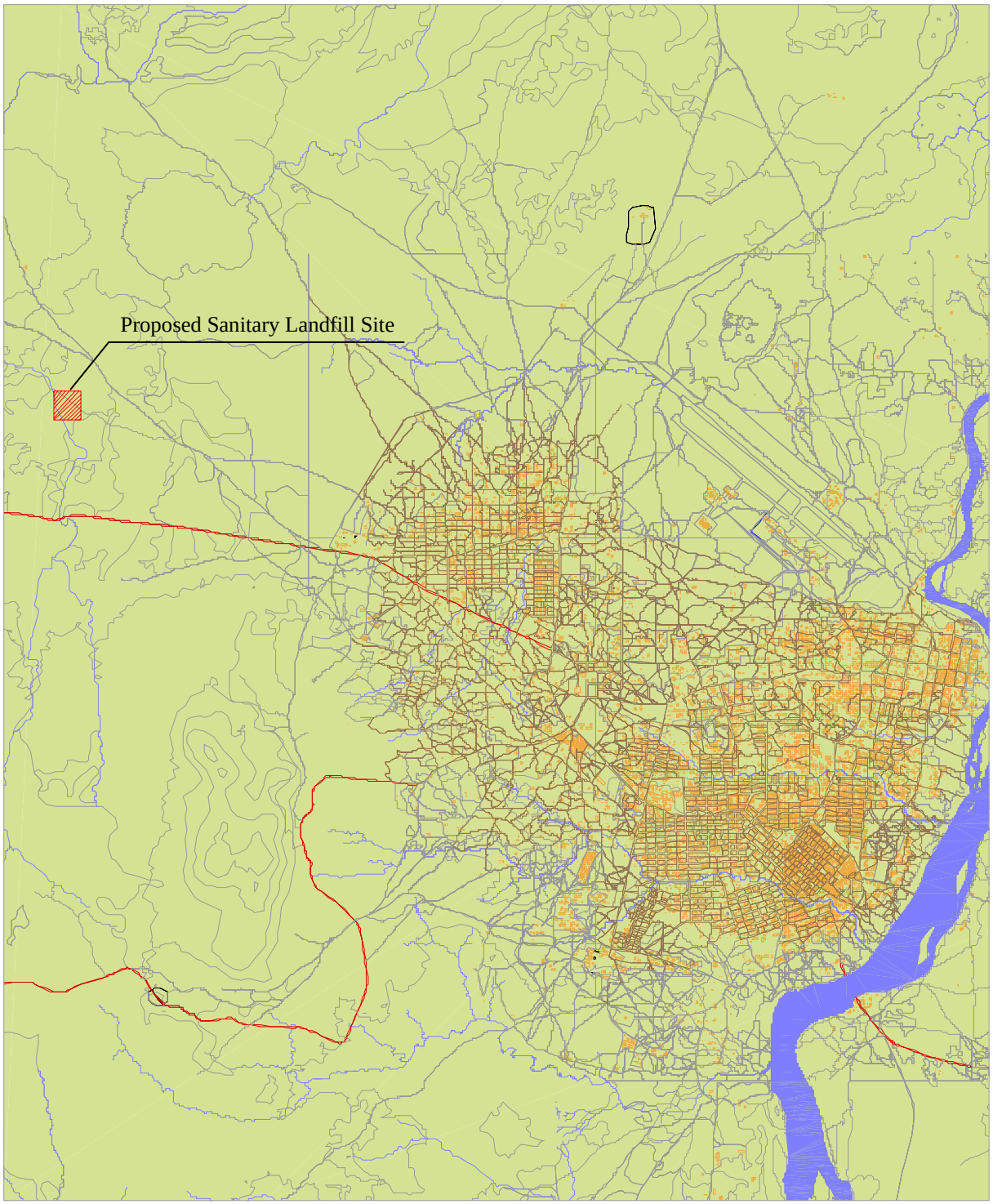


Figure 5.2-33 Location of Sanitary Landfill Site

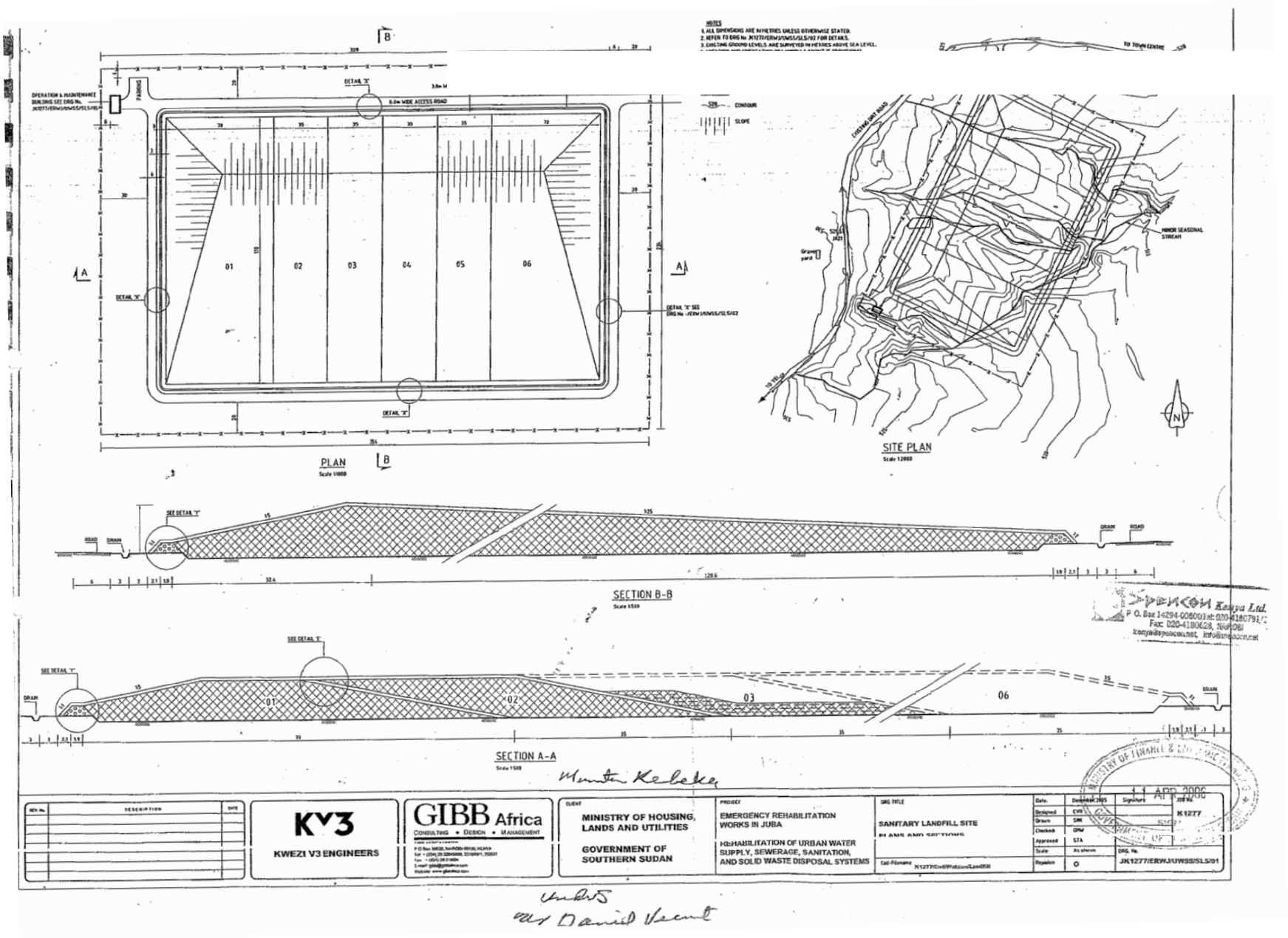


Figure 5.2-34 Plan and Section of Sanitary Landfill Site Designed by GOSS

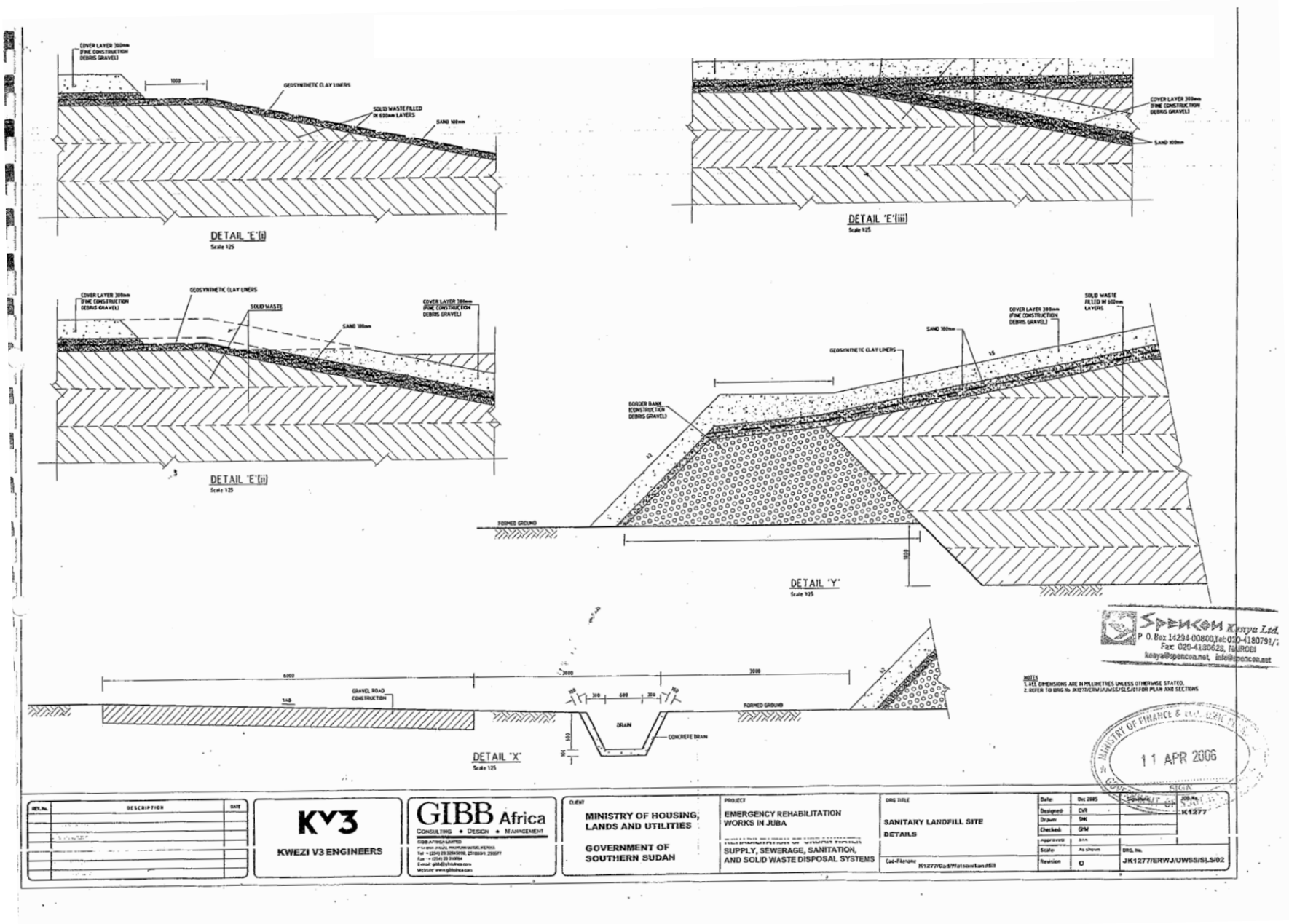


Figure 5.2-35 Detailed Section of Sanitary Landfill Site Designed by GOSS

(4) Staged Implementation Plan

In order to achieve the principal goal of the development plan, the strategies for the establishment of major technical and institutional system components are proposed as shown in Table 5.2-63. Staged implementation plan is shown in Table 5.2-64.

Table 5.2-63 Strategies for the SWM Development Plan

Short-Term (2006-2011)	
Technical Aspects	• A public container system shall be established by 2011 • A compactor truck shall be procured in order to achieve the 50% waste collection rate by 2011. • Promotion of public education of proper discharge rules. • The public cleansing system, manual sweeping system based on road type, will be maintained. Prevention of littering in the city will be achieved through an intensive public education campaign and enforcement. • The sanitary landfill site, with a capacity of approx. 144,000m^3 shall be constructed by GOSS on the north side of Jebel Kujur by 2011(shown in Figure 5.2-30 and Figure 5.2-31). • Medical waste will be treated and disposed properly at the medical waste disposal site.
Institutional Aspects	• The current administrative system among Ministry of Housing, Lands and Utilities of GOSS, State Ministry of Physical Infrastructure and Districts shall be improved through a review of the system and redefinition of the tasks/assignments in order to meet with the proposed technical systems. • The current legal provisions in diverse laws and regulations shall be revised into an integrated and transparent package, especially to properly operate proposed new technical systems. • Establishment of a financially sustainable system • A systematic monitoring and information management system for SWM shall be established in the Joint Committee. At first the unit costs of operations shall be identified to evaluate cost/benefit, cost/efficiency and cost/effectiveness. Along with this a database all of SWM activities shall be developed and maintained to continuously check the quality and costs of the cleansing services by both public and private sectors. • A human resource development program shall be developed in order to train professionals involved in SWM. The program shall cover a broad spectrum of professionals and employees, from management to operational levels, including those responsible for supporting activities. • A code of practice shall be formulated for medical waste disposal. In order to establish a proper medical waste control/management system, the current organization of GOSS as well as the State Government shall be strengthened. As a measure of strengthening, the establishment of a regional medical waste authority shall be examined. The costs of medical waste disposal (from collection to final disposal) shall be gradually covered by the fee from the generators.
Medium-Term (2012-2015)	
Technical Aspects	• The ratio of the mechanical sweeping operation will be raised if the labor cost is increased and the road conditions improved. If these labor and road conditions allow, a whole system for major roads shall be changed to a fully mechanical system. • A public container system shall be enhanced in order to achieve the 82% waste collection rate by 2015. • The compactor truck shall be procured in order to achieve the 82% waste collection rate by 2015. • The sanitary landfill site shall be operated properly on the north side of Jebel Kujur. • Medical waste shall be treated at generation site by autoclaves in steam resistant bags, and lacerating materials crushed at the site of generation. • All medical waste shall be continuously disposed of at a medical waste disposal site.

Institutional Aspects	• The administrative system, including the roles of Ministry of Housing, Lands and Utilities of GOSS, State Ministry of Physical Infrastructure and Districts shall be reviewed and improved in order to meet the change of SWM, i.e., the increase in the NIMBY (Not In My Back Yard) syndrome, etc. • The organizations responsible for SWM shall be further strengthened in terms of administrative and control capabilities not only for municipal SW but also hazardous and industrial SW. • The database of SWM activities shall be maintained. The comparative cost data and other performance data obtained in the database shall be used to measure the efficiency of the services, and utilized for good management and decision making. • All staff concerned with SWM shall undergo a programme of proper training and professional development. Vocational qualifications shall be set up to act as a means of assessing the competence of persons responsible for SWM facilities and operations. • All costs of medical waste disposal (from collection to final disposal) shall be covered by the fee from the generators. • The coverage rate of cleansing tax for the SWM costs shall be raised to 100 % by 2015. The tipping-fee for waste treatment/disposal shall be raised to 100 % of the necessary cost.
Long-Term (2016-2025)	
Technical Aspects	• A public container system shall be enhanced and expanded on the east side area of the River Nile by 2025 • A compactor truck shall be procured in order to expand service to the east side area of the River Nile and to achieve the 100% waste collection rate by 2025. • The separate discharge and collection system shall be established by 2025. In order to reduce the amount of disposal waste, the separate discharge and collection system shall be started in accordance with the change of socio-economic situation, i.e., the increase of separate items, improvement of discharge method by use of decomposable container for compostable wastes, etc. • The most appropriate mechanical and manual sweeping operations shall be applied, considering the labour and road conditions. • A government related recycling system shall be fully established. • The sorting/compost plants shall be started by 2025. • The new final disposal site shall be constructed and operated. • All medical waste shall be continuously disposed of at a medical waste disposal site.
Institutional Aspects	• The administrative system, including the roles of Ministry of Housing, Lands and Utilities of GOSS, State Ministry of Physical Infrastructure and Districts shall be reviewed and improved in order to meet the change of SWM, i.e., the increase in the NIMBY (Not In My Back Yard) syndrome, etc. • The organizations responsible for SWM shall be further strengthened in terms of administrative and control capabilities not only for municipal SW but also hazardous and industrial SW. • The database of all SWM activities shall fully function to provide all data necessary for administration, policy decision, control/monitoring, public relation, financial management, etc. • The coverage rate of cleansing tax for the SWM costs shall be maintained to 100 % by 2025. The tipping-fee for waste treatment/disposal shall be maintained to 100 % of the necessary cost.

Table 5.2-64 The SWM Staged Implementation Plan in Juba

Components \ Phase	Present (2006)	Short term (2006 - 2011)	Medium term (2012 - 2015)
1. MSW Generation			
Population in Juba	Approx.250,000	366,000	510,000
Juba Town district	Approx.103,000	120,000	134,000
Kator District	Approx.69,000	90,000	107,000
Munuki District	Approx.78,000	156,000	219,000
Rajaf District			50,000
MSW Amount (ton/day)			
Generation	166.1	426.4	798.7
Discharge	38.2	213.2	654.9
Collection	25.9	213.2	654.9
2. Refuse Collection & Transportation			
Collection rate	16%	50 %	82 %
Collection system	Point collection and door to door collection	Communal container collection (point collection)	Communal container collection (point collection)
Types of communal container	none	wheeled container	wheeled container
Major type of vehicles (units)	Compactor trucks (6.2 m^3): 2 Lorry (3.5ton): 2	Compactor trucks (8 m3): 20	Compactor trucks (8 m^3): 25
Transportation system	Direct haulage	Direct haulage	Direct haulage
Executing organization	Each district (Payam)	Each district (Payam)	Each district (Payam)
3. Public Area Cleansing			
Method of sweeping	Manual labor	Machinery and manual labor	Machinery and manual labor
Operation by	Each district (Payam)	Each district (Payam)	Each district (Payam)
4. Final Disposal			
Method of operation	Open dumping	Sanitary landfill	Sanitary landfill
Final disposal site	on south side of Mt. Jebel Kujur	on east side of Mt. Jebel Kujur	on east side of Mt. Jebel Kujur
Distance from city (km)	Approx.15	Approx.5	Approx.5
Operation by	None	State Ministry of Physical & Infrastructure	State Ministry of Physical & Infrastructure
No. of workers	None	10	10
Main equipment	None	Bulldozer: 1 Excavator: 1 Dump truck: 2 Water tanker: 1	Bulldozer: 1 Excavator: 1 Dump truck: 2 Water tanker: 1
5. Maintenance & Repair			
Preventive Maintenance	District workshop	District and private workshop	District and private workshop
Major repair	District workshop	Private workshop	Private workshop
Operation by	District	District and private	District and private
6. Organizations Responsible on SWM			
Policy or Master plan	GOSS	GOSS	GOSS
Budgeting	GOSS, State Ministry	GOSS	GOSS
Detailed plan	GOSS, State Ministry	State Ministry	State Ministry
Construction	GOSS, State Ministry	State Ministry	State Ministry
O & M	District (Payam)	District (Payam)	District (Payam)
7. Public Co-operation	There are very few public education programs and co-operation	Conduct of active public education and co-operation campaigns	Conduct of active public education and co-operation campaigns
8. Medical SWM			
Generation (kg/day)	140.8	695.9	1233.9
Treatment at generation	Burning at oil barrel	Majority	All institutions
Final disposal	Open dumping	medical waste disposal site operated by the hospital	medical waste disposal site operated by the hospital
9. Industrial SWM			
Generation of HW (ton/day)	ND	ND(Construction and demolition waste will increase)	ND(Construction and demolition waste will increase)
HW treatment	None	Treat at generation	Treat at generation
Final disposal	Little control and possibility of HW dumping at disposal site	To prohibit and control HW disposal at disposal site	To prohibit and control HW disposal at disposal site

The life span of the equipment is estimated as follows;

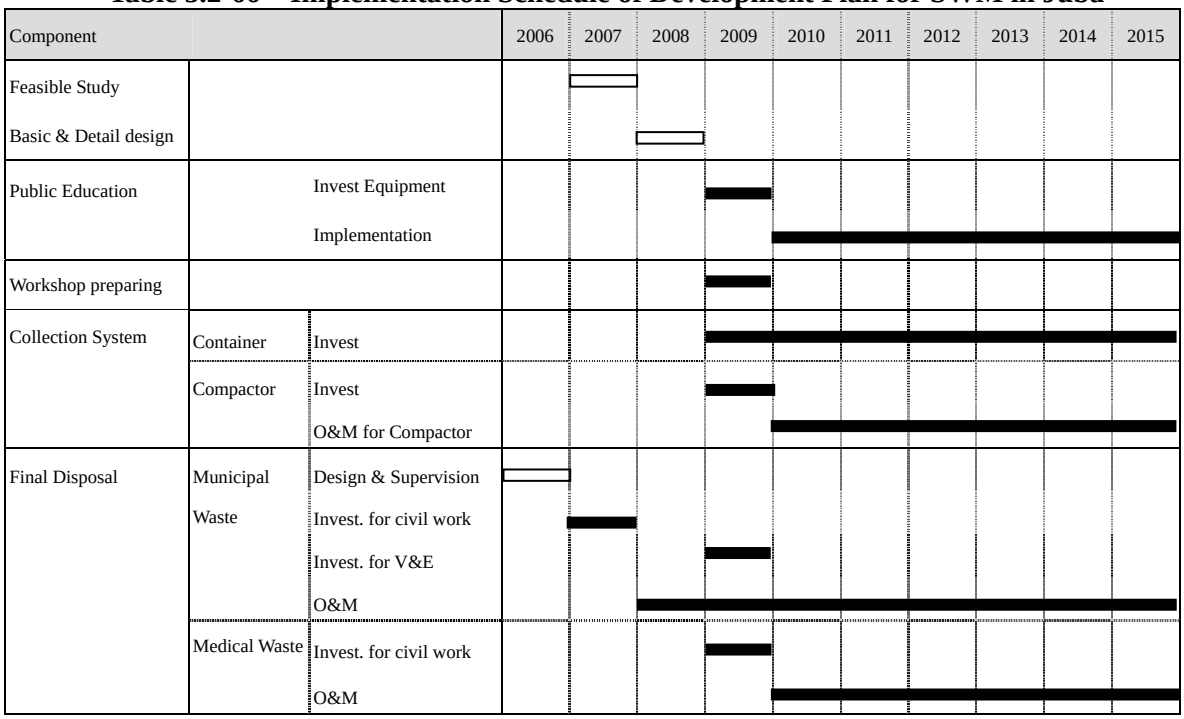
Table 5.2-65 Equipment and Facility Life Span

Items	Life Span (years)	Residual Value (%)
Vehicles & Heavy Equipment	7	10
Machinery	15	0
Buildings	30	0

Note: The life span of civil works and the facilities, other than buildings, depends on their period of operation.

The implementation schedule of the development plan in Juba from 2006 to 2015 is shown in Table 5.2-66.

Table 5.2-66 Implementation Schedule of Development Plan for SWM in Juba



Note: V&E: Vehicles and Equipment

5.2.3.2 Waste Water Management

(1) Present Situation

The development plan for waste water management in the Study focuses on “semi-liquid waste” (herein after referred to as “human waste”) and “liquid waste” (hereinafter referred to “sewage water”), while the development plan for SWM focuses on “solid waste”.

1) Human Waste

In general, the provision of sanitary facilities in Juba is very poor. Most residents commonly

defecate in open bushes rather than use latrines. Most households do not have latrines, while several hotels, government offices and state departments in the town have latrines. The human waste stored in the latrines is collected periodically by ten vacuum tankers owned by several individual enterprises. The collected human waste is disposed in the field (N04.47'.47", E31.29'.21") on the south side of Mt. Jebel Kujur without any regulation. The distance from then custom market to the dumping area is approximately 15 km. The amount of human waste collected in Juba and disposed in the field is estimated as follows;

Table 5.2-67 The Amount of Human Waste Collection and Disposal

Capacity of tanker	Number of vacuum tanker	trips	Amount of collection and Disposal (m3/day)
7,000 litters	10	avg. 4	280.0

2) Sewage Water

There are only two areas in the town connected to sewage systems; however both of the sewage systems have not been functioning for approximately twenty years. One of the sewage systems is for government offices and consists of internal plumbing and drainage to external manholes. It is connected to a 150mm diameter sewer pipe discharging in a stabilization pond system. The sewer system was established in 1974 and operated until 1984. The sewage system has been disused for more than twenty years and needs refurbishment.

The other sewage system is for ministerial houses that consist of ninety houses connected to pipes and the treatment facility. The treatment facility is composed of two sets of stabilization ponds near Juba Airport. The sewage system was established in 1972 and operated until 1983. Similar to the sewage system mentioned above, this sewage system also has been disused for more than twenty years and needs refurbishment.

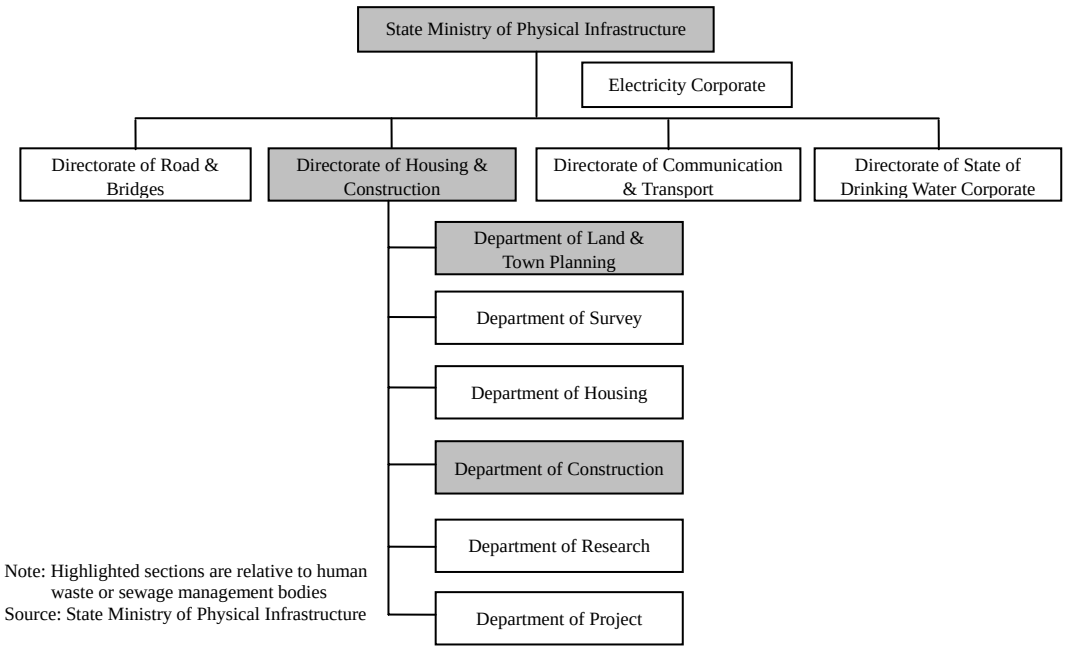
3) Organizations Responsible

There is no specific law for human waste and sewerage. Also, there is no legislation which clearly specify the organizations responsible for the management of them. There are several organizations which are in charge of the management of human waste and sewage and the executing bodies in Juba are as follows;

- The Ministry of Housing, Lands and Utilities (MHLU) of GOSS
- State Ministry of Physical Infrastructure (SMPI)
- Private sector

The Ministry of Housing, Lands and Utilities (MHLU) of GOSS is the organization in charge of the design of the master plan, detailed plan and construction of the facility for sewage. MHLU of GOSS designed the master plan for sewage and implemented the bidding for the

rehabilitation project of the existing sewage facilities of the ministerial complex and ministerial house in 2006. In the meantime, the State Ministry of Physical Infrastructure (SMPI) is the organization in charge of the detailed plan and the construction of a facility for human waste and sewage in Juba as well. Despite having some plans for human waste, since 2005 SMPI has not yet implemented the construction regarding human waste or sewage. There is still no clear demarcation of this task between GOSS and the SMPI. The organization chart of the SMPI is shown in Figure 5.2-36.



Note: Highlighted sections are relative to human waste or sewage management bodies
Source: State Ministry of Physical Infrastructure

Figure 5.2-36 Organization Chart of State Ministry of Physical Infrastructure

While there is no official organization responsible for the collection and transportation of human waste and sewerage in Juba, approximately ten human waste tankers owned by individual enterprises are collecting and transporting human waste from several hotels, government offices and state departments. The current disposal area, owned by the community of the Munuki District, has been instructed by the SMPI as the dumping area for each district. The human waste transported by individual enterprises is disposed in the field on the south side of Mt. Jebel Kujur with solid waste without any regulation.

4) Joint Committee for the Issue of Sanitation

A joint committee for the issue of sanitation is held among related organizations every week or every ten days. The agenda covers mainly sanitary issues such as garbage problems, hygiene in public areas, human waste and so on. The participants are the State Ministry of Health, State Ministry of Physical Infrastructure, commissioner of Juba County, executive director of each district (payam), town councils of each district (payam), and so on.

5) Expected or On-Going Projects

Expected or on-going projects regarding human waste and sewerage are shown as the follows;

① Rehabilitation of government office sewerage and wastewater stabilization ponds

Execution body: GOSS

Location: Government office complex

Status: Bidding for the construction completed as of July 2006

Detail: Shown in Table 5.2-68

Table 5.2-68 Details of Rehabilitation of Government Office Sewerage and Wastewater Stabilization Ponds

Description	Unit	Qty
Government offices sewers		
➢ Identify, excavate, and repair breakages in fiber cement pipes for all sizes using VJ-repair coupling		
• PVC insert	no	35
➢ Clean and rod fiber cement sewer lines of the following diameter		
• 100mm	m	1,000
• 150mm	m	1,280
➢ Clean and repair brick manholes including		
• Setting and channeling	no	91
➢ Replace broken manhole covers with medium duty cast iron		
• Covers	no	40
Wastewater stabilization ponds		
➢ Excavate existing stabilization ponds to ensure treatment of water		
• Minimum depth of 1.5m and 0.5m freeboard	m^3	1,500
➢ Repair and reinstate concrete wave protection to sides of ponds, 75mm concrete on well compacted base with joints		
• Every 1.5m	m^2	368
➢ Repair and reinstate embankment walkways with 75mm gavel pavement		
• Concrete on well compacted base with joints every 1.5m	m^2	368
• Shape and redo storm water embankments around ponds	m	224
• Provide 300 wide concrete overflow weirs between ponds	no	2
➢ Provide and lay 150 diameter PVC drainage pipe 1 m deep		
• Down to nearest water course	m	1,000
➢ Provide screenings manhole c/w GI screen 300 wide, bar		
• Spaced at 25crs x 5mm at an angle of 45 degree	sum	1
➢ Provide a steel structure with corrugated iron roof of plan dimensions 3 x 6m and concrete floor comprising a lockable store room of 3 x 2m, a flush toilet, shower cubicle 3 x 2m, of brick construction and doors and windows c/w		
• Burglar bars and glazing	sum	1
➢ Construct a screening drying platform sloped to a center		
• 50mm drain in the open covered space next to the store	sum	1
➢ Provide raking equipment for the screens, a swimming pool net on an aluminum extendable pole, shovel and 5 off		
• 100ltr heavy duty HDPE garbage collection bins with covers	sum	1
• Provide a steel table and 2 chairs	sum	1
➢ Provide a 1.8m galvanized diamond wire fence to acceptable building standards		
• Pedestrian gate	m	300
➢ Provide ventilated approved pit latrine in brick		
• Design and specifications	sum	1
➢ Provide a water connection and standpipe for cleaning purpose		
• Construct similar lower at a new location		

Source: GIBB Africa (2005 September): Government of South Sudan City of Juba-Urgent Infrastructure Needs Assessment Draft Report

② Rehabilitation of ministerial houses sewage and wastewater stabilization ponds

- Execution body: GOSS
- Location: Ministerial houses complex
- Status: Bidding for the construction completed as of July 2006
- Detail: Shown in Table 5.2-69

Table 5.2-69 Details of Rehabilitation of Ministerial Houses Sewage and Wastewater Stabilization Ponds

Description	Unit	Qty
Ministerial houses sewers		
➢ Identify, excavate and repair breakages in fiber cement pipes for all sizes using VJ-repair coupling		
• PVC insert	no	45
➢ Clean and rod fiber cement sewer lines of the following diameter		
• 100mm	m	1,600
• 150mm	m	760
• 200mm	m	462
➢ Clean, repair and make good brick manholes		
• Setting and channeling	no	75
➢ Replace broken manhole covers with medium duty cast iron		
• Covers	no	88
Wastewater stabilization ponds		
➢ Clean and excavate existing stabilization ponds to ensure treatment of water		
• Minimum depth of 1.5m and 0.5m freeboard	m^3	3,440
➢ Repair and reinstate concrete wave protection at sides of ponds, with 75mm concrete on well compacted base with joints		
• Every 1.5m	m^2	126
➢ Repair and reinstate embankment walkways with 75mm gavel pavement		
• Concrete on well compacted base with joints every 1.5m	m^2	252
• Shape and redo storm water embankments around ponds	sum	1
➢ Provide and lay 150 diameter PVC drainage pipe 1 m deep		
• Down to nearest water course	m	20
➢ Provide screenings manhole c/w GI screen 300 wide and bar		
• Spaced at 25crs x 5mm at an angle of 45	sum	1
➢ Provide a steel structure with corrugated iron roof of plan dimensions 3 x 6m and concrete floor comprising a lockable store room of 3 x 2m, a flush toilet, shower cubicle 3 x 2m of brick removable-cover and doors and windows c/w		
• Burglar bars and glazing	sum	1
➢ Construct a screening and drying platform sloped to a center		
• 50mm drain in the covered open space next to the store	sum	1
➢ Provide raking equipment for the screens, a swimming pool net on an aluminum extendable pole and shovel		
• 100ltr heavy duty HDPE garbage collection bins with covers	sum	1
• Provide a steel table and 2 chairs	sum	1
➢ Provide a 1.8m galvanized diamond wire fence to acceptable building standards with 3m height and 1m width		
• Pedestrian gate	m	350
➢ Provide ventilated approved pit latrine of brick		
• Design and specifications	sum	1

Source: GIBB Africa (2005 September): Government of South Sudan City of Juba-Urgent Infrastructure Needs Assessment Draft Report

③ Toilet Facilities in Public Places

- Execution body: GOSS
- Location: Public places, markets and stadium
- Status: Bidding for the construction completed as of July 2006
- Detail: shown in Table 5.2-70

Table 5.2-70 Details of Toilet Facilities in Public Places

Description	Unit	Qty
1. Provide typical 6 toilet bowl units ventilated toilet	nos.	36
2. Markets	nos.	3
3. Staduim	nos.	4

④ Plan for Human Waste Treatment Ponds

- Execution body: State Ministry of Physical and Infrastructure
- Location: Approx. 8km from custom market near the check point on south side of Jebel Kujur (N04.49'.31", E31.32'.22")
- Status: Site selection completed as of July 2006
- Detail: None

6) Issues to be Solved in Sanitation Management

There are four main issues to be solved in sanitation management in Juba. Firstly the common practice of defecation of residents in open bushes, rather than using latrines should be ceased. Although it does not seem to cause a major problem at present, it is anticipated that incidences of intestinal and gastric diseases will become quite frequent. The practice of defecation needs to be dealt with as the problem will increase dramatically as the urban population increases. Poor sanitation is already reported to be an issue in the informal settlements in Juba, where flood or stream water during wet season water is already a major problem.

Secondly, the lack of capability for collection of human waste needs be solved. Once residents start to use latrines rather than open bushes, the collection amount of human waste from households or public toilets will increase dramatically. The human waste stored in the latrine needs to be collected periodically. However the number of current vacuum trucks is approximately ten and this number is not enough to cover the whole Juba. The capacity of human waste collection needs to be strengthened as soon as possible.

Thirdly, open dumping of collected human waste shall be ceased. The human waste collected by individual enterprises is dumped in the field on the south side of Mt. Jebel Kujur without any regulation. There is no pond, fence, gate, staff, or treatment facility at the open dumping field. The human waste is dumped in the field without control, resulting in serious environmental issues such as offensive odor, pests and underground water pollution. A treatment facility for the human waste shall be constructed and operated properly. The treatment facility will consist of inlet, outlet, treatment ponds, fence and gate.

Finally, the lack of capacity for collection, transportation and treatment of sewage water shall

be solved. The amount of sewage water will increase dramatically in accordance with the increase of the water supply which will be providing safe water to entire population in Juba by 2015. Although there are two existing sewage systems near the government office and the ministerial houses, both of them are not quite enough to cover entire population. The capability for collection, transportation and treatment through a network of piped sewers and stabilization ponds shall be enhanced to cope with the increasing amount of water supply.

(2) Future Needs

1) Sewage Water and Human Waste Amount Forecast

The sewage water amount is calculated by multiplying the generation rate by population. The generation rates are classified depending on the three levels of water supply; 100 ltr/cap. (High Level), 50 ltr/cap. (Middle Level) and 20 ltr/cap. (Low Level) in 2006; and 120 ltr/cap., 60 ltr/cap. and 40 ltr/cap. both in 2011 and 2015. The total population is divided into three; 5% as High Level of water supply, 15% as Middle Level and 80% as Low Level in 2006, and 15%, 40% and 45% in 2015. Share of three water supply levels in 2011 was interpolated between 2006 and 2015.

The human waste generation amount is calculated by multiplying the generation rate, 1.5 liters per capita per day, by the population. Future human waste generation amount will increase in proportion to the increase in population,

Table 5.2-71 Sewage Water and Human Waste Amount in 2006, 2011 and 2015

Type of sanitation management	Current (2006)				Forecast					
							2011		2015	
	Water supply level (% of pop.)	Generation rate (litter per capita)	Population	Generation (m^3/day)	Water supply level (% of pop.)	Generation rate (litter per capita)	Population	Generation (m^3/day)	Population	Generation (m^3/day)
Sewage water	High (5%)	100	6,795	680	High (15%)	201.6[1)]	32,089	6,469	76,500	15,422
	Middle (10%)	50	13,590	680	Middle (40%)	100.8[2)]	81,067	8,172	204,000	20,563
	Low (85%)	20	115,516	2,310	Low (45%)	67.2[3)]	190,844	12,825	229,500	15,422
	Sub total		135,901	3,669	Sub total		304,000	27,465	510,000	51,408
Human waste	No supply		N/A	N/A		1.5[4)]	197,000[5)]	296	91,800[6)]	138

1) 120 litter per capita / 0.75 (load factor) x 1.26 (public facility)=201.6 litter per capita
2) 60 litter per capita / 0.75 (load factor) x 1.26 (public facility)=100.8 litter per capita
3) 40 litter per capita / 0.75 (load factor) x 1.26 (public facility)=67.2 litter per capita
4) Source: Guy H. and Jamie B. (2003); Domestic Water Quantity, Service Level and Health, WHO,
5) 394,000 x 50%=197,000
6) 510,000 x (100%-82%)=91,800

2) Measures to be Taken

The proposed measures to be taken, in order to attain the goals, are summarized below.

① Technical System

- Establishment of a proper human waste storage system.

- Provision of sufficient human waste collection service.
- Establishment of a treatment facility for the collected human waste.
- Establishment of a network of piped sewers and stabilization ponds.

② Institutional System

- Improvement and strengthening of management/control capability of public organizations concerned with sanitary management.
- Establishment of laws and regulations for sanitary management, especially human waste and sewage water.
- Establishment of a financially sustainable system.
- Establishment of a proper monitoring and information management system, including an effective, operational database.
- Full utilization of available human resources through the establishment of proper human resources development programs.

(3) Proposed Projects

The principal goal of the development plan for sanitation management is to create an environment where:

"Eighty two (82) % of the population in Juba can access improved Sewage Management by the target year 2015"

The Millennium Development Goals (MDGs) provide the internationally agreed targets against which the needs of the people of South Sudan can be assessed. They also reveal that rapid acceleration of development is needed, particularly in war-affected and disadvantaged regions. The "Synthesis Framework for Sustained Peace, Development and Poverty Eradication" by Joint Assessment Mission (JAM) Sudan in 2015" illustrated the massive scale of the development challenge against the MDGs using available data for South Sudan, while recognizing that local conditions are unique and should shape the national targets that are adopted. JAM mentioned in the report that the challenging target of MDG for environmental issues focuses on 58% of the population in South Sudan having access to improved sanitation in 2015, while it focuses on 82% of the population in North Sudan. Since Juba became the capital city of GOSS and Central Equatorial State in 2005, the population growth is predicted to be rapid and it will cause serious environmental pollution in the area surrounding Juba. Therefore, the JICA study adopts "82% of the population" as the challenging target of MDG for environmental issue in Juba in 2015.

1) Sewerage Rehabilitation Project under Emergency Rehabilitation Work in Juba (ERWJ)

(See Chapter 3.)

2) Sewerage System Development Project

① Background

The general provision of sanitary facilities in Juba is very poor. The practice of defecation in the open bush, rather than the use of latrines, is common. Improper defecation causes a high incidence of intestinal and gastric disease. Furthermore, it contaminates environment seriously. The term sewerage refers to a waterbone system for the collection and disposal of wastewater through a network of piped sewers. Although the amount of wastewater is not large at the moment, it is essential to treat waste waster in accordance with the increasing of water supply in the foreseeable future in Juba.

② Objectives

- To promote public health education
- To establish sewage system to treat wastewater in accordance with increasing water supply.
- To mitigate public health hazard caused by poor sanitation

③ Location

- Whole Juba Town and the surrounding areas

④ Scope of the Project

- Execution of public health education
- Construction of sewage treatment facility on the River Nile (See Figure 5.2-37, Figure 5.2-38 and Figure 5.2-39)
- Installation of sewage trunk pipes and brunch pipes (Figure 5.2-37)
- Establishment of sewerage management institution

⑤ Responsible Agency (expected)

- Project Implementation: Ministry of Housing Lands and Utilities of GOSS, Ministry of Health of GOSS, State Ministry of Physical Infrastructure
- Operation: State Ministry of Health, Juba Town, Munuki and Kator (Payam)
- Maintenance: Juba Town, Munuki and Kator (Payam)

⑥ Project Cost

- Detailed Design Cost : USD 1.1mil.
- Implementation/Construction Cost* :
  Sewerage pipe installation : USD 149.3mil.
  Construction of treatment facility (sanitation pond) : USD 1.2mil.
- Total Cost : USD 151.7mil.

* Including construction supervision cost

⑦ Beneficiaries

(a) Target Beneficiaries :

- The whole population in Juba and surrounding area and residents on the downstream of the River Nile

(b) Effects of the Project :

- Reduction of high incidence of intestinal and gastric diseases
- Mitigation of environmental pollution caused by human waste and wastewater
- Betterment of urban environment.

⑧ Project Evaluation

(a) Economic Viability

Although no economic analysis is done, it is expected that the Project is economically viable because large amount of benefit is expected to accrue from the reduction of external diseconomy including casualties by diseases.

(b) Financial Soundness

Total amount of cleaning tax is not enough for sewage; hence subsidy should be provided by the district or state ministry.

(c) Environmental Impacts

- Positive Impacts
  - Decrease of diseases
  - Betterment of urban environment.
- Negative Impacts
  None

⑨ Conditions Required

(a) External Condition

- Civil war will not happen again.

(b) Preconditions

- GOSS and state ministry promote wastewater management in Juba and surrounding area.

⑩ Relationship with Other Projects

The plan of rehabilitation of sewerage system and wastewater stabilization ponds for government offices and ministerial houses is being implemented by GOSS. However the project is stand-alone.

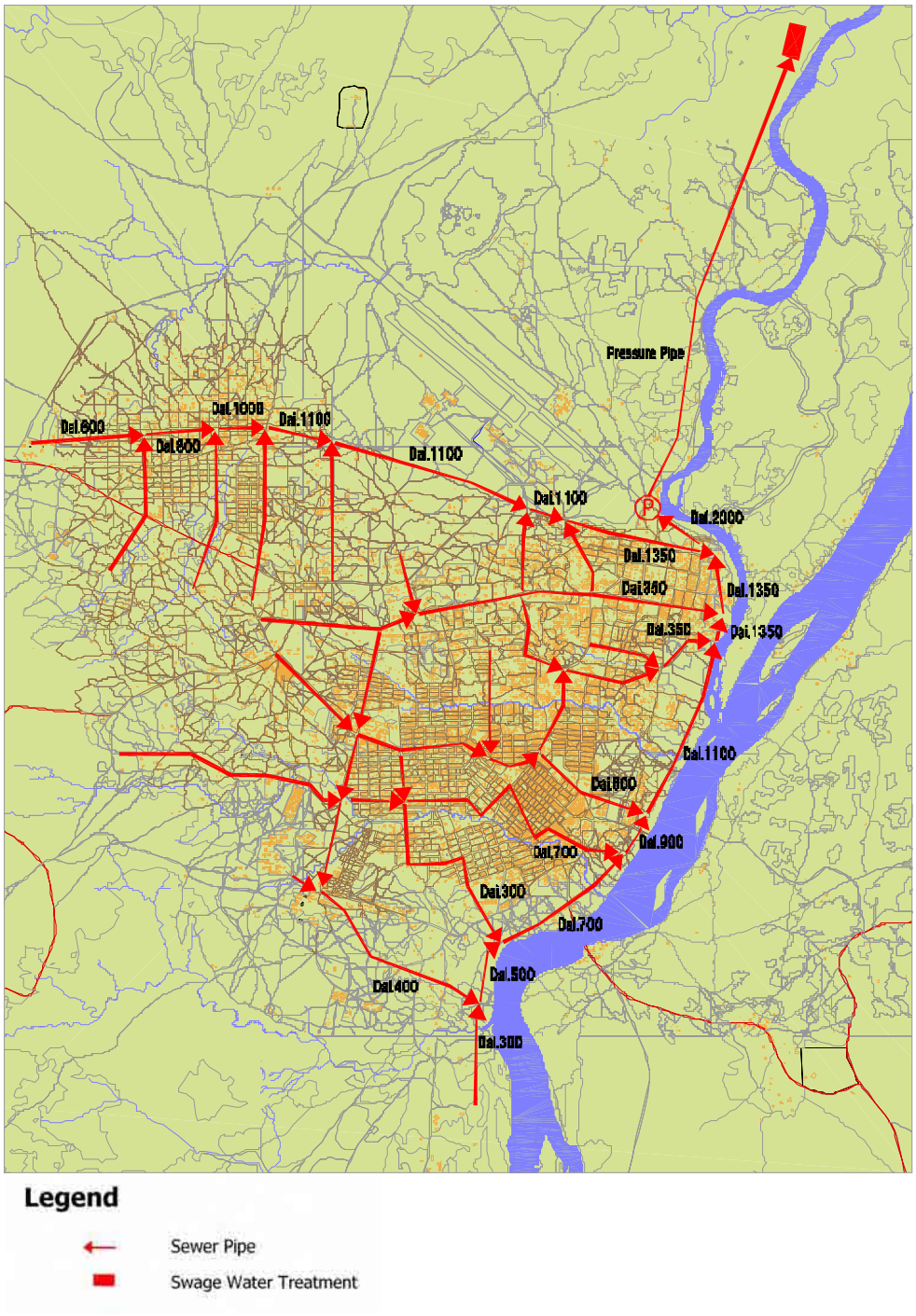


Figure 5.2-37 Plan of Network of Sewer Pipe and Treatment Facility in Juba

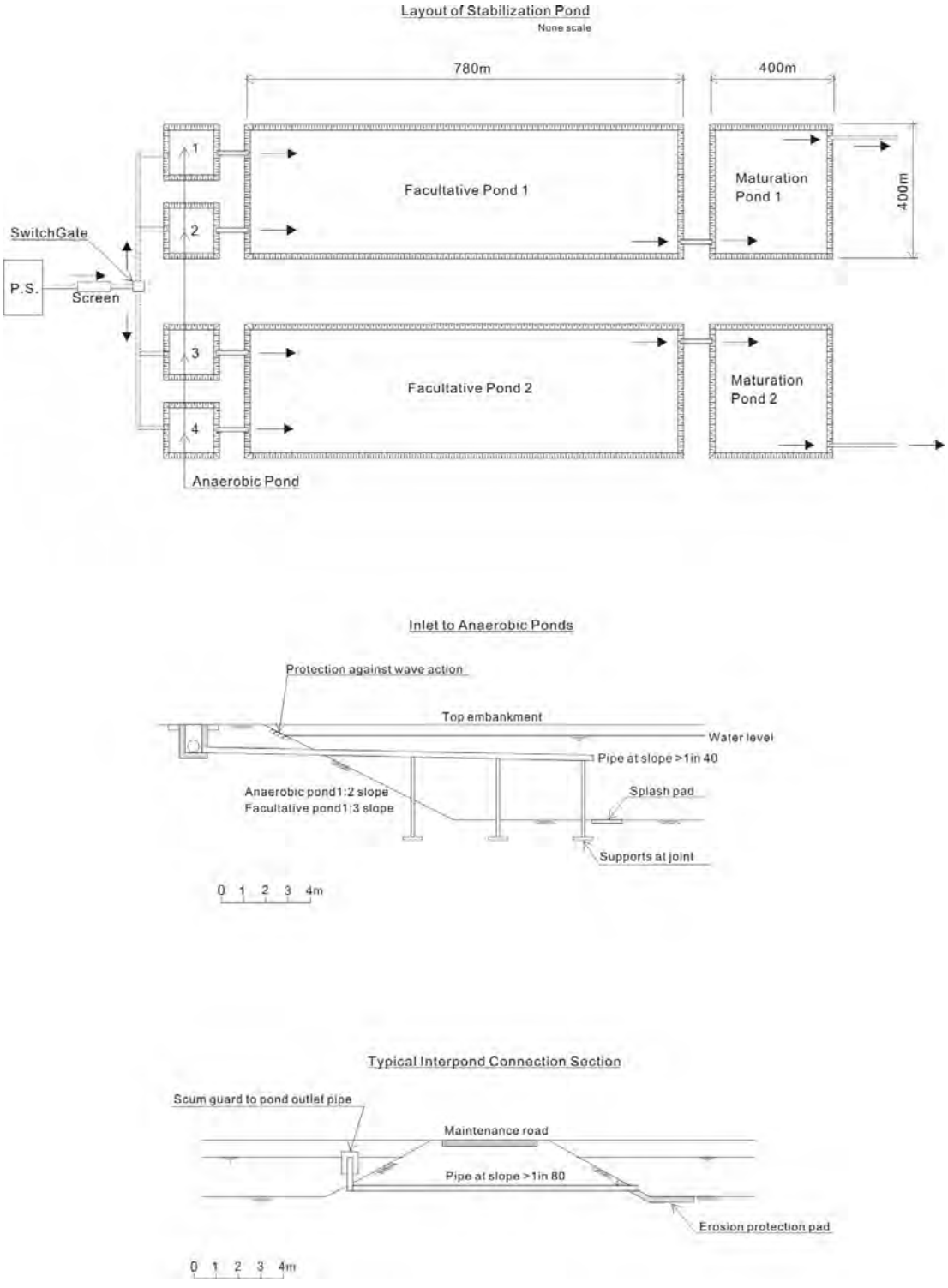


Figure 5.2-38 Layout and Typical Section of Stabilization Pond

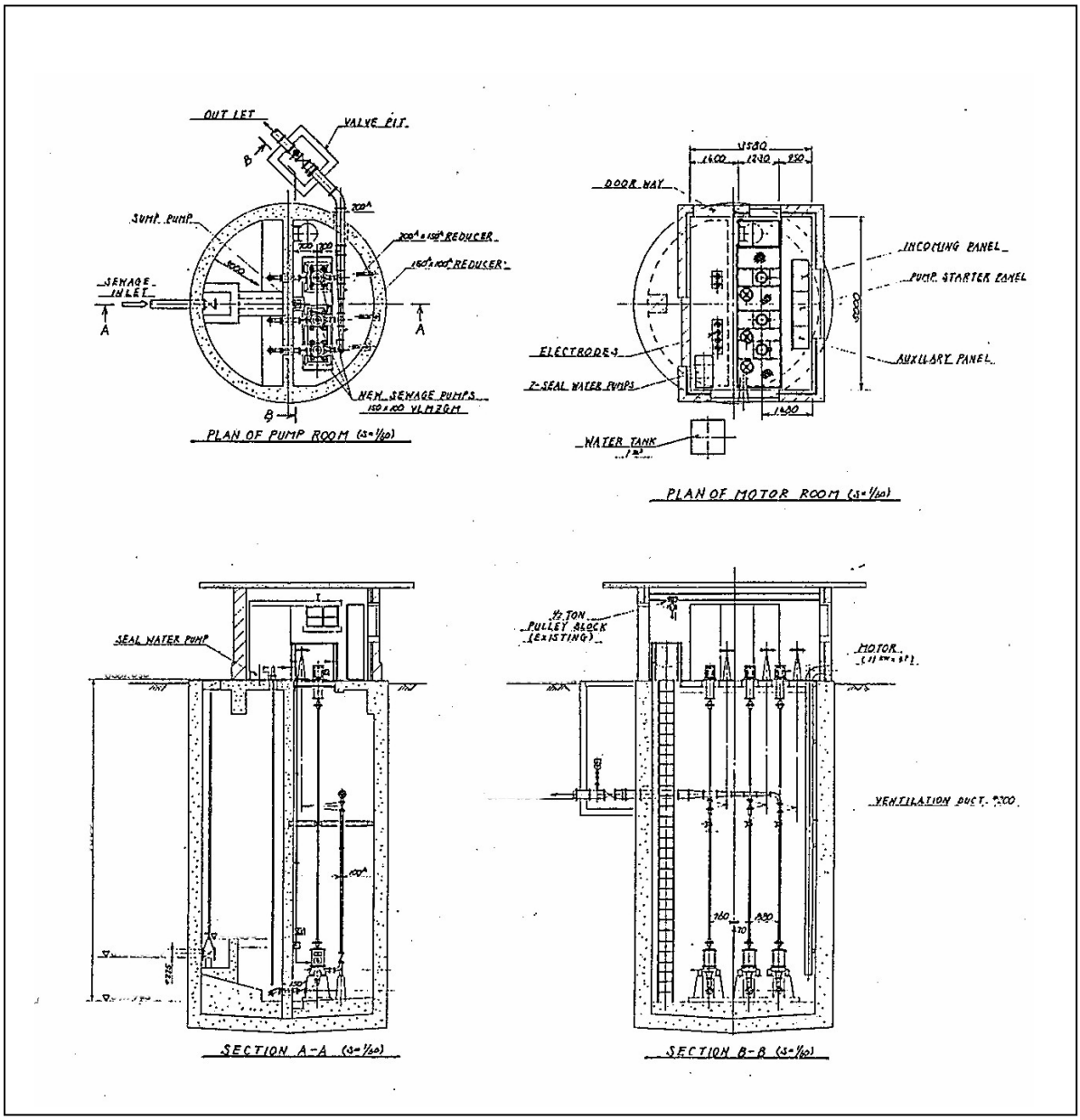


Figure 5.2-39 Layout of Typical Pump Station

3) Human Waste Treatment System Development Project

① Background

The general provision of sanitary facilities in Juba is very poor. The practice of defecation in the open bush, rather than the use of latrines, is common. Improper defecation causes a high incidence of intestinal and gastric disease. Furthermore, it contaminates environment seriously. The term sewerage refers to a waterbone system for the collection and disposal of wastewater through a network of piped sewers. Although the amount of wastewater is not large at the moment, it is essential to treat waste water in accordance with the increasing of water supply in the foreseeable future in Juba.

② Objectives

- To promote public health education
- To establish a human waste treatment system
- To decrease public health hazard caused by poor sanitation

③ Location

Public toilet: Markets, existing schools, communities

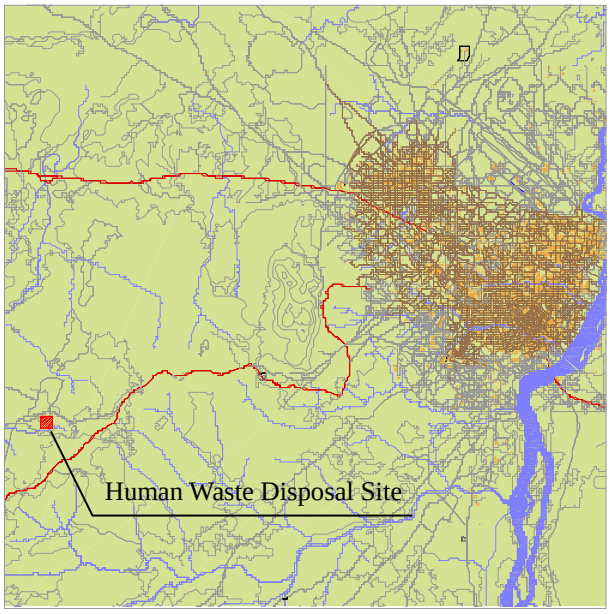


Figure 5.2-40 Location of Human Waste Disposal Site

④ Scope of the Project

- Implementation of public health education
- Construction of public toilets
- Procurement of vehicles for the O & M
- Empowerment of institution for the human waste treatment

⑤ Responsible Agency (expected)

- Project Implementation: Ministry of Housing Lands and Utilities of GOSS, Ministry of Health of GOSS, State Ministry of Physical Infrastructure
- Operation: State Ministry of Health, Juba Town, Munuki and Kator (Payam)
- Maintenance: Juba Town, Munuki and Kator (Payam)

⑥ Project Cost

- Detailed Design Cost : USD 0.4mil.
- Implementation/Construction Cost* :
  - Hygiene education : USD 0.15mil.
  - Construction of public toilets : USD 1.8mil.
- Total Cost : USD 2.3mil.

* Including construction supervision cost

⑦ Beneficiaries

(a) Target Beneficiaries :

- The whole population in Juba and surrounding area and residents on the down stream of the River Nile

(b) Effects of the Project :

- Reduction of high incidence of intestinal and gastric diseases
- Mitigation of environmental pollution caused by human waste and wastewater
- Betterment of urban environment.

⑧ Project Evaluation

(a) Economic Viability

Although no economic analysis is done, it is expected that the Project is economically viable because large amount of benefit is expected to accrue from the reduction of external diseconomy including casualties by diseases.

(b) Financial Soundness

Total amount of cleaning tax is not enough for sewage; hence subsidy should be provided by the district or state ministry.

(c) Environmental Impacts

- Positive Impacts
  - Decrease of diseases
  - Betterment of urban environment.

- Negative Impacts
  None

⑨ Conditions Required

(a) External Condition

- Civil war will not happen again.

(b) Preconditions

- GOSS and state ministry promote wastewater management in Juba and surrounding area.

⑩ Relationship with Other Projects

The construction plans of several 6-unit type toilets at public area and human waste treatment ponds are being carried out by GOSS. Those should be integrated into this Project.

(4) Stage Implementation Plan

In order to achieve the principle goal of the development plan, the strategies for the establishment of major technical and institutional system components are proposed as shown in Table 5.2-72. Staged implementation plan is shown in Table 5.2-73.

Table 5.2-72 Strategies for the Sanitary Management Development Plan

	Short-term (2006-2011)
Technical Aspects	• Hygiene education shall be promoted for proper defecation practice. • Public toilets shall be constructed for all residents in Juba except for those who can access a sewage system. • A vacuum truck shall be procured in order to achieve the 100% human waste collection rate by 2011. • A treatment facility for the collected human waste shall be constructed by GOSS. • A network of piped sewers shall be installed in order to cover 50% of the population in Juba by 2011. • Stabilization ponds shall be constructed for the treatment of collected sewage water.
Institutional Aspects	• The current administrative system among Ministry of Housing, Lands and Utilities of GOSS, State Ministry of Physical Infrastructure and private sector shall be improved through a review of the system and redefinition of the tasks/assignments in order to meet the proposed technical systems. • The current legal provisions in diverse laws and regulations shall be revised into an integrated and transparent package, especially to properly operate the proposed new technical systems. • A financially sustainable system shall be established. • A systematic monitoring and information management system for sanitary management shall be established in the Joint Committee. At first the unit costs of operations shall be identified to evaluate cost/benefit, cost/efficiency and cost/effectiveness. Along with this a database on all sanitary management activities shall be developed and maintained to continuously check the quality and costs of the cleansing services by both public and private sectors. • A human resource development program shall be developed in order to train professionals involved in sanitary management. The program shall cover a broad spectrum of professionals and employees, from management to operational levels, including those responsible for supporting activities. - to be continued -

Medium term (2011-2015)	
Technical Aspects	• Hygiene education for proper defecation practice shall be enhanced and expanded. • Public toilets which all the population in Juba can access, except for sewage system, shall be maintained. • The vacuum truck shall be procured and maintained in order to keep going the 100% human waste collection rate by 2015. • The treatment facility for the collected human waste shall be maintained by the State Ministry of Physical Infrastructure. • The network of piped sewers shall be installed in order to cover 82% of the population in Juba by 2015. • The stabilization ponds for the treatment of collected sewage water shall be expanded.
Institutional Aspects	• The administrative system, including the roles of the Ministry of Housing, Lands and Utilities of GOSS, State Ministry of Physical Infrastructure and private sector will be reviewed and improved in order to meet the change of sanitation management, i.e., the increase in the NIMBY (Not In My Back Yard) syndrome, etc. • The database on sanitary management activities will be maintained. The comparative cost data and other performance data obtained by the database will be used to measure the efficiency of the services, and used for good management and decision making. • A systematic monitoring and information management system for sanitary management shall be maintained in the Joint Committee. • A financially sustainable system shall be maintained. • All staff concerned with sanitary management shall undergo a program of proper training and professional development. Vocational qualifications shall be set up to act as a means of assessing the competence of persons responsible for sanitary management facilities and operations.
Long term (2016-2025)	
Technical Aspects	• Hygiene education for proper defecation practices shall be enhanced and expanded on the east side area of the River Nile by 2025 • Public toilets which all the population in Juba can access, except for sewage system, shall be constructed on the east side area of the River Nile. • The vacuum truck shall be procured in order to achieve the 100% human waste collection rate which covers on the east side area of the River Nile. • The treatment facility for the collected human waste shall be maintained by the State Ministry of Physical and Infrastructure. • The network of piped sewers covering 82% of the population in Juba shall be installed on the east and west side area of the River Nile by 2025. • The stabilization ponds for the collected sewage water collected on the west side area of Nile River shall be maintained. • The stabilization ponds for the collected sewage water collected on the east side area of Nile River shall be constructed.
Institutional Aspects	• The administrative system, including the roles of the Ministry of Housing, Lands and Utilities of GOSS, State Ministry of Physical Infrastructure and private sector shall be reviewed and improved in order to meet the expansion of network of piped sewer area on the east of the River Nile, etc. • The database on sanitary management activities shall be maintained. The comparative cost data and other performance data obtained from the database will be used to measure the efficiency of the services, and used for good management and decision making. • A systematic monitoring and information management system regarding sanitary management shall be expanded in the Joint Committee. • A financially sustainable system shall be enhanced in accordance with the expansion of the network of the piped sewer area on the east of the River Nile. • A human resources development program shall be developed in order to train professionals involved in sanitary management. The program shall cover a broad spectrum of professionals and employees, from management to operational levels, including those responsible for supporting activities.

Table 5.2-73 Staged Implementation Plan for Waste Water Management Development Plan in Juba

Components \ Phase	Present (2006)	Short term (2006 - 2011)	Medium term (2012 - 2015)
1. Population			
Population in Juba	Approx.250,000	366,000	510,000
Juba Town district (payam)	Approx.103,000	120,000	134,000
Kator district (payam)	Approx.69,000	90,000	107,000
Munuki district (payam)	Approx.78,000	156,000	219,000
Rajaf (payam)			50,000
2. Sewage Water			
Sewage water Amount (m^3/day)			
Generation	3,669	27,465	51,408
Collection	0	8,240	42,155
Collection rate	0%	30 %	82 %
Collection system	There is no system except for abandoned government office sewers and ministerial houses sewers.	New network piped sewer and the rehabilitated government office sewers and ministerial houses sewers.	New network piped sewer and the rehabilitated government office sewers and ministerial houses sewers.
Treatment facility	-Open dumping -Government office stabilization pond -Ministerial house stabilization pond	Stabilization pond	Stabilization pond
Trunk pipe dai.600-900mm	0m	9,600m	9,600m
dai.1000-1350mm	0m	8,400m	8,400m
Pressure trunk pipe Dai.1000-1350mm	0m	2,000m	2,000m
Brunch pipe dai.250-500mm	Government office:2,280m Ministerial house:2,822m	New installation:138,200m Government office:2,280m Ministerial house:2,822m	New installation:329,300m Government office:2,280m Ministerial house:2,822m
Pump station	None	2	2
Water pipe bridge	None	Approx.250m	Approx. 250m
Distance from city to treatment facility (km)	Approx. 15km	Approx.4km	Approx. 4km
Executing Organization			
Policy or Master plan	None	GOSS	GOSS
Budgeting	None	GOSS	GOSS
Detailed plan	None	State Ministry	State Ministry
Construction	None	State Ministry	State Ministry
O & M	None	District (payam)	District (payam)
No. of workers	None	30	30
Main equipment	None	Excavator:1 Dump truck:2 Water tanker:1 Pickup truck:2	Excavator:1 Dump truck:2 Water tanker:1 Pickup truck:2
3. Human waste			
Human waste Amount (m^3/day)			
Generation	N/A	296	138
Collection	280	296	138
Collection rate	N/A	100 %	100 %
Collection system	Private vacuum tracks collected from several hotels, government offices and state department.	Toilet facilities will be built in public places. Private vacuum tracks will collect human waste from each toilet.	Toilet facilities will be built in public places. Private vacuum tracks will collect human waste from each toilet.
No. of public toilet facilities	None	6 toilet vowel units ventilated toilet :36 Market :3 Stadium :4 Others :186	6 unit ventilated toilet :36 Market :3 Stadium :4 Others :186
Treatment facility	Just Open dumping	Stabilization pond	Stabilization pond
Distance from city to treatment facility (km)	Approx. 15km	Approx.10 km	Approx. 10km
Executing Organization			
Policy or Master plan	None	GOSS	GOSS
Budgeting	None	GOSS	GOSS
Detailed plan	None	State Ministry	State Ministry
Construction	None	State Ministry	State Ministry
O & M	None	District (payam)	District (payam)
Collection	Private sector	Private sector	Private sector
No. of workers	None	20	20
Main equipment	Vacuum truck:10	Vacuum truck:10	Vacuum truck:5